FAYETTE County
Create Your Story!

Purchasing Department
140 Stonewall Avenue West, Ste 204
Fayetteville, GA 30214
Phone: 770-305-5420
www.fayettecountyga.gov

July 7, 2023

Subject: Invitation to Bid ITB #2285-B: FCWS – Trilith Studios Elevated Water Storage Tank

Gentlemen/Ladies:

Fayette County, Georgia invites you to submit a bid for construction of a new metal elevated water storage tank and booster pump station at the Trilith Studios property. You are invited to submit a bid in accordance with the information contained herein.

A mandatory pre-bid conference will be held at 9:00 a.m., Thursday, July 27, 2023, at 140 Stonewall Avenue West, Suite 100, Fayetteville, GA 30214. We will then travel to the Trilith Studios at 400 Veterans Parkway, Fayetteville, GA 30214, to provide an opportunity for you to become more familiar with the project, and to ask questions. Companies that attend will be invited to submit bids. Questions concerning this invitation to bid should be addressed to Natasha M. Duggan in writing via email to nduggan@fayettecountyga.gov or fax to (770) 719-5534. Questions will be accepted until 4:30 p.m., Friday, July 28, 2023. Purchasing Department office hours are Monday through Friday 8:00 a.m. to 5:00 p.m. The office telephone number is (770) 305-5420. Please return your response to the following address:

Fayette County Purchasing Department
140 Stonewall Avenue West, Suite 204
Fayetteville, Georgia 30214

Bid Number: ITB #2285-B
Bid Name: FCWS – Trilith Studios Elevated Water Storage Tank

Your envelope *must* be sealed and should show your company's name and address. Bids will be received at the above address until 3:00 p.m., Thursday, August 10, 2023 in the Purchasing Department, Suite 204. Bids will be opened at that time. Bids must be signed to be considered. Late bids cannot be considered. Faxed bids or emailed bids cannot be considered.

If you download this invitation to bid from the County's web site, it will be your responsibility to check the web site for any addenda that might be issued for this solicitation. The County cannot not be responsible for a vendor not receiving information provided in any addendum.

Thank you for participating in the solicitation process.

Sincerely,

Ted L. Burgess
Director of Purchasing

CONTRACT DOCUMENTS

FOR CONSTRUCTION OF

ITB #2285-B FCWS – TRILITH STUDIOS ELEVATED WATER STORAGE TANK

Issued for Construction

July 2023

Prepared For:
Fayette County Water System
245 McDonough Rd., Fayetteville, GA 30214
(770) 461-8666

Prepared By:
Arcadis U.S., Inc.
2839 Paces Ferry Road Suite 900
Atlanta, GA 30339
(770) 431-8666

00 01 07 DESIGN PROFESSIONAL SEALS

	Specification Sections Sealed
Michael Diaz, PE **Arcadis U.S. Inc.**	**Division 00 Bidding and Contracting Requirements**

	Specification Sections Sealed
Travis Thomas, PE **Arcadis U.S. Inc.**	**Division 01 General Requirements** **Division 02 Site Construction** **Division 31 Earthwork** **31 20 00 Earth Moving** **31 23 16.26 Rock Removal** **Division 32 Exterior Improvements** **Division 33 Utilities**

	Specification Sections Sealed
Carlos Gallo, PE, SE **Arcadis U.S. Inc.**	**Division 03 Concrete** **Division 05 Metals** **Division 31 Earthwork** **31 63 16 Auger Cast Grout Piles**

	Specification Sections Sealed
Errol Dawkins, PE **Arcadis U.S. Inc.**	**Division 07 Thermal Moisture Protection** **Division 08 Openings** **Division 09 Finishes** **Division 10 Specialties** **Division 13 Special Construction**

	Specification Sections Sealed
Quyen Tu, PE **Arcadis U.S. Inc.**	**Division 23 Heating, Ventilation, and Air Conditioning**

	Specification Sections Sealed
Hamilton Giles, PE **Arcadis U.S. Inc.**	**Division 40 Process Integration** **Division 43 Process Gas and Liquid Handling, Purification, and Storage Equipment**

	Specification Sections Sealed
Thomas Powell, PE **Arcadis U.S. Inc.**	**Division 26 Electrical** **Division 40 Process Integration** 40 05 93 Common Motor Requirements 40 60 05 Instrumentation and Controls for Process Systems

END OF SECTION 00 01 07

SECTION 00 01 10

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END OF SECTION

Checklist of Required Documents

(Be Sure to Return This Checklist and
the Required Documents in the order listed below)

ITB #2285-B: FCWS – Trilith Studios Elevated Water Storage Tank

Contractor Affidavit under O.C.G.A. § 13-10-91(b)(1) _____

Exceptions to Specifications _____

Bid Form (Section 00 41 13) _____

Bid Bond (Section 00 43 13)* _____

Qualifications Statement (Section 00 45 13) _____

***FAILURE TO INCLUDE THIS ITEM WILL RESULT IN DISQUALIFICATION**

COMPANY NAME: _____

Contractor Affidavit under O.C.G.A. § 13-10-91(b)(l)

The undersigned contractor ("Contractor") executes this Affidavit to comply with O.C.G.A § 13-10-91 related to any contract to which Contractor is a party that is subject to O.C.G.A. § 13-10-91 and hereby verifies its compliance with O.C.G.A. § 13-10-91, attesting as follows:

a) The Contractor has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program;

b) The Contractor will continue to use the federal work authorization program throughout the contract period, including any renewal or extension thereof;

c) The Contractor will notify the public employer in the event the Contractor ceases to utilize the federal work authorization program during the contract period, including renewals or extensions thereof;

d) The Contractor understands that ceasing to utilize the federal work authorization program constitutes a material breach of Contract;

e) The Contractor will contract for the performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the Contractor with the information required by O.C.G.A. § 13-10-91(a), (b), and (c);

f) The Contractor acknowledges and agrees that this Affidavit shall be incorporated into any contract(s) subject to the provisions of O.C.G.A. § 13-10- 91 for the project listed below to which Contractor is a party after the date hereof without further action or consent by Contractor; and

g) Contractor acknowledges its responsibility to submit copies of any affidavits, drivers' licenses, and identification cards required pursuant to O.C.G.A. § 13-10-91 to the public employer within five business days of receipt.

_____ _____

Federal Work Authorization User Identification Number Date of Authorization

_____ ITB #2285-B: FCWS – Trilith Studios Elevated Water Storage Tank

Name of Contractor Name of Project

Fayette County, Georgia
Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, _____, 2023 in _____ (city), _____ (state).

_____
Signature of Authorized Officer or Agent

_____
Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME
ON THIS THE _____ DAY OF _____, 2023.

_____
NOTARY PUBLIC

My Commission Expires: _____

EXCEPTIONS TO SPECIFICATIONS

ITB #2285-B: FCWS – Trilith Studios Elevated Water Storage Tank

Please list below any exceptions or clarifications to the specifications of this bid. Explain any exceptions in full.

_____

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_____

COMPANY NAME_____

INSTRUCTIONS TO BIDDERS

Fayette County, Georgia
Fayetteville, Georgia
FCWS - Trilith Studios Elevated Water Storage Tank

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ARTICLE 1—DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.

ARTICLE 2—BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.03 Owner has established a Bidding Documents Website as indicated in the Invitation to Bid. Owner recommends that Bidder obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Addenda issued by Owner will be posted in the Website.

2.04 *Electronic Documents*

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.06.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and

responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

C. After the Contract is awarded, the Owner will provide or direct the Engineer to provide for the use of the Contractor documents that were developed by Engineer as part of the Project design process, as Electronic Documents in native file formats.

1. Electronic Documents that are available in native file format include:

a. **Specifications and Drawings**

2. Release of such documents will be solely for the convenience of the Contractor. No such document is a Contract Document.

3. Unless the Contract Documents explicitly identify that such information will be available to the Successful Bidder (Contractor), nothing herein will create an obligation on the part of the Owner or Engineer to provide or create such information, and the Contractor is not entitled to rely on the availability of such information in the preparation of its Bid or pricing of the Work. In all cases, the Contractor shall take appropriate measures to verify that any electronic/digital information provided in Electronic Documents is appropriate and adequate for the Contractor's specific purposes.

4. In no case will the Contractor be entitled to additional compensation or time for completion due to any differences between the actual Contract Documents and any related document in native file format.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 Bidder is to submit the following information with its Bid to demonstrate Bidder's qualifications to perform the Work: (Complete the Qualifications Statement included in the Bidding Documents.)

A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.

B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.

C. Bidder's state or other contractor license number, if applicable.

D. Subcontractor and Supplier qualification information.

E. Other required information regarding qualifications.

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

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

ARTICLE 4—PRE-BID CONFERENCE

4.01 A mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Proposals will not be accepted from Bidders who do not attend the conference. It is each Bidder's responsibility to sign in at the pre-bid conference to verify its participation. Bidders must sign in using the name of the organization that will be submitting a Bid. A list of qualified Bidders that attended the pre-bid conference and are eligible to submit a Bid for this Project will be issued in an Addendum.

4.02 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 *Site and Other Areas*

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

5.02 *Existing Site Conditions*

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

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:

a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

c. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the

Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

5.03 *Owner's Safety Program*

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

5.04 *Other Work at the Site*

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

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Express Representations and Certifications in Bid Form, Agreement*

A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing to the Owner as indicated in the Invitation to Bid Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than 21 days prior to the date for opening of Bids may not be answered.

7.03 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract

Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of **5%** percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.

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

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those "or-equal" or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an "or-equal" or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer within 10 days of the issuance of the Advertisement for Bids or invitation to Bidders. Each such request must comply with the requirements of Paragraphs 7.05 and 7.06 of the General Conditions, and the review of the request will be governed by the principles in those paragraphs. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such

proposed item, such approval will be set forth in an Addendum issued to all registered Bidders. Bidders cannot rely upon approvals made in any other manner.

10.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.01 A Bidder must be prepared to retain specific Subcontractors and Suppliers for the performance of the Work if required to do so by the Bidding Documents or in the Specifications. If a prospective Bidder objects to retaining any such Subcontractor or Supplier and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

11.02 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work within five days after Bid opening:

A. **Civil Site**

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

11.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

ARTICLE 12—PREPARATION OF BID

12.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form must be completed by typing or printing with ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

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

12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

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

12.06 A Bid by an individual must show the Bidder's name and official address.

12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

12.08 All names must be printed in ink below the signatures.

12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

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

12.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 *Lump Sum*

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

13.02 *Allowances*

A. For Cash and Contingency Allowances, the Bid Price must include the amount established by the Owner on the Bid Form

ARTICLE 14—SUBMITTAL OF BID

14.01 The Bidding Documents include one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.

14.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to the location designated in the Advertisement.

14.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

15.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.

15.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, the Bidder may withdraw its Bid, and the Bid security will be returned.

ARTICLE 16—OPENING OF BIDS

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

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

18.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.

18.05 *Evaluation of Bids*

A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

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

ARTICLE 19—BONDS AND INSURANCE

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

19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

20.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful

Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 21—STATUTORY AND FUNDING-FINANCING REQUIREMENTS (NOT USED)

ARTICLE 22—SALES AND USE TAXES

22.01 Owner is exempt from Georgia state sales and use taxes (O.C.G.A. § 48-8-3) on materials and equipment to be incorporated in the Work. (Exemption Documentation ST-5). Said taxes must be included in the Bid. Refer to Paragraph SC-7.10 of the Supplementary Conditions for additional information.

ARTICLE 23—CONTRACTS TO BE ASSIGNED (NOT USED)

Fayette County, Georgia

Fayetteville, Georgia

FCWS – Trilith Studios Elevated Water Storage Tank

Invitation to Bid ITB#2285-B

BID FORM

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

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to: **Fayette County Purchasing Department, 140 Stonewall Avenue West, Suite 204, Fayetteville, Georgia 30214**

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

ARTICLE 2—ATTACHMENTS TO THIS BID

2.01 The required documents to be submitted with and made a condition of this Bid are listed in the Checklist of Required Documents in 00 11 13 Invitation to Bid.

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

3.01 *Lump Sum Bids*

A. Bidder will complete the Work in accordance with the Contract Documents for the following lump sum (stipulated) price(s), together with any Unit Prices indicated in Paragraph 3.02:

1. Lump Sum Price (Single Lump Sum)

Item No. 1	Site Work	$
Item No. 2	Booster Pump Station	$
Item No. 3	400,000 Gallon Elevated Storage Tank	$

B. All specified allowance(s) to be approved by County Manager are included in the price(s) set forth below.

Item No. **1**	Lump Sum Cash Allowance **Materials Testing Laboratory**	$ 10,000.00
Item No. **2**	Lump Sum Contingency Allowance **Owner-Directed Changes**	$ 50,000.00
Total for all Lump Sum Contingency Allowances		$ 60,000.00

3.02 *Total Bid Price (Lump Sum and Unit Prices)*

Total Bid Price (Total of all Lump Sum	$

ARTICLE 4—BASIS OF BID—COST-PLUS FEE (NOT USED)

ARTICLE 5—PRICE-PLUS-TIME BID (NOT USED)

ARTICLE 6—TIME OF COMPLETION

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

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

ARTICLE 7—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

7.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

7.02 *Instructions to Bidders*

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

7.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 8—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

8.01 *Bidder's Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

8.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.

3. Bidder has not solicited or induced any individual or entity to refrain from bidding.
4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:
    a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.
    b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.
    c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.
    d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

BIDDER hereby submits this Bid as set forth above:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: (if applicable) _____

BID BOND (PENAL SUM FORM)

Bidder	**Surety**
Name: **[Full formal name of Bidder]** Address *(principal place of business)*: **[Address of Bidder's principal place of business]**	Name: **[Full formal name of Surety]** Address *(principal place of business)*: **[Address of Surety's principal place of business]**
Owner	**Bid**
Name: **[Full formal name of Owner]** Address *(principal place of business)*: **[Address of Owner's principal place of business]**	Project *(name and location)*: **FCWS – Trilith Studios Elevated Water Storage Tank / Trilith Water Tower Pump House, 400 Veterans Parkway, Building 13, Fayetteville, GA 30214** Bid Due Date: **August 10, 2023**
Bond Penal Sum: **[Amount]** Date of Bond: **[Date]**	

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

Bidder	Surety
_____ *(Full formal name of Bidder)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature) (Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:

Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.

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

SECTION 00 45 13

QUALIFICATIONS STATEMENT

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.02 Provide information on the Business's organizational structure:

Form of Business:	☐ Sole Proprietorship ☐ Partnership ☐ Corporation
☐ Limited Liability Company ☐ Joint Venture comprised of the following companies:	
	1.
	2.
	3.
Provide a separate Qualification Statement for each Joint Venturer.	
Date Business was formed:	State in which Business was formed:
Is this Business authorized to operate in the Project location?	☐ Yes ☐ No ☐ Pending

1.03 Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

1.04 Provide information regarding the Business's officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

3.01 Provide information regarding Business's Diverse Business Certification, if any. Provide evidence of current certification.

Certification	Certifying Agency	Certification Date
☐ Disadvantaged Business Enterprise		
☐ Minority Business Enterprise		
☐ Woman-Owned Business Enterprise		
☐ Small Business Enterprise		
☐ Disabled Business Enterprise		
☐ Veteran-Owned Business Enterprise		

☐ Service-Disabled Veteran-Owned Business			
☐ HUBZone Business (Historically Underutilized) Business			
☐ Other			
☐ None			

ARTICLE 4—SAFETY

4.01 Provide information regarding Business's safety organization and safety performance.

Name of Business's Safety Officer:	

Safety Certifications		
Certification Name	Issuing Agency	Expiration

4.02 Provide Worker's Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—FINANCIAL

5.01 Provide information regarding the Business's financial stability. Provide the most recent audited financial statement, and if such audited financial statement is not current, also provide the most current financial statement.

Financial Institution:		
Business address:		
Date of Business's most recent financial statement:		☐ Attached
Date of Business's most recent audited financial statement:		☐ Attached
Financial indicators from the most recent financial statement		
Contractor's Current Ratio (Current Assets ÷ Current Liabilities)		

Contractor's Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)	

ARTICLE 6—SURETY INFORMATION

6.01 Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?	☐ Yes ☐ No		
Is surety listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? ☐ Yes ☐ No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 7—INSURANCE

7.01 Provide information regarding Business's insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):	
Insurance Provider	Type of Policy (Coverage Provided)
Are providers licensed or authorized to issue policies in the Project location?	☐ Yes ☐ No
Does provider have an A.M. Best Rating of A-VII or better?	☐ Yes ☐ No
Mailing Address (principal place of business):	
Physical Address (principal place of business):	

Phone (main):		Phone (claims):	

ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.02 Provide information regarding the Business's previous contracting experience.

Years of experience with projects like the proposed project:				
As a general contractor:		As a joint venturer:		
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:				
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been barred from contracting by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been released from a bid in the past 5 years? ☐ Yes ☐ No				
Defaulted on a project or failed to complete any contract awarded to it? ☐ Yes ☐ No				
Refused to construct or refused to provide materials defined in the contract documents or in a change order? ☐ Yes ☐ No				
Been a party to any currently pending litigation or arbitration? ☐ Yes ☐ No				
Provide full details in a separate attachment if the response to any of these questions is Yes.				

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business's experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business's key leaders as well.

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.

B. Diverse Business Certifications if required by Paragraph 3.01.

C. Certification of Business's safety performance if required by Paragraph 4.02.

D. Financial statements as required by Paragraph 5.01.

E. Attachments providing additional information as required by Paragraph 8.02.

F. Schedule A (Current Projects) as required by Paragraph 8.03.

G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.

H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.

I. Additional items as pertinent.

This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

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

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

Schedule A—Current Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
onstruction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule C—Key Individuals

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

END OF SECTION

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

This Agreement is by and between **Fayette County, Georgia** ("Owner") and **[name of contracting entity]** ("Contractor").

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

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: **Construction and commissioning of a metal elevated storage tank and booster pump station at the Trilith Studios property.**

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **Increase water storage capacity for the Fayette County Water System.**

ARTICLE 3—ENGINEER

3.01 The Owner has retained **Arcadis U.S., Inc.** ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by **Engineer**.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

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

4.02 *Contract Times: Days*

A. The Work will be substantially complete within **395** calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within **425** calendar days after the date when the Contract Times commence to run.

4.04 *Milestones*

A. Parts of the Work must be substantially completed on or before the following Milestone(s):

1. Milestone 1 **Phase 1: Elevated Storage Tank 305 calendar days**

4.05 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified (e.g., rain days or other allowed days). These liquidated damages are not established as a penalty but are calculated and agreed upon in advance by the Owner and the Contractor due to the uncertainty and difficulty of making a determination as to the actual and consequential damages which are incurred by the Owner and the general public as a result of the failure on the part of the Contractor to complete the Work on time. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner $1,500 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $500 for each day that expires after such time until the Work is completed and ready for final payment.

3. *Milestones:* Contractor shall pay Owner $1,500 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved, or until the time specified for Substantial Completion is reached, at which time the rate indicated in Paragraph 4.05.A.1 will apply, rather than the Milestone rate.

4. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

ARTICLE 5—CONTRACT PRICE

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

A. For all Work other than Unit Price Work and Allowances, a lump sum as indicated in the Contractor's Bid Form.

B. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item) as indicated in the Contractor's Bid Form.

The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

C. Total of Lump Sum Amount, Allowances, and Unit Price Work (subject to final Unit Price adjustment) $**[number]**.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the **25th** day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. **95** percent of the value of the Work completed (with the balance being retainage).

b. **95** percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **100** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **200** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

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

6.04 *Consent of Surety*

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

6.05 *Interest*

A. All amounts not paid when due will bear interest at the rate of **six (6)** percent per annum.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual (copy of list attached).
6. Drawings (not attached but incorporated by reference) consisting of **sixty** sheets with each sheet bearing the following general title: **FCWS - Trilith Studios Elevated Water Storage Tank**.
7. Addenda (numbers **[number]** to **[number]**, inclusive).
8. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.
    d. Field Orders.
    e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

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

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.
7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

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

8.03 *Standard General Conditions*

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

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

This Agreement will be effective on **[indicate date on which Contract becomes effective]** (which is the Effective Date of the Contract).

Owner:	Contractor:
_____ *(typed or printed name of organization)*	_____ *(typed or printed name of organization)*
By: _____ *(individual's signature)*	By: _____ *(individual's signature)*
Date: _____ *(date signed)*	Date: _____ *(date signed)*
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)* *(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*
Attest: _____ *(individual's signature)*	Attest: _____ *(individual's signature)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address for giving notices:	Address for giving notices:
_____	_____
_____	_____
_____	_____
Designated Representative:	Designated Representative:
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address:	Address:
_____	_____
_____	_____
_____	_____
Phone: _____	Phone: _____
Email: _____ *(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*	Email: _____ License No.: _____ *(where applicable)* State: _____

SECTION 00 52 14

ADDITIONAL TERMS AND CONDITIONS

ITB # 2285-B FCWS – Trilith Studios Elevated Water Storage Tank

1. **Definitions**: The term "contractor" as used herein and elsewhere in these Terms and Conditions shall be used synonymously with the term "successful bidder." The term "County" shall mean Fayette County, Georgia.

2. **Bid is Offer to Contract**: Each bid constitutes an offer to become legally bound to a contract with the County, incorporating the invitation to bid and the bidder's bid. The binding offer includes compliance with all terms, conditions, special conditions, specifications, and requirements stated in the invitation to bid, except to the extent that a bidder takes written exception to such provisions. All such terms, conditions, special conditions, specifications, and requirements will form the basis of the contract. The bidder should take care to answer all questions and provide all requested information, and to note any exceptions in the bid submission. Failure to observe any of the instructions or conditions in this invitation to bid may result in rejection of the bid.

3. **Binding Offer**: To allow sufficient time for a contract to be awarded, each bid shall constitute a firm offer that is binding for sixty (60) days from the date of the bid opening until the date of contract award, unless the bidder takes exception to this provision in writing.

4. **Bidder's Questions**: -As appropriate, the County will post answers to questions and/or other information concerning the invitation to bid in the form of an addendum on the County's website at www.fayettecountyga.gov. It is the responsibility of the prospective bidder to check the website for any addenda issued for this invitation to bid.

5. **References**: Include with your bid a list of three (3) jobs that your company has done that are of the same or similar nature to the work described in this invitation to bid on the form provided. Include all information as requested on the form.

6. **Bid Submission**: Submit your bid, along with any addenda issued by the County, in a sealed opaque envelope with the following information written on the outside of the envelope:

    a. The bidder's company name,
    b. The bid number, which is **# 2285-B**, and
    c. The bid name, which is **FCWS – Trilith Studios Elevated Water Storage Tank**.

Mail or deliver one (1) original bid, signed in ink by a company official authorized to make a legal and binding offer, and one (1) copy on a flash drive, to:

Fayette County Government
Purchasing Department
140 Stonewall Avenue West, Suite 204
Fayetteville, GA 30214

Attention: Contracts Administrator

You may submit bids in person, by U.S. mail, or by a commercial carrier. Do not submit bids by facsimile, e-mail, or other electronic means. Once submitted, all bids become the property of Fayette County.

7. **Bid Preparation Costs**: The bidder shall bear all costs associated with preparing the bid.

8. **Late Bids**: Bids not received by the time and date of the scheduled bid opening will not be considered unless the delay is a result of action or inaction by the County.

9. **More than One Bid**: Do not submit alternate bids or options, unless requested or authorized by the County in the Invitation to Bid. If a responder submits more than one bid without being requested or authorized to do so, the County may disqualify the bids from that responder, at the County's option.

10. **Bid Corrections or Withdrawals**: The bidder may correct a mistake, or withdraw a bid, before the bid opening by sending written notification to the Director of Purchasing. Bids may be withdrawn after the bid opening only with written authorization from the Director of Purchasing.

11. **Defects or Irregularities in Bids**: The County reserves the right to waive any defect or irregularity in any bid received. In case of a discrepancy between unit prices and extended prices, the unit price will govern unless the facts or other considerations indicate another basis for correction of the discrepancy.

12. **Prices Held Firm**: Prices quoted shall be firm for the period of the contract, unless otherwise specified in the bid. All prices for commodities, supplies, equipment, or other products shall be quoted FOB Destination, Fayette County or job site.

13. **Brand Name**: If items in this invitation for bid have been identified, described, or referenced by a brand name or trade name description, such identification is intended to be descriptive, but not restrictive and is to indicate the quality and characteristics of products that may be offered. Alternative products may be considered for award if clearly

identified in the bid. Items offered must meet required specifications and must be of a quality which will adequately serve the use and purpose for which intended.

14. **Bidder Substitutions**: Bidders offering substitutions or deviations from specifications stated in the invitation to bid, shall list such substitutions or deviations on the "Exceptions to Specifications" sheet provided, or on a separate sheet to be submitted with the bid. The absence of such list shall indicate that the bidder has taken no exception to the specifications. The evaluation of bids and the determination as to equality and acceptability of products or services offered shall be the responsibility of the County.

15. **Samples**: When the County requires samples as part of the bid and vendor selection process, bidders must provide requested samples within the time allotted, and at no cost to the County unless otherwise specified. Any goods provided under contract shall conform to the sample submitted. The County will return samples only at the bidder's request, and at the bidder's expense, if they are not destroyed by testing.

16. **Non-Collusion**: By responding to this invitation to bid, the bidder represents that the bid is not made in connection with any competing bidder, supplier, or service provider submitting a separate response to this invitation to bid and is in all respects fair and without collusion or fraud.

17. **Bid Evaluation**: Award will be made to the lowest responsive, responsible bidder, taking into consideration payment terms, vendor qualifications and experience, quality, references, any exceptions listed, and/or other factors deemed relevant in making the award. The County may make such investigation as it deems necessary to determine the ability of the bidder to perform, and the bidder shall furnish to the County all information and data for this purpose as the County may request. The County reserves the right to reject any bid item, any bid, or all bids, and to re-advertise for bids.

18. **Payment Terms and Discounts**: The County's standard payment terms are Net 30. Any deviation from standard payment terms must be specified in the resulting contract, and both parties must agree on such deviation. Cash discounts offered will be a consideration in awarding the bid, but only if they give the County at least 15 days from receipt of invoice to pay. For taking discounts, time will be computed from the date of invoice acceptance by the County, or the date a correct invoice is received, whichever is the later date. Payment is deemed made, for the purpose of earning the discount, on the date of the check.

19. **Trade Secrets – Confidentiality**: If any person or entity submits a bid or proposal that contains trade secrets, an affidavit shall be included with the bid or proposal. The affidavit shall declare the specific included information which constitutes trade secrets. Any trade secrets must be either (1) placed in a separate envelope, clearly identified and marked as such, or (2) at a minimum, marked in the affidavit or an attached document explaining exactly where such information is, and otherwise marked, highlighted, or made plainly

visible. See O.C.G.A. § 50-18-72 (A)(34).

20. **Trade Secrets – Internal Use**: In submitting a bid, the bidder agrees that the County may reveal any trade secret materials contained in the bid to all county staff and officials involved in the selection process, and to any outside consultant or other third parties who may assist in the selection process. The bidder agrees to hold harmless the County and each of its officers, employees, and agents from all costs, damages, and expenses incurred in connection with refusing to disclose any material which the bidder has designated as a trade secret.

21. **Ethics – Disclosure of Relationships**: Before a proposed contract in excess of $10,000.00 is recommended for award to the Board of Commissioners or the County Administrator, or before the County renews, extends, or otherwise modifies a contract after it has been awarded, the contractor must disclose certain relationships with any County Commissioner or County Official, or their spouse, mother, father, grandparent, brother, sister, son or daughter related by blood, adoption, or marriage (including in-laws). A relationship that must be reported exists if any of these individuals is a director, officer, partner, or employee, or has a substantial financial interest the business, as described in Fayette County Ordinance Chapter 2, Article IV, Division 3 (Code of Ethics).

    If such relationship exists between your company and any individual mentioned above, relevant information must be presented in the form of a written letter to the Director of Purchasing. You must include the letter with any bid, proposal, or price quote you submit to the Purchasing Department.

    In the event that a contractor fails to comply with this requirement, the County will take action as appropriate to the situation, which may include actions up to and including rejection of the bid or offer, cancellation of the contract in question, or debarment or suspension from award of a county contract for a period of up to three years.

22. **Contract Execution & Notice to Proceed**: After the Board of Commissioners makes an award, all required documents are received by the County, and the contract is fully executed with signature of both parties, the County will issue a written Notice to Proceed. The County shall not be liable for payment of any work done or any costs incurred by any bidder prior to the County issuing the Notice to Proceed.

23. **Unavailability of Funds**: This contract will terminate immediately and absolutely at such time as appropriated and otherwise unobligated funds are no longer available to satisfy the obligations of the County under the contract.

24. **Insurance**: The successful bidder shall procure and maintain the following insurance, to be in effect throughout the term of the contract, in at least the amounts and limits as

follows:

a. **General Liability Insurance**: $1,000,000 combined single limit per occurrence, including bodily and personal injury, destruction of property, and contractual liability.

b. **Automobile Liability Insurance**: $1,000,000 combined single limit each occurrence, including bodily injury and property damage liability.

c. **Worker's Compensation & Employer's Liability Insurance**: Workers Compensation as required by Georgia statute.

d. **Builder's "All Risk" Insurance**: In the event the contractor is performing construction services under the contract, contractor shall procure and maintain "all-risk" builder's insurance, providing coverage for the work performed under the contract, and the materials, equipment or other items 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 at least 100% of the value of the contract, including any additional costs which are normally insured under such policy.

Before a contract with the successful bidder is executed, the successful bidder shall provide Certificates of Insurance for all required coverage. The successful offeror can provide the Certificate of Insurance after award of the contract but must be provided prior to execution of the contract document by both parties. The certificate shall list an additional insured as follows:

Fayette County, Georgia, 140 Stonewall Avenue West, Fayetteville, GA 30214

Arcadis U.S., Inc., 2839 Paces Ferry Rd SE, Suite 900, Atlanta GA, 30339

25. **Bid Bond**: You must include a bid bond with your bid, equal to five percent (5%) of the total amount bid. Bid bonds shall be provided by a surety which appears on Georgia's list of approved sureties administered by the State Insurance Commissioner, or the U.S. Treasury's list of approved bond sureties (Circular 570).

26. **Performance and Payment Bonds**: Prior to execution of a contract, the successful bidder shall submit performance and payment bonds each equal to 100 percent of the contract value, provided by a surety which appears on Georgia's list of approved sureties administered by the State Insurance Commissioner, or the U.S. Treasury's list of approved bond sureties (Circular 570).

27. **Building Permits**: Work performed for the County requiring building permits by licensed contractors will not have permit fees assessed, although any re-inspection fees for disapproved inspections will be the responsibility of the contractor prior to final inspections and the Certificate of Occupancy or Certificate of Completion being issued.

28. **Unauthorized Performance**: The County will not compensate the contractor for work performed unless the work is authorized under the contract, as initially executed, or as amended.

29. **Assignment of Contract**: Assignment of any contract resulting from this invitation to bid will not be authorized, except with express written authorization from the County.

30. **Indemnification**: The contractor shall indemnify and save the County and all its officers, agents, and employees harmless from all suits, actions, or other claims of any character, name and description brought for or on account of any damages, losses, or expenses to the extent caused by or resulting from the negligence, recklessness, or intentionally wrongful conduct of the contractor or other persons employed or utilized by the contractor in the performance of the contract. The contractor shall pay any judgment with cost which may be obtained against the County growing out of such damages, losses, or expenses.

31. **Severability**: The invalidity of one or more of the phrases, sentences, clauses, or sections contained in the contract shall not affect the validity of the remaining portion of the contract. If any provision of the contract is held to be unenforceable, then both parties shall be relieved of all obligations arising under such provision to the extent that the provision is unenforceable. In such case, the contract shall be deemed amended to the extent necessary to make it enforceable while preserving its intent.

32. **Delivery Failures**: If the contractor fails to deliver contracted goods or services within the time specified in the contract or fails to replace rejected items in a timely manner, the County shall have authority to make open-market purchases of comparable goods or services. The County shall have the right to invoice the contractor for any excess expenses incurred or deduct such amount from monies owed the contractor. Such purchases shall be deducted from contracted quantities.

33. **Substitution of Contracted Items**: The contractor shall be obligated to deliver products awarded in this contract in accordance with terms and conditions specified herein. If a contractor is unable to deliver the products under the contract, it shall be the contractor's responsibility to obtain prior approval of the ordering agency to deliver an acceptable substitute at the same price quoted in the contractor's original bid. In the event any contractor consistently needs to substitute or refuses to substitute products, the County reserves the right to terminate the contract or invoke the "Delivery Failures" clause stated herein.

34. **Inspection and Acceptance of Deliveries**: The County reserves the right to inspect all goods and products delivered. The County will decide whether to accept or reject items delivered. The inspection shall be conclusive except with respect to latent defects, fraud, or such gross mistakes as shall amount to fraud. Final inspection resulting in acceptance or rejection of the products will be made as soon as practicable, but failure to inspect shall not be construed as a waiver by the County to claim reimbursement or damages for such products which are later found to be in non-conformance with specifications. Should public necessity demand it, the County reserves the right to use or consume articles delivered which are substandard in quality, subject to an adjustment in price to be determined by the Purchasing Director.

35. **Termination for Cause**: The County may terminate the contract for cause by sending written notice to the contractor of the contractor's default in the performance of any term of this agreement. As appropriate, the County will compensate the contractor for completed performance, and for any partially completed performance as determined by the County to be adequately performed. Termination shall be without prejudice to any of the County's rights or remedies by law.

36. **Termination for Convenience**: The County may terminate the contract for its convenience at any time with 10 days' written notice to the contractor. In the event of termination for convenience, the County will pay the contractor for services performed. The County will compensate partially completed performance based upon a signed statement of completion submitted by the contractor, which shall itemize each element of performance completed.

37. **Force Majeure**: Neither party shall be deemed to be in breach of the contract to the extent that performance of its obligations is delayed, restricted, or prevented by reason of any act of God, natural disaster, act of government, or any other act or condition beyond the reasonable control of the party in question.

38. **Governing Law**: This agreement shall be governed in accordance with the laws of the State of Georgia. The parties agree to submit to the jurisdiction in Georgia, and further agree that any cause of action arising under this agreement shall be required to be brought in the appropriate venue in Fayette County, Georgia.

END OF SECTION

PERFORMANCE BOND

Contractor Name: **[Full formal name of Contractor]** Address *(principal place of business)*: **[Address of Contractor's principal place of business]**	**Surety** Name: **[Full formal name of Surety]** Address *(principal place of business)*: **[Address of Surety's principal place of business]**
Owner Name: **[Full formal name of Owner]** Mailing address *(principal place of business)*: **[Address of Owner's principal place of business]**	**Contract** Description *(name and location)*: **FCWS – Trilith Studios Elevated Water Storage Tank/ Trilith Water Tower Pump House, 400 Veterans Parkway, Building 13, Fayetteville, GA 30214** Contract Price: **[Amount from Contract]** Effective Date of Contract: **[Date from Contract]**

Bond

Bond Amount: **[Amount]**

Date of Bond: **[Date]**

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 16

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

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

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

1. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

2. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:

    2.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

    2.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

    2.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

3. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

4. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

    4.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

    4.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

    4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

4.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

5. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

6. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

6.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

6.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

6.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

7. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

8. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

9. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

10. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

11. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

12. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

13. Definitions

    13.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    13.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    13.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    13.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    13.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

14. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

15. Modifications to this Bond are as follows: **[Describe modification or enter "None"]**

PAYMENT BOND

Contractor	**Surety**
Name: **[Full formal name of Contractor]** Address *(principal place of business)*: **[Address of Contractor's principal place of business]**	Name: **[Full formal name of Surety]** Address *(principal place of business)*: **[Address of Surety's principal place of business]**
Owner	**Contract**
Name: **[Full formal name of Owner]** Mailing address *(principal place of business)*: **[Address of Owner's principal place of business]**	Description *(name and location)*: **FCWS – Trilith Studios Elevated Water Storage Tank/ Trilith Water Tower Pump House, 400 Veterans Parkway, Building 13, Fayetteville, GA 30214** Contract Price: **[Amount, from Contract]** Effective Date of Contract: **[Date, from Contract]**

Bond

Bond Amount: **[Amount]**

Date of Bond: **[Date]**

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 18

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

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:

    5.1. Claimants who do not have a direct contract with the Contractor

        5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2. Pay or arrange for payment of any undisputed amounts.

    7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety

shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

    16.1. *Claim*—A written statement by the Claimant including at a minimum:

        16.1.1. The name of the Claimant;

        16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

16.1.4. A brief description of the labor, materials, or equipment furnished;

16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: **[Describe modification or enter "None"]**

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

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

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

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

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

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

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

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

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

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

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

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

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

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

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

4.02 *Starting the Work*

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

4.03 *Reference Points*

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

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

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

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

5.01 *Availability of Lands*

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

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

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

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

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

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

5.03 *Subsurface and Physical Conditions*

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

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

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

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

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

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

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

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

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

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

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

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

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

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

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

B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

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

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

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

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

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

7.10 *Taxes*

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

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give w ritten notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

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

7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

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

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

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

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

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

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.

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

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

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

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

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

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

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

9.03 *Furnish Data*

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

9.04 *Pay When Due*

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

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

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

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

9.07 *Change Orders*

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

9.08 *Inspections, Tests, and Approvals*

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

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

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

9.11 *Evidence of Financial Arrangements*

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

9.12 *Safety Programs*

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

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

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

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

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

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

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

10.05 *Determinations for Unit Price Work*

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

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

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

10.07 *Limitations on Engineer's Authority and Responsibilities*

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

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

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

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

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

10.08 *Compliance with Safety Program*

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

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

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

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

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

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

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

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

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

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

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

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

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

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

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

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

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

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

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

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

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

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

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

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

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

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

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

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

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

14.01 *Access to Work*

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

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

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

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

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

14.04 *Acceptance of Defective Work*

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

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

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

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

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

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

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

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

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work;

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

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

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

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

15.03 *Substantial Completion*

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

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

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

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

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

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

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

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

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

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

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

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

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

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

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

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

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

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

18.03 *Cumulative Remedies*

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

18.04 *Limitation of Damages*

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

18.05 *No Waiver*

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

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

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

18.08 *Assignment of Contract*

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

18.09 *Successors and Assigns*

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

18.10 *Headings*

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

SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

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

Article 1—**DEFINITIONS AND TERMINOLOGY**

SC-1.01.A.16 Add the following to Paragraph 1.01.A.16:

The terms “Contractor” and “CONTRACTOR” have the same meaning.

SC-1.01.A.22 Add the following to Paragraph 1.01.A.22:

The terms “Engineer” and “ENGINEER” have the same meaning.

SC-1.01.A.30 Add a new sentence to Paragraph 1.01.A.30 that is to read as follows:

The terms “Owner” and “OWNER” have the same meaning.

SC-1.01.A.40 Add a new sentence to Paragraph 1.01.A.40 that is to read as follows:

Trucking, shipping, and delivery firms, consultants, and entities performing testing or inspection retained by Contractor or any Subcontractor are considered to be Subcontractors.

SC-1.01.A.45 Add a new sentence to Paragraph 1.01.A.45 that is to read as follows:

Entities that rent construction equipment or machinery, but are not incorporated into the Work, are considered to be Suppliers. If such rental entity furnishes both equipment and one or more personnel to operate and maintain the equipment, such entity is a Subcontractor.

Article 2—**PRELIMINARY MATTERS**

2.01 *Delivery of Bonds and Evidence of Insurance*

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

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

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

2.02 *Copies of Documents*

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

Owner shall furnish to Contractor **one** printed copies of the Contract Documents (including one fully signed counterpart of the Agreement), and **one copy** in electronic portable document format (PDF).

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

A. Owner shall furnish to Contractor **one** printed copy of conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract (including one fully signed counterpart of the Agreement), and **one** in electronic portable document format (PDF). Additional printed copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction.

2.06 *Electronic Transmittals*

SC-2.06 Delete Paragraph 2.06.B in its entirety and insert the following in its place:

B. Electronic Means are established in Specification Section 01 31 26, Electronic Document Protocol.

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

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

1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.

2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor ("Request") in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner's response to the Request, and to the following conditions to which Contractor agrees:

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

b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Engineer to Contractor under the request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.

c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from Contractor's use, adaptation, or distribution of any Electronic Documents provided under the Request.

d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.

e. Contractor agrees to execute ENGINEER's standard agreement for release of electronic files (copy attached to Specification Section 01 n78 39. Record Documents) and shall abide by the provisions of such agreement for release of electronic files.

3. In the event that Owner elects to provide or directs the Engineer to provide to Contractor any Contractor-requested Electronic Document versions of Project information that is not explicitly identified in the Contract Documents as being available to Contractor, the Owner shall be reimbursed by Contractor on an hourly basis (at $**[number]** per hour) for any engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Engineer.

Article 3—**CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE**

No suggested Supplementary Conditions in this Article.

Article 4—**COMMENCEMENT AND PROGRESS OF THE WORK**

No suggested Supplementary Conditions in this Article.

Article 5—**SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS**

5.03 *Subsurface and Physical Conditions*

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

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely: **If there are no such reports, so indicate in the table.**

Report Title	Date of Report	Technical Data
Report of Subsurface Exploration and Geotechnical Engineering Evaluation – Trilith Studios Above Ground Storage Tank and Addendums 1 – 2.	October 4, 2022	Recommendations of deep foundations for support of the above ground storage tank.

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely: **If there are no such drawings, so indicate in the table.**

Drawings Title	Date of Drawings	Technical Data
Trilith Studios Main Entrance	TBD	Alignment of main entrance to the movie studios.

G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at **Fayette County Water System** during regular business hours, or may request copies from Engineer.

Article 6—**BONDS AND INSURANCE**

6.01 *Performance, Payment, and Other Bonds*

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

1. *Required Performance Bond Form:* The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond (2010, 2013, or 2018 edition).
2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2010, 2013, or 2018 edition).

6.02 *Insurance—General Provisions*

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

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

6.03 *Contractor's Insurance*

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

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: **Trilith Studios, LLC, 400 Veterans Parkway, Fayetteville, GA 3021.**

E. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation as required by Georgia statute.

F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.
5. Personal injury coverage.
6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
2. Any exclusion for water intrusion or water damage.

3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	**Policy limits of not less than:**
Bodily Injury and Property Damage—Each Occurrence	$1,000,000

J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	**Policy limits of not less than:**
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000

Article 7—**CONTRACTOR'S RESPONSIBILITIES**

7.02 *Supervision and Superintendence*

SC-7.02 Amend Paragraph 7.02.B of the General Conditions by adding the following sentence:

> Unless the Owner otherwise agrees in writing, the superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

7.03 *Labor; Working Hours*

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

1. Regular working hours will be Monday through Friday, excluding holidays, occurring between the hours of 7:00 AM and 7:00 PM, unless restricted otherwise. Contractor shall establish a 40-hour work week with regular scheduled work times, e.g., four 10-hour days or five 8-hour days, within the hours and days allowed above. Approval for specific work outside regular scheduled work times shall be requested no less than 48 hours prior to the requested work period. Contractor shall request approval of changes

in regular scheduled work times no less than one week prior to the desired change. Occasional unscheduled overtime on weekdays may be permitted provided reasonable notice is given to Engineer .

2. Owner's legal holidays are: New Year's Day, Martin Luther King Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Veterans Day, Thanksgiving, Day After Thanksgiving, Christmas Eve, and Christmas Day.

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

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

7.10 *Taxes*

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

A. Owner is exempt from payment of sales and compensating use taxes of the State of **Georgia** and of cities and counties thereof on all materials to be incorporated into the Work.

1. Contractor will furnish the required invoices to Owner for use in the purchase of supplies and materials to be incorporated into the Work, for submittal to the State.

7.13 *Safety and Protection*

SC-7.13 Amend the second sentence of Paragraph 7.13.G by deleting the words "…the Supplementary Conditions or Specifications." and replace with the words Specification Section 01 35 23, Safety Requirements".:

7.14 *Hazard Communication Programs*

SC-7.14 Add the following new paragraph immediately after Paragraph 7.14.A:

B. Contractor shall provide a centralized location for the maintenance of the safety data sheets or other hazard communication information required to be made available by any employer on the Site. Location of the safety data sheets or other hazard communication information shall be readily accessible to the employees of all employers on the Site.

Article 8—**OTHER WORK AT THE SITE**

8.02 *Coordination*

SC-8.02 Add the following new Paragraph 8.02.C immediately after Paragraph 8.02.B and renumber the following paragraphs:

C. Trilith Studios intends to contract with others for the performance of other work at or adjacent to the Site.

1. Trilith Studios shall have authority and responsibility for coordination of the various contractors and work forces at the Site;

Article 9—**OWNER'S RESPONSIBILITIES**

No suggested Supplementary Conditions in this Article.

Article 10—**ENGINEER'S STATUS DURING CONSTRUCTION**

10.03 *Resident Project Representative*

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

C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:

1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

3. *Liaison*

   a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.

4. *Review of Work; Defective Work*

   a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

   b. Observe whether any Work in place appears to be defective.

   c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. *Inspections and Tests*

   a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

   b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. *Payment Requests:* Review Applications for Payment with Contractor.

7. *Completion*

   a. Participate in Engineer's visits regarding Substantial Completion.

   b. Assist in the preparation of a punch list of items to be completed or corrected.

   c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

   d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Authorize Owner to occupy the Project in whole or in part.

Article 11—**CHANGES TO THE CONTRACT**

No suggested Supplementary Conditions in this Article.

Article 12—**CLAIMS**

SC-12.01 Delete Paragraph 12.01.D Mediation in its entirety and renumber subsequent paragraphs.

Article 13—**COST OF WORK; ALLOWANCES, UNIT PRICE WORK**

13.01 *Cost of the Work*

SC-13.01 Supplement Paragraph 13.01.B.5.c.(2) by adding the following sentence:

The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of Rental Rate Blue Book for Construction Equipment, or the AED Green Book: Rental Rates & Specifications for Construction Equipment.

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than $500.

Article 14—**TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCCEPTANCE OF DEFECTIVE WORK**

No suggested Supplementary Conditions in this Article.

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

15.01 ***PROGRESS PAYMENTS***

SC-15.01 Amend Paragraph 15.01D.1 of the General Conditions by replacing "Ten days" with "Thirty days".

15.03 *Substantial Completion*

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

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

Article 16—**SUSPENSION OF WORK AND TERMINATION**

No suggested Supplementary Conditions in this Article.

Article 17—**FINAL RESOLUTIONS OF DISPUTES**

17.01 *Methods and Procedures*

SC-17.01 Amend Paragraph 17.01.B.3 of the General Conditions by adding the following sentence:

The parties agree to submit to the jurisdiction in Georgia, and further agree that any cause of action arising under this agreement shall be required to be brought in the appropriate venue in Fayette County, Georgia.

17.02 *Attorneys' Fees*

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

17.02 *Attorneys' Fees*

A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration

panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

Article 18—**MISCELLANEOUS**

SC-18.11 Add the following new paragraph immediately after Paragraph 18.10:

SC-18.11 *Confidential Information*

A. All Drawings, Specifications, technical data, and other information furnished to Contractor either by Owner or Engineer or developed by Contractor or others in connection with the Work are, and will remain, the property of Owner or Engineer, and shall not be copied or otherwise reproduced or used in any way except in connection with the Work, or disclosed to third parties or used in any manner detrimental to the interests of Owner or Engineer.

B. The following information is not subject to the above confidentiality requirements:

1. information in the public domain through no action of Contractor in breach of the Contract Documents; or
2. information lawfully possessed by Contractor before receipt from Owner or Engineer; or
3. information required to be disclosed by Laws or Regulations, or by a court or agency of competent jurisdiction. However, in the event Contractor shall be so required to disclose such information, Contractor shall, prior to disclosure, provide reasonable notice to Owner and Engineer, who shall have the right to interpose all objections Owner may have to the disclosure of such information.

C. Contractor shall not disclose to any third party the nature of its Work on the Project, nor engage in publicity or public media disclosures with respect to the Project without the prior written consent of Owner.

DIVISION 1 - GENERAL REQUIREMENTS

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SECTION 01 11 13

SUMMARY OF WORK

PART 1 - GENERAL

1.1 - SECTION INCLUDES

A. This Section includes the following Articles:

1.02 Location and Description of Work
1.03 Work by Others
1.04 Work by Owner
1.05 Sequence and Progress of Work
1.06 Contractor's Use of Site
1.07 Easements and Rights-Of-Way
1.08 Notices to Owners and Authorities of Properties Adjacent to the Work
1.09 Salvage of Materials and Equipment

1.2 LOCATION AND DESCRIPTION OF WORK

A. The Work is located at Trilith Studios, 400 Veterans Parkway, Fayetteville, 30214. The Work to be performed under this Contract includes, but is not limited to, constructing the Work described below and all related appurtenances. The Work includes, but is not limited to, the following:

1. Clear site as necessary for removal, repair, and/or installation of the proposed improvements and maintain erosion control measures throughout the duration of the project.

2. Cut and fill as required to bring site to new grade as shown in the contract drawings.

3. Restore all disturbed areas such as roadways, driveways, parking areas, curbs, curb and gutter, sidewalks, yards, ornamental plantings, etc., and clean-up the project work area and return the area to its pre-construction conditions.

4. Construction of elevated steel water storage tank and associated foundations and supports.

5. Construction of new booster pump building and installation of associated pumps, piping, and appurtenances.

6. Installation of new buried watermain and connection to existing distribution main. Installation of interconnecting piping between watermain, elevated tank, and booster pump building. Includes a buried precast valve vault and other buried valves.

7. Installation of new perimeter fencing and gate.

8. Coordination of incoming electrical service with Coweta-Fayette EMC for installation of new utility transformer, meter and to perform required trenching/earthwork. Transformer along with its prefabricated concrete pad, meter base, primary conduit and wiring will be provided by the utility.

9. Installation of new LED lighting inside the pump station building as well as to the exterior walls of the building.

10. Provision of power distribution along with necessary control wiring and grounding required for the equipment and instrumentation, both inside and outside of the pump station building.

11. I&C

B. Contracting Method: The Project shall be constructed under one prime Contract.

C. Hazardous Environmental Conditions:

1. To the best of Trilith's knowledge, information, and belief, the prior use of the Site was undeveloped agricultural land until 2013, when the site was converted into a movie studio.

1.3 WORK BY OTHERS

A. Non-Professional Services Contracted by OWNER: OWNER will retain services of the following entities to perform the services indicated relative to the Project. CONTRACTOR shall coordinate and schedule the Work with, and cooperate with, the entities performing the following services for OWNER.

1. None

1.4 WORK BY OWNER

A. OWNER will perform the following in connection with the Work:

1. Operate all existing valves, gates, pumps, equipment, and appurtenances that will affect OWNER's operation, unless otherwise specified or indicated.

1.5 SEQUENCE AND PROGRESS OF WORK

A. Requirements for sequencing and coordinating with OWNER's operations, including maintenance of facility operations during construction, and requirements for tie-ins and shutdowns, are in Section 01 14 16, Coordination with Owner's Operations.

1.6 CONTRACTOR'S USE OF SITE

C. Limits on contractor's use of the site are:

1. Do not use the site for operations other than those required for the project. All access and operations outside of the construction limits must have Trilith's approval.

1.7 EASEMENTS AND RIGHTS-OF-WAY

A. General:

1. Easements and rights-of-way required for the permanent improvements included in the Work are provided by the OWNER.

2. Confine construction operations within limits of construction, public rights-of-way, easements obtained by OWNER, and limits shown, and for which CONTRACTOR has made arrangements directly with Trilith.

3. Use care in placing construction tools, equipment, excavated materials, and materials and equipment to be incorporated into the Work to avoid damaging property and interfering with traffic.

4. Do not enter Trilith property outside the construction limits without permission from Trilith.

1.8 NOTICES TO OWNERS AND AUTHORITIES OF PROPERTIES ADJACENT TO THE WORK

A. Notify Trilith or the OWNER of the Work may affect their property, facilities, or use of property.

B. Notify utility owners and other concerned entities not less than 48 hours prior to cutting or closing streets or other traffic areas or excavating near Underground Facilities or exposed utilities.

1.9 SALVAGE OF MATERIALS AND EQUIPMENT

A. Existing materials and equipment removed and not shown or specified to be reused in the Work will become CONTRACTOR's property, except the following items that shall remain OWNER's property: None

B. Existing materials and equipment removed by CONTRACTOR shall not be reused in the Work, except for the following: None

C. Removal, Storage, Handling, Reinstallation:

1. Carefully remove in manner to prevent damage all materials and equipment shown or indicated to be salvaged and reused or to remain property of Trilith.

2. Store and protect salvaged items shown or indicated .

3. Replace in-kind or with new items those items of materials and equipment damaged during removal, storage, or handling through CONTRACTOR’s actions, negligence, or improper procedures.

1.10 PARTIAL UTILIZATION BY OWNER

A. Prior to Substantial Completion of the entire Work under the Contract, whenever, in the opinion of the Engineer, any section or portion of the Work or any structure is in suitable condition, it may be put into use upon the written order of the Engineer and such usage will not be held in any way as an acceptance of said Work or structure, or any part thereof, or as a waiver of any of the provisions of these Specifications and the Contract. Pending final completion and acceptance of the Work, all necessary repairs and replacements, due to defective materials or workmanship or operations of the Contractor, for any section of the Work so put into use shall be performed by the Contractor at Contractor's own expense.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 13 13

MILESTONES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section describes Work to be substantially completed to comply with Milestones indicated in the Agreement. This Section is not intended to describe all the Work or its constraints, interrelationships, or sequential requirements required.

2. CONTRACTOR shall provide all labor, materials, equipment, tools, and incidentals required to perform the Work in accordance with the Contract Times provisions of the Contract Documents.

3. To achieve each Milestone indicated in this Section, substantially complete those elements of the Work indicated starting with Article 0 of this Section, together with related equipment, systems, and appurtenant Work and activities.

4. Comply with the General Conditions, as may be modified by the Supplementary Conditions, regarding partial utilization and property insurance.

1.2 MILESTONE REQUIREMENTS

A. Complete the following activities by the indicated date or days after the Notice to Proceed:

Milestone	**Consecutive Calendar Days after Notice to Proceed**	**Liquidated Damages Per Calendar Day**
Phase 1: Elevated Storage Tank	305	$1,000
Substantial Completion of All Work	395	$1,000
Final Completion of All Work	425	$500

B. Substantial completion for the purposes of assessing liquidated damages shall be defined as the time at which the work (or a specified part thereof) is complete in the opinion of engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 14 16

COORDINATION WITH OWNER'S OPERATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section includes requirements for coordinating with OWNER's operations during the Project, and includes requirements for tie-ins and shutdowns necessary to complete the Work without impact on OWNER's operations except as allowed in this Section.

2. CONTRACTOR shall provide all labor, materials, equipment, tools, and incidentals shown, specified, and required to coordinate with OWNER's operations during the Work in accordance with this Section.

B. Coordination:

1. Review construction procedures under other Specifications sections and coordinate Work that will be performed with or before the Work specified in this Section.

C. Related Sections:

1. Section 01 11 13, Summary of Work.

2. Section 01 73 29, Cutting and Patching.

D. Except for shutdowns specified in this Section, perform the Work such that OWNER's facilities remain in continuous satisfactory operation during the Project. Schedule and conduct the Work such that the Work does not: impede OWNER's production or processes, create potential hazards to operating equipment and personnel, reduce the quality of the facility's products or effluent, cause odors or other nuisances, or affect the public health, safety, and convenience.

E. Work not specifically covered in this Section or in referenced Sections may, in general, be completed, within the Contract Times, at any time during regular working hours in accordance with the Contract Documents, subject to the requirements in this Section.

F. As a substitute to the procedures specified in this Section, CONTRACTOR may propose providing additional temporary facilities that can eliminate or mitigate a constraint without additional cost to OWNER, provided such additional temporary facilities: do not present hazards to the public, personnel, structures, and equipment; that such additional temporary facilities do not adversely affect OWNER's ability to

comply with Laws and Regulations, permits, and operating requirements; that such temporary facilities do not generate or foster the generation of odors and other nuisances; and that requirements of the Contract Documents are fulfilled.

G. Coordinate shutdowns with OWNER and ENGINEER. When possible, combine multiple tie-ins into a single shutdown to reduce impacts on OWNER's operations and processes.

H. Operation of Existing Systems and Equipment during the Work:

1. Do not shut off or disconnect existing operating systems or equipment, unless accepted by ENGINEER in writing.

2. Operation of existing systems and equipment will be by OWNER unless otherwise specified or indicated.

3. Where necessary for the Work, CONTRACTOR shall seal or bulkhead OWNER-operated gates and valves to prevent leakage that may affect the Work, OWNER's operations, or both.

4. Provide temporary watertight plugs, bulkheads, and line stops as required. After completing the Work, remove seals, plugs, bulkhead, and line stops to satisfaction of ENGINEER.

1.2 SUBMITTALS

A. Action Submittals: Submit the following:

1. Sequence Submittal: Furnish in detail the proposed sequence or procedures and associated effects, including evidence that OWNER's operations will not be adversely affected, to an extent greater than originally contemplated in the Contract Documents. List benefits including benefits to Progress Schedule. Submit in accordance with the requirements of the Contract Documents.

B. Informational Submittals: Submit the following:

1. Shutdown Planning Submittal:

a. For each shutdown, submit an inventory of labor, materials, and equipment required to perform the shutdown and tie-in tasks, an estimate of time required to accomplish the complete shutdown including time for OWNER to take down and start up existing equipment, systems, or conduits, and written description of steps required to complete the Work associated with the shutdown.

b. Furnish submittal to ENGINEER not less than 30 days prior to proposed shutdown start date. Do not start shutdown until obtaining ENGINEER's acceptance of shutdown planning submittal.

2. Shutdown Notification: After ENGINEER's acceptance of shutdown planning submittal and prior to starting the shutdown, submit written notification to OWNER and ENGINEER of date and time each shutdown is to start. Submit notification not less than 5 calendar days in advance of each shutdown.

1.3 GENERAL CONSTRAINTS

A. Indicated in the Contract Documents are the sequence and shutdown durations, where applicable, for OWNER'S equipment, systems, and conduits (including piping and ducting) that are to be taken out of service temporarily for the Work. New materials, equipment, and systems may be used by OWNER after the specified field quality controls and testing are successfully completed and the materials or equipment are Substantially Complete in accordance with the Contract Documents.

B. The following constraints apply to coordination with OWNER's operations:

1. Schedule and perform equipment and system start-ups for Monday through Thursday. Equipment and systems shall not be placed into operation on Friday, Saturday, and Sunday without prior approval of OWNER, unless specifically indicated otherwise in the Contract Documents.

2. Dead End Valves or Conduits: Provide blind flanges, watertight bulkheads, or valve at temporary and permanent terminuses of conduits, including piping and ducting. Blind flanges and bulkheads shall be suitable for the service and braced and blocked, as required, or otherwise restrained as directed by ENGINEER. Temporary valves shall be suitable for their associated service. Where valve is provided at permanent terminus of conduit, including piping or ducting, also provide on downstream side of valve a blind flange with drain/flushing connection.

3. CONTRACTOR is responsible for dewatering process tanks, basins, conduits, and other work areas to be dewatered for shutdowns. Maintain clean and dry work area by pumping and properly disposing of fluid and other material that accumulates in work areas.

4. Draining and Cleaning of Conduits, Tanks, and Basins:

a. Unless otherwise shown or indicated, CONTRACTOR shall dewater process tanks, basins, conduits (including piping) at beginning of each shutdown. Flush, wash down, and clean tanks, basins, conduits (including piping), and other work areas.

b. CONTRACTOR shall remove liquids and solids and dispose of them at appropriate location at the Site as directed by OWNER. Unless otherwise specified or indicated, contents of tanks, basins, and conduits (including piping) undergoing modifications shall be transferred to existing process tanks or conduits at the Site with capacity sufficient to accept such discharges, using hoses, temporary piping, temporary pumps, or other means provided by CONTRACTOR. Discharge of fluids across floors is not allowed.

c. If drainage point is not available on the conduit (including piping) to be drained, provide a wet tap using tapping saddle and valve or other method approved by ENGINEER. Uncontrolled spillage of contents of conduits (including piping) is not allowed.

d. Spillage shall be brought to ENGINEER's attention immediately, both verbally and in writing, and reported in accordance with Laws and Regulations. CONTRACTOR shall wash down spillage to floor drains or sumps or other appropriate location and flush the system to prevent clogging and odors. If spillage is not suitable for discharge to the drainage system, such as chemical spills, as determined by ENGINEER, CONTRACTOR shall remove spillage by other method, such as vactor truck, sorbents, or other method acceptable to ENGINEER.

1.4 RECOMMENDED SEQUENCE OF WORK

A. Recommended Sequence of the Work is indicated . Certain phases or stages of the Work may require working 24-hour days or work during hours outside of regular working hours. Work may be accelerated from a later stage to an earlier stage if OWNER's operations are not adversely affected by proposed sequence change, with ENGINEER's acceptance. Stages specified in this Article 0 are sequence-dependent.

B. Phase 1:

1. Demolition Activities:

a. Removal of existing well pump and electrical equipment from project site.

2. Installation of buried piping and appurtenances.

3. Intermediate earth moving and preparation of tank foundations.

4. Construction and erection and painting of elevated storage tank.

C. Phase 2:

1. Construction of pump building and installation of above ground pumps, piping, and equipment.
2. Final site grading.
3. Electrical/I&C Installation
    a. Portions of electrical/I&C work may be performed in previous phases, as appropriate.

1.5 TIE-INS

A. Table 01 14 16-A in this Section lists connections by CONTRACTOR to existing facilities. Table 01 14 16-A may not include all tie-ins required for the Work; CONTRACTOR shall perform tie-ins required to complete the Work as shown or indicated regardless of whether tie-in is indicated in Table 01 14 16-A. For tie-ins not indicated in Table 01 14 16-A, obtain requirements for tie-ins from ENGINEER by requesting an interpretation or clarification.

1.6 SHUTDOWNS

A. General:

1. Terminology: A "shutdown" is when a portion of the normal operation of OWNER's facility, whether equipment, systems, conduit (including piping and ducting), has to be temporarily suspended or taken out of service to perform the Work.
2. Work that may interrupt normal operations shall be accomplished at times convenient to OWNER unless otherwise indicated in the Contract Documents.
3. Furnish at the Site, in close proximity to the shutdown and tie-in work areas, tools, materials, equipment, spare parts, both temporary and permanent, necessary to successfully perform the shutdown. Complete to the extent possible, prefabrication of piping and other assemblies prior to commencing the associated shutdown. Demonstrate to ENGINEER's satisfaction that CONTRACTOR has complied with such requirements before commencing the shutdown.
4. If CONTRACTOR's operations cause an unscheduled interruption of OWNER's operations, immediately re-establish satisfactory operation for OWNER.
5. Unscheduled shutdowns or interruptions of continued safe and satisfactory operation of OWNER's facilities that result in fines or penalties by authorities having jurisdiction shall be paid solely by CONTRACTOR if, in ENGINEER's opinion, CONTRACTOR did not comply with requirements of the Contract Documents, or was negligent in the Work, or did not exercise proper precautions in

performing the Work and complying with applicable permits, Laws, and Regulations.

6. Shutdowns shall be in accordance with Table 01 14 16-B of this Section. Work requiring service interruptions for tie-ins shall be performed during scheduled shutdowns.

7. Temporary, short-term shutdowns of smaller conduits (including piping and ducting), equipment, and systems may not be included in Table 01 14 16-B. Coordinate requirements for such shutdowns with ENGINEER and OWNER. Where necessary, obtain ENGINEER's interpretation or clarification before proceeding.

B. Shutdowns of Electrical Systems:

1. Comply with Laws and Regulations, including the National Electric Code.

2. CONTRACTOR shall lock out and tag circuit breakers and switches operated by OWNER and shall verify that affected cables and wires are de-energized to ground potential before shutdown Work is started.

3. Upon completion of shutdown Work, remove the locks and tags and notify ENGINEER that facilities are available for use.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. In addition to requirements of this section, comply with section 01 73 29, cutting and patching and other contract documents applicable to work associated with shutdowns, tie-ins, temporary pumping (where applicable), and similar work.

3.2 SHUTDOWN REQUIREMENTS

A. General:

1. A county distribution main shutdown is required to perform the storage tank supply/return piping tie in.

2. Shutdown shall be coordinated with FCWS at least 14 days in advance of the shutdown.

3. Shutdown shall be limited to a maximum of 8 hours.

B. Prior to Shutdown:

1. Obtain ENGINEER's acceptance of proposed shutdown planning submittal and shutdown notification submittal.

2. Bring necessary piping, couplings, valves, equipment, and appurtenances to the work areas.

3. Assist OWNER in preparing to take distribution main temporarily out of service.

C. During Shutdown:

1. Perform required work to connect to distribution main.

D. Following Shutdown:

1. Verify functionality of equipment and systems.

2. Verify operation of new equipment and systems, and verify that joints in conduits (including piping and ducting) are watertight or gastight as applicable.

3. Repair joints that are not watertight or gastight, as applicable.

3.3 SCHEDULES

A. The schedules indicated below, attached following this Section's "End of Section" designation, are part of this Specifications Section:

1. Table 01 14 16-A, Schedule of Tie-ins.

2. Table 01 14 16-B, Schedule of Shutdowns.

+ + END OF SECTION + +

TABLE 01 14 16-A
SCHEDULE OF TIE-INS

Tie-In No.	New Line Size and Service	Existing (Connecting) Line Size & Service	Tie-In Building/Location	Construction Phase	Remarks
1	12" Potable Water	16" Potable Water Distribution Main	Veteran's Pkwy	1	

TABLE 01 14 16-B
SCHEDULE OF SHUTDOWNS

Shut-down No.	Process Equipment and Service Lines Out-of-Service During Shutdown	Process Equipment In Operation During Shutdown	Tie-In Nos.	Maximum Duration hrs.
1	16" Potable Water Distribution Main		1	4

SECTION 01 21 00

ALLOWANCES

PART 1 – GENERAL

1.1 SCOPE

A. Scope:
   1. This Section includes administrative and procedural requirements governing the following types of allowances:

      a. Cash allowances.
      b. Contingency allowances.

B. Authorization of Allowances:
   1. Work that will be paid under an allowance will be authorized in OWNER's written instruction to CONTRACTOR using the form included with this Section or other written allowance authorization issued by OWNER.
   2. Do not perform Work under an allowance without written authorization of OWNER.

1.2 CASH ALLOWANCES

A. General:
   1. Cash allowances are stipulated amounts for anticipated purchase of materials or equipment.
   2. In addition to this Section, refer to the General Conditions, as may be modified by the Supplementary Conditions; and individual Specification Sections for CONTRACTOR's costs to be covered by cash allowances, and CONTRACTOR's costs, including overhead and profit, to be included elsewhere in the Contract Price.

B. Timing:
   1. At earliest practical date after the Contract Times commence running, notify ENGINEER of date when final selection and purchase of each material or equipment item described by a cash allowance must be completed to avoid delaying the Work.

C. Selection of Materials or Equipment Included in Cash Allowance:
   1. Consult with ENGINEER in selecting Suppliers and obtain proposals for price and time from selected suppliers. Submit proposals to ENGINEER along with recommendations relevant to furnishing and installing products covered in the cash allowance.
   2. Purchase materials or equipment from Suppliers selected by ENGINEER.

D. Documentation:
   1. Proposals:
      a. Prior to selection of Supplier by ENGINEER, submit proposals from prospective suppliers as indicated in above.
      b. For each allowance, submit to ENGINEER a Change Proposal to adjust Contract Price for difference between specified cash allowance amount and actual cost. Prepare Change Proposals in accordance with the General Conditions and Supplementary Conditions and Section 01 26 00, Contract Modification Procedures, except that payment within limit of a cash allowance shall exclude cost of bond and insurance premiums.
   2. When applying for payment for materials or equipment furnished under a cash allowance, submit with the Application for Payment invoices or delivery slips as evidence of actual costs and quantities of materials or equipment furnished and used in fulfilling each cash allowance.

1.3 CONTINGENCY ALLOWANCE

A. Contingency allowances are stipulated amounts available as reserve for sole use by OWNER to cover unanticipated costs.

B. When authorization of Work under contingency allowance is contemplated by OWNER for a defined scope, submit Change Proposal to ENGINEER. Prepare Change Proposal in accordance with the General Conditions and Supplementary Conditions and Section 01 26 00, Contract Modification Procedures, except that payments within limit of contingency allowance shall exclude cost of bond and insurance premiums.

1.4 SCHEDULE OF ALLOWANCES

A. Cash Allowances:

   1. Materials Testing Laboratory

B. Contingency Allowances:

   1. Schedule of Contingency Allowances: Include the following allowances for use in accordance with OWNER's instructions:

Contract and Bid/Payment Item No.	**Allowance Name**	**Include Contingency Allowance Amount Of**
Lump Sum Bids, Item No. 2	Owner-Directed Changes	See Bid Form

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 ATTACHMENTS

A. The documents listed below and attached following this Section's "End of Section" designation, are part of this Specification Section.
   1. Allowance Authorization Form (one page).

+ + END OF SECTION + +

ALLOWANCE AUTHORIZATION

Project: _____ Authorization Number: _____

_____ From: _____

To: _____ Date: _____

_____ Engineer Project No.: _____

Re: _____ Contract For: _____

You are authorized to perform the following item(s) of Work and to adjust the Contract allowance amount accordingly:

1. [*Allowance Title*] / [*Title of Change*]:

THIS IS NOT A CHANGE ORDER AND DOES NOT INCREASE OR DECREASE THE CONTRACT PRICE

Original Allowance	$ _____
Allowance Expenditures prior to this Authorization	$ _____
Allowance Balance prior to this Authorization	$ _____
Allowance will be decreased by this Authorization	$ _____
New Allowance Balance	$

RECOMMENDED BY

ARCADIS U.S., Inc.
Engineer

By Date

OWNER APPROVAL

Owner

By Date

CONTRACTOR ACCEPTANCE

Contractor

By Date

☐ Attachments

Copies: ☐ Owner ☐ Contractor ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ File

SECTION 01 22 13

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Items listed starting in Article 0 of this Section refer to and are the same pay items listed in the Bid Form and constitute all pay items for completing the Work.

2. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, plant or facility services, CONTRACTOR's or ENGINEER's field offices, layout surveys, Project signs, sanitary requirements, testing, safety provisions and safety devices, submittals and record drawings, water supplies, power and fuel, maintenance of traffic, removal of waste, security, coordination with OWNER's operations, information technology (including hardware, software, and services) required during construction, commissioning where specified, bonds, insurance, or other requirements of the General Conditions, Supplementary Conditions, Division 01 Specifications, and other requirements of the Contract Documents.

3. Compensation for all services, items, materials, and equipment shall be included in prices stipulated for lump sum and unit price pay items listed in this Section and included in the Contract.

B. Each lump sum and unit price, as bid, shall include an amount considered by contractor to be adequate to cover contractor's overhead and profit for each separately identified item.

C. Bid prices included on the bid form shall be full compensation for all materials, labor, equipment, tools, construction equipment and machinery, heat, utilities, transportation, taxes, overhead, markup, incidentals and services necessary for the execution and completion of the work in the contract documents to be performed under this contract. For the work described, the allowance and unit price, actual used and installed quantities of each bid item shall be measured in the field and certified by the engineer and/or owner upon completion of construction in the manner set forth for each item in this and other sections of the specifications.

Payment for all items listed on the bid form will constitute full compensation for all work shown and specified to be performed.

1.2 ENGINEER'S ESTIMATE OF QUANTITIES

A. ENGINEER's estimated quantities for items of Unit Price Work, as included in the Contract, are approximate only and are included solely for purpose of comparing Bids and pricing. OWNER does not expressly or by implication agree that nature of materials encountered below the ground surface or actual quantities of material encountered or required will correspond with the quantities included in the Contract at the time of award and reserves the right to increase or decrease quantities, and to eliminate quantities, as OWNER may deem necessary.

B. CONTRACTOR and OWNER will not be entitled to adjustment in unit prices as a result of change in estimated quantity and agree to accept the unit prices accepted in the Bid as complete and total compensation for additions or deletions caused by changes or alterations in the Unit Price Work directed by OWNER.

1.3 RELATED PROVISIONS

A. Payments to contractor: refer to general conditions, supplementary conditions, agreement, and section 01 29 76, progress payment procedures.

B. Changes in contract price: refer to general conditions, supplementary conditions, and section 01 26 00, contract modification procedures.

C. Schedule of values: refer to general conditions, supplementary conditions, and section 01 29 73, schedule of values.

1.4 BID ITEMS

A. Lump sum payment will be full compensation for completing the work, as shown or indicated under division 01 through division 46, including owner/engineer directed work items.

B. The following Item No. 1 through 3 comprise the Base Bid Total as listed on the Bid Form

1. Item No. 1 – Site Work

a. Measurement and Payment: Lump sum payment for Item 1 will be full compensation for all required site work, including erosion and sedimentation controls, demolition, and removal of any abandoned equipment on the existing site, tree removal necessary to allow installation of the site fencing, clearing and grubbing of the area, site grading, finish grading, installation of paved surfaces, bollards, rip rap, fences and lawns. Complete installation of the buried

watermain indicated on the plans and specifications, to connect the new storage tank with the Owner's existing water system, including all valves, and appurtenances, tie-ins, and shutdowns. Coordination with the power provider, and installation of all electrical components required to provide electrical service to the new storage tank and site.

2. Item No. 2 – Booster Pump Station

   a. Measurement and Payment: Lump sum payment for Item 2 will be full compensation for the complete installation of a new booster pump station as shown on the plans and indicated in the specifications, including pumps and associated valves and instruments inside the Booster Pump Station.

3. Item No. 3 – 400,000 Gallon Elevated Storage Tank

   a. Measurement and Payment: Lump sum payment for Item 3 will be full compensation for the complete installation of a new 400,000-gallon elevated water storage tank as shown on the plans and indicated in the specifications, including all foundation work, tank erection, and painting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 22 13

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Section includes:

1. Administrative and procedural requirements for selecting materials and equipment for the Project.

2. Procedural requirements for substitutions of materials and equipment.

3. Procedural requirements for substitute construction methods or procedures when construction methods or procedures are specified.

B. A proposed substitute will not be accepted for review if:

1. Approval would require changes in design concept or a substantial revision of the Contract Documents.

2. Approval would delay completion of the Work or the work of other contractors.

3. Substitution request is indicated or implied on a Shop Drawing or other submittal, or on a request for interpretation or clarification, and is not accompanied by CONTRACTOR's formal and complete request for substitution.

C. If proposed substitute is not approved, CONTRACTOR shall provide the specified materials, equipment, method, or procedure, as applicable.

D. Approval of a substitute does not relieve CONTRACTOR from requirement for submitting Shop Drawings and other submittals in accordance with the Contract Documents.

E. ENGINEER and OWNER have the right to rely upon the completeness and accuracy of the information included in CONTRACTOR's request for approval of a substitute, and CONTRACTOR accepts full responsibility for the completeness and accuracy thereof.

F. When approved substitute is defective or fail to perform in accordance with the Contract Documents, responsibility for remedying the defect or failure resides solely with CONTRACTOR and Supplier.

1.2 SUBSTITUTE MATERIALS AND EQUIPMENT

A. Requests for approval of substitute items of materials or equipment will be considered within a period of 30 days after the Effective Date of the Contract. After the end of specified period, substitution requests will be

considered only in case of unavailability of a specified item of material or equipment or other conditions beyond CONTRACTOR's control.

B. Procedure:

1. Submit requests for substitution in accordance with requirements for furnishing submittals, as indicated in Section 01 33 00, Submittal Procedures.

2. Submit separate request for each proposed substitute.

3. Submit request for substitution using forms attached to this Section. Complete all information requested on each form and enclose with the forms supplementary information as required. In addition to requirements of the General Conditions and information required on substitution request forms, include with each substitute request the following:

a. Identification of the materials and equipment (as applicable), including manufacturer's name and address.

b. Manufacturer's literature with description of the materials and equipment, performance and test data, and reference standards with which materials and equipment comply.

c. Samples, when appropriate.

d. Name and address of similar projects on which the materials and equipment were used, date of installation, and names and contact information (including telephone number) for the facility operations and maintenance manager.

1.3 SUBSTITUTE CONSTRUCTION METHODS OR PROCEDURES

A. Where construction methods or procedures are specified, for a period of 30 days after the Effective Date of the Contract, ENGINEER will consider CONTRACTOR's written requests for substitute construction methods or procedures shown or specified in the Contract Documents.

B. The provisions of the General Conditions, as may be modified by the Supplementary Conditions, regarding substitute items of materials and equipment are hereby extended to apply to substitute construction methods or procedures.

C. Procedure:

1. Submit requests for substitution in accordance with requirements for furnishing submittals, as indicated in Section 01 33 00, Submittal Procedures.

2. Submit separate request for each proposed substitute.

3. Submit request for substitution using forms attached to this Section. Complete all information requested on each form and

enclose with the forms supplementary information as required. In addition to requirements of the General Conditions and information required on substitution request forms, include with each substitute request the following:

a. Detailed description of proposed method or procedure.

b. Itemized comparison of the proposed substitution with the specified method or procedure.

c. Drawings illustrating method or procedure.

d. Other data required by ENGINEER to establish that proposed substitution is equivalent to specified method or procedure.

1.4 CONTRACTOR'S REPRESENTATIONS

A. In submitting request for substitution, CONTRACTOR represents that:

1. CONTRACTOR has read and fully understands the provisions regarding substitutes as indicated in the General Conditions, as may be modified by the Supplementary Conditions.

2. Substitution request is complete and includes all information required by the Contract Documents.

3. CONTRACTOR certifications required by the General Conditions, as may be modified by the Supplementary Conditions, are valid and made with CONTRACTOR's full knowledge, information, and belief.

4. CONTRACTOR will provide the same or better guarantees or warranties for proposed substitute as for the specified materials, equipment, methods, or procedures, as applicable.

5. CONTRACTOR waives all Claims for additional costs or extension of time related to proposed substitute that subsequently may become apparent.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

A. The documents listed below and attached following this Section's "End of Section" designation, are part of this Specification Section.

1. Substitution Request Form (two pages).

2. Product Substitution Checklist (one page).

END OF SECTION 01 25 00

SUBSTITUTION REQUEST

Project: _____ Substitution Request Number: _____

_____ Engineer Project Number: _____

To: _____ Date: _____

_____ From: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section Page Article/Paragraph:

Proposed Substitute: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No. _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New Product ☐ 1 to 4 years old ☐ 5 to 10 years old ☐ More than 10 years old

Differences between proposed substitute and specified item: _____

☐ Point-by-point comparative data attached — REQUIRED BY THE CONTRACT DOCUMENTS

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Engineer _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes Explain _____

Savings to Owner for accepting substitute: ($)

(attach detailed, itemized estimate)

Proposed substitute changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days

(clarify whether change is to Substantial Completion, Milestone, or time for readiness for final payment)

Supporting Data Attached: ☐Drawings ☐Product Data ☐Samples ☐Tests ☐Reports ☐

SUBSTITUTION REQUEST
(Continued)

☐ Substitute product, method, or procedure is subject to payment of licensing fee or royalty (check if "yes" and attach information)

☐ Substitute product, method, or procedure is patented or copyrighted (check if "yes" and attach information)

The undersigned certifies:

- Representations in the General Conditions and in Section 01 25 00, Substitution Procedures, regarding substitutions are valid.
- Same or better warranty and guarantee will be furnished for proposed substitution as for specified item.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitute will have no adverse effect on other trades and will not affect or delay Progress Schedule.
- Cost data as stated above is complete. Claims for additional costs or time related to accepted substitution which may subsequently become apparent are waived.
- Proposed substitute does not affect dimensions and functional clearances.
- Payment will be made for Engineer's review and changes, if any, to the design and Contract Documents, and construction costs caused by the substitute.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted By: _____

Signed By: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: ☐

ENGINEER'S REVIEW AND ACCEPTANCE (OR NON-ACCEPTANCE) WILL BE DOCUMENTED IN A FIELD ORDER OR CHANGE ORDER, AS APPROPRIATE.

Additional Comments: ☐Contractor ☐Subcontractor ☐Supplier ☐Manufacturer ☐Engineer ☐Other:

Adapted from CSI Form No. 13.0B, 2004 edition

PRODUCT SUBSTITUTION CHECKLIST

Date:		Re:	
Engineer Project Number:		Manufacturer's Project Number:	
Filing Number:		Contract For:	

Itemized Equivalence:

☐Is the submitted item equivalent to the specified item?

☐Does it serve the same function?

☐Does it have the same dimensions?

☐Does it have the same appearance?

☐Will it last as long?

☐Does it comply with the same codes, and standards and performance requirements?

☐Has the item been used locally, and where are the projects?

☐Has a problem occurred with the item, and what was the remedy?

Effect of Project:

☐Will the substitute affect other aspects of the construction?

☐Are any details affected and are changes required?

☐What is the cost of the changes?

☐Who pays for the required changes?

☐Are Contract Times affected?

Effect of Warranty:

☐How does the proposed warranty differ from the specified warranty?

☐Does the manufacturer have a track record of standing behind the warranty?

Adapted from CSI Form No. 20.3, 1998 edition

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope.

1. This Section expands upon provisions of the General Conditions, as may be modified by the Supplementary Conditions, and includes:

   a. Requests for interpretation.

   b. Written clarifications.

   c. Minor changes in the Work and Field Orders.

   d. Work Change Directives.

   e. Proposal Requests.

   f. Change Proposals.

   g. Change Orders.

B. Submit Contract modification documents to ENGINEER, addressed to the contact person and contact information indicated in Section 01 33 00, Submittal Procedures, and in accordance with Section 01 31 26, Electronic Communication Protocols.

C. Retain at CONTRACTOR's office and at the Site complete copy of each Contract modification document and related documents, and ENGINEER's response.

1.2 REQUESTS FOR INTERPRETATION

A. General.

1. Transmit written requests for interpretation to ENGINEER. CONTRACTOR and OWNER may prepare and transmit requests for interpretation.

2. Prepare and transmit request for interpretation to obtain clarifications or interpretations of the Contract Documents. Report conflicts, errors, ambiguities, and discrepancies in the Contract Documents by requesting an interpretation.

3. Do not transmit request for interpretation when other form of communication is appropriate, such as CONTRACTOR's submittals, requests for approvals of substitutes, notices, ordinary correspondence, or other form of communication. Improperly

prepared or inappropriate requests for interpretation will be returned without response or action by ENGINEER.

4. Do not submit request for interpretation or clarification when:

   a. answer may be obtained by observations at the Site; or

   b. required information is clearly indicated in the Contract Documents; or

   c. required information is included in industry standards referenced in the Contract Documents or Supplier's instructions that are consistent with the Contract Documents; or

   d. are reasonably inferable from any of foregoing.

5. CONTRACTOR shall have sole financial responsibility for requests for interpretations or clarifications that are submitted late, out of sequence, or that are unnecessary.

B. Procedure.

1. Transmit requests for interpretation in accordance with Section 01 31 26, Electronic Communication Protocols, and requirements of this Section. Include with each request for interpretation a separate letter of transmittal.

2. ENGINEER will provide timely review of requests for interpretation. Allow sufficient time for review and response.

3. ENGINEER will maintain log of requests for interpretation. Upon request, copy of log will be transmitted to requestor.

4. ENGINEER's response to requests for interpretation will be transmitted in accordance with Section 01 31 26, Electronic Communication Protocols, and requirements of this Section. Each response to a request for interpretation will include a separate letter of transmittal.

5. ENGINEER's written response to each request for interpretation will be distributed to:

   a. CONTRACTOR.

   b. OWNER.

   c. Resident Project Representative (RPR).

   d. ENGINEER.

6. If ENGINEER requests additional information to make an interpretation, entity requesting the interpretation shall transmit the information requested within ten days, unless ENGINEER allows additional time, via correspondence referring to request for interpretation number.

7. Interpretations that One or Both Parties Believes Entails a Change to the Contract:

   a. If CONTRACTOR or OWNER believes that a change in the Contract Price or Contract Times or other change to the Contract is required as a result of ENGINEER's interpretation, so advise ENGINEER in writing before proceeding with the Work associated with the request for interpretation.

   b. If, after this initial communication, either OWNER or CONTRACTOR believes that change in Contract Price, Contract Times, both, or other relief with respect to the terms of the Contract is necessary, recourse shall be in accordance with the Contract Documents.

C. Preparation of Requests for Interpretation:

1. Prepare each request for interpretation on the "Request for Interpretation" form included with this Section, or other form acceptable to ENGINEER.

2. Number each request for interpretation as follows: Numbering system shall be the Contract number and designation followed by a hyphen and three-digit sequential number. Example: First request for interpretation on the general contract for project titled, "Contract A15" would be, "RFI No. A15-GC-001".

3. In space provided on form, describe the interpretation requested. Provide additional sheets as necessary. Include text and sketches as required in sufficient detail to describe the need for an interpretation.

4. When applicable, request for interpretation shall include CONTRACTOR's recommended resolution.

1.3 WRITTEN CLARIFICATIONS

A. General:

1. Written clarifications, when required, will be initiated and issued by ENGINEER.

2. Written clarifications do not change the Contract Price or Contract Times, and do not alter the Contract Documents.

3. Written clarifications will be issued as correspondence or using clarification notice form, with additional information as required.

B. Procedure.

1. ENGINEER's written clarifications will be transmitted in accordance with Section 01 31 26, Electronic Communication Protocols, and requirements of this Section.

2. Each written clarification will be distributed to:
    a. CONTRACTOR.
    b. OWNER.
    c. Resident Project Representative (RPR).
    d. ENGINEER.
3. Written Clarifications that One or Both Parties Believes Entails a Change to the Contract:
    a. If CONTRACTOR or OWNER believes that a change in the Contract Price or Contract Times or other change to the Contract is required as a result of ENGINEER's written clarification, so advise ENGINEER in writing before proceeding with the Work associated with the written clarification.
    b. If, after this initial communication, either OWNER or CONTRACTOR believes that change in Contract Price, Contract Times, both, or other relief with respect to the terms of the Contract is necessary, recourse shall be in accordance with the Contract Documents.
4. If ENGINEER's written clarification is unclear, prepare and transmit a request for interpretation.

1.4 MINOR CHANGES IN THE WORK AND FIELD ORDERS

A. General:
1. Field Orders, when required, will be initiated and issued by ENGINEER.
2. Field Orders authorize minor variations in the Work but do not change the Contract Price or Contract Times.
3. Field Orders will be in the form of Engineers Joint Contract Documents Committee document EJCDC® C-942, "Field Order".
4. ENGINEER will maintain a log of Field Orders issued.

B. Procedure.
1. Field Orders will be transmitted in accordance with Section 01 31 26, Electronic Communication Protocols, and requirements of this Section. Each Field Order will include a separate letter of transmittal.
2. Each Field Order will be distributed to:
    a. CONTRACTOR.
    b. OWNER.
    c. Resident Project Representative (RPR).

d. ENGINEER.

3. Field Orders that One or Both Parties Believes Entails a Change to the Contract Price or Contract Times:

a. If CONTRACTOR or OWNER believes that a change in the Contract Price or Contract Times or other change to the Contract is required as a result of a Field Order, so advise ENGINEER in writing before proceeding with the Work associated with the Field Order.

b. If, after this initial communication, CONTRACTOR believes that change in Contract Price, Contract Times, both, or other relief with respect to the terms of the Contract is necessary, recourse shall be in accordance with the Contract Documents.

4. If the Field Order is unclear, submit request for interpretation.

1.5 WORK CHANGE DIRECTIVES

A. General:

1. Work Change Directives, when required, order additions, deletions, or revisions to the Work.

2. Work Change Directives do not change the Contract Price or Contract Times but are evidence that the parties to the Contract expect that the change ordered or documented by the Work Change Directive will be incorporated in subsequently issued Change Order following agreement by the parties as to the Work Change Directive's effect, if any, on the Contract Price or Contract Times..

3. Work Change Directives will be in the form of EJCDC® C-940, "Work Change Directive".

B. Procedure.

1. Work Change Directives signed by OWNER and ENGINEER will be transmitted in accordance with Section 01 31 26, Electronic Communication Protocols, and requirements of this Section. Each Work Change Directive will include a separate letter of transmittal. CONTRACTOR shall print three originals of Work Change Directive for CONTRACTOR's signature.

2. CONTRACTOR shall promptly sign each original Work Change Directive and, within five days of receipt, return all originals to ENGINEER.

3. Original, signed Work Change Directives will be distributed as follows:

a. CONTRACTOR: One original.

b. OWNER: One original.

c. ENGINEER: One original.

4. One copy of each Work Change Directive will be distributed to:

a. Resident Project Representative (RPR).

5. Documentation of Costs:

a. When basis of payment for Work ordered under a Work Change Directive will be paid as Cost of the Work, or when otherwise required by ENGINEER, document for the Work performed under each separate Work Change Directive, for each day, the following:

1) Number and labor classifications of workers employed and hours worked.

2) Construction equipment used including manufacturer, model, and year of manufacture, and number of hours such equipment was onsite and used for the Work under the Work Change Directive.

3) Consumables and similar materials used.

4) Receipts, bills, or invoices for and descriptions of materials and equipment incorporated into the Work.

5) Invoices and labor and equipment breakdowns for Subcontractors and Suppliers.

6) Other information required by OWNER or ENGINEER,

b. Submit such information in a format acceptable to ENGINEER.

c. Transmit such documentation to ENGINEER as a Change Proposal.

1.6 PROPOSAL REQUESTS

A. General:

1. Proposal Requests may be initiated by ENGINEER or OWNER.

2. Proposal Requests are for requesting the effect on the Contract Price and the Contract Times and other information relative to contemplated changes in the Work. Proposal Requests do not authorize changes or variations in the Work, and do not change the Contract Price or Contract Times or terms of the Contract.

3. Proposal Requests will be furnished using the “Proposal Request” form included with this Section.

B. Procedure.

1. Proposal Requests will be transmitted in accordance with Section 01 31 26, Electronic Communication Protocols, and requirements of this Section. Each Proposal Requests will include a separate letter of transmittal.

2. Each signed Proposal Request will be transmitted to:
   a. CONTRACTOR.
   b. OWNER.
   c. Resident Project Representative (RPR).
   d. ENGINEER.

3. Transmit request for interpretation to clarify conflicts, errors, ambiguities, and discrepancies in Proposal Request.

4. Upon receipt of Proposal Request, CONTRACTOR shall prepare and transmit to ENGINEER a Change Proposal, in accordance with the Contract Documents, for the proposed Work described in the Proposal Request.

1.7 CHANGE PROPOSALS

A. General.

1. Prepare and transmit written Change Proposal to ENGINEER in response to each Proposal Request; or when CONTRACTOR believes a change in the Contract Price or Contract Times or other change to the terms of the Contract is required; or to appeal an initial decision by ENGINEER concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract.

B. Procedure.

1. Prepare and transmit Change Proposals within time limits indicated in the General Conditions, as may be modified by the Supplementary Conditions.

2. Transmit Change Proposals in accordance with Section 01 31 26, Electronic Communication Protocols, and requirements of this Section. Include with each Change Proposal all required supporting documentation and a separate letter of transmittal.

3. ENGINEER’s Review and Requests for Additional Information:

   a. ENGINEER will review and act on each Change Proposal in accordance with, and within the time limits indicated in, the General Conditions, as may be modified by the Supplementary Conditions.

b. When ENGINEER requests additional information to render a decision, submit required information within five days of receipt of ENGINEER's request, unless ENGINEER allows more time. Submit the required information via correspondence that refers to the specific Change Proposal number.

c. OWNER shall transmit to ENGINEER such comments, if any, that OWNER has on the Change Proposal, within 10 days of OWNER's receipt of the Change Proposal.

d. ENGINEER will render a written decision on the Change Proposal.

e. ENGINEER's response to Change Proposals will be transmitted in accordance with Section 01 31 26, Electronic Communication Protocols, and requirements of this Section, the General Conditions, and the Supplementary Conditions.

4. ENGINEER's response to each Change Proposal will be distributed to:

a. CONTRACTOR.

b. OWNER.

c. Resident Project Representative (RPR).

d. ENGINEER.

5. If Change Proposal is recommended for approval by ENGINEER and is approved by OWNER, a Change Order will be issued or, when applicable, an appropriate use of contingency allowance will be authorized by OWNER.

6. If parties do not agree on terms for the change, OWNER or CONTRACTOR may file a Claim against the other, in accordance with the General Conditions, as may be modified by the Supplementary Conditions.

C. Preparation of Change Proposals:

1. Each Change Proposal shall be submitted on the "Change Proposal" form included with this Section, or other form acceptable to ENGINEER.

2. Number each Change Proposal as follows: Numbering system shall be the Contract number and designation followed by a hyphen and three-digit sequential number. Example: First Change Proposal for the general contract for project named "Contract A15" would be, "Change Proposal No. A15-GC-001".

3. In space provided on Change Proposal form:

a. Describe scope of each proposed change. Include text and sketches on additional sheets as required to provide detail sufficient for ENGINEER's review and response. If a change item is submitted in response to Proposal Request, write in as scope, "In accordance with Proposal Request No." followed by the Proposal Request number. Submit written clarifications, if any, to scope of change.

b. Submit justification for each proposed change. If change is in response to proposal request, write in as justification, "In accordance with Proposal Request No." followed by the proposal request number.

c. List the total change in the Contract Price and Contract Times for each separate change item included in the Change Proposal.

4. Unless otherwise directed by ENGINEER, attach to the Change Proposal detailed breakdowns of pricing (Cost of the Work and CONTRACTOR's fee) including:

a. List of Work tasks to accomplish the change.

b. For each task, labor cost breakdown including labor classification, total hours per labor classification, and hourly cost rate for each labor classification.

b. Construction equipment and machinery to be used, including manufacturer, model, and year of manufacture, and number of hours for each.

c. Detailed breakdown of cost of materials and equipment to be incorporated into the Work, including quantities, unit costs, and total cost, with Supplier's written quotations.

d. Breakdowns of the Cost of the Work and fee for Subcontractors, including labor, construction equipment and machinery, and materials and equipment incorporated into the Work, other costs, and Subcontractor fees (e.g., overhead and profit).

e. Breakdown of other costs eligible, in accordance with the General Conditions and the Supplementary Conditions under "Cost of the Work" provisions.

f. Other information required by ENGINEER.

g. CONTRACTOR's fees applied to eligible CONTRACTOR costs and eligible Subcontractor costs.

1.8 CHANGE ORDERS

A. General:

1. Change Orders will be recommended by ENGINEER (when required by the General Conditions), and will be signed by OWNER and CONTRACTOR, to authorize additions, deletions, or revisions to the Work, or changes to the Contract Price or Contract Times.
2. Change Orders will be in the form of EJCDC® C-941, "Change Order".

B. Procedure.

1. Change Orders for signature by CONTRACTOR will be transmitted in accordance with Section 01 31 26, Electronic Communication Protocols, and requirements of this Section. Each Change Order will include a separate letter of transmittal. CONTRACTOR shall print three originals of Change Order for CONTRACTOR's signature.
2. CONTRACTOR shall promptly sign each original Change Order and, within five days of receipt, return all originals to ENGINEER.
3. ENGINEER will sign each original Change Order and forward them to OWNER.
4. After approval and signature by OWNER, original Change Orders will be distributed as indicated below.
5. Original, signed Change Orders will be distributed as follows:
   a. CONTRACTOR: One original.
   b. OWNER: One original.
   c. ENGINEER: One original.
6. One copy of each Change Order will be distributed to:
   a. Resident Project Representative (RPR).

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 ATTACHMENTS

A. The forms listed below, following this Section's "End of Section" designation, are part of this Specifications Section:

1. Request for Interpretation form (one page).
2. Proposal Request form (one page).
3. Change Proposal form (one page).

END OF SECTION 01 26 00

ARCADIS Design & Consultancy for natural and built assets

REQUEST FOR INTERPRETATION

Owner: _____

Project Name: _____

Contractor: _____ RFI No. _____

Date Transmitted: _____ Date Received: _____

Date Response Requested: _____ Date Response Transmitted: _____

Subject: _____

Specification Section and Paragraph: _____

_____

Drawing References: _____

INTERPRETATION REQUESTED:

Signature: _____ Date: _____

ENGINEER'S RESPONSE:

Signature: _____ Date: _____

PROPOSAL REQUEST

Owner: _____

Project Name: _____

Proposal Request No.: _____ Date: _____

Contract Name and No.: _____

Contractor: _____

Other Contracts Involved in Proposed Change: _____

_____

TO CONTRACTOR: Please submit a complete Change Proposal for the proposed modifications described below. If the associated Change Proposal is approved, a Change Order or allowance authorization will be issued to authorize adjustment so the scope of the Work. This Proposal Request is not a Change Order, Work Change Directive, Field Order, or an authorization to proceed with the proposed Work described below.

SCOPE OF PROPOSED WORK:

1. *Item*:
2. *Item*:
3. *Item*:

Proposal requested by: _____

Signature of Requestor: _____

CHANGE PROPOSAL

Owner:
_____

Project Name:
_____

Change Proposal No.: _____ Date: _____

Submitted in Response to Proposal Request No.:
_____

Contract Name and No.: _____
___

Contractor: _____
___

Subject:
_____
_____
_____

The following changes to the Contract are proposed:

SCOPE OF WORK: *(attach and list supporting information as required)*

1. *Item*:
2. *Item*:

JUSTIFICATION:

1. *Item*:
2. *Item*:

CHANGES IN CONTRACT PRICE AND CONTRACT TIMES:

We propose that the Contract Price and Contract Times be changed as follows:

For Contract Price, attach detailed cost breakdowns for Contractor and Subcontractors, Supplier quotations, and other information required.

For the Contract Times, state increase, decrease, or no change to Contract Times for Substantial Completion, readiness for final payment, and Milestones, if any. If increase or decrease, state specific number of days for changes to the Contract Times.

Description	Amount	Contract Times (days)	
		Substantial	Final
1. Item	$0.00	0	0
2. Item	$0.00	0	0
Total This Change Proposal	**$0.00**	**0**	**0**

Changes to Milestones, if any:
_____

Contractor represents that supporting data attached to this Change Proposal are accurate and complete. The requested time or price adjustment indicated in this Change Proposal is the entire adjustment to which Contractor believes it is entitled as a result of the proposed change(s) indicated herein.

Change Proposal by: _____

Signature of Proposer:
_____

SECTION 01 29 73

SCHEDULE OF VALUES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall prepare and submit to ENGINEER for acceptance a Schedule of Values that allocates cost to each item of the Work. Schedule of Value list of line items shall correspond to each aspect of the Work, establishing in detail the portion of the Contract Price allocated to each major component of the Work.

2. Upon request of ENGINEER, support values with data that substantiate their correctness.

3. Submit preliminary Schedule of Values to ENGINEER for initial review. CONTRACTOR shall incorporate ENGINEER's comments into the Schedule of Values and resubmit to ENGINEER. ENGINEER may require corrections and re-submittals until Schedule of Values is acceptable.

4. Schedule of Values may be used as a basis for negotiating price of changes, if any, in the Work.

5. Schedule of Values and the Progress Schedule updates specified in Section 01 32 16, Progress Schedule, will be basis for preparing each Application for Payment.

1.2 SUBMITTALS

A. Informational Submittals: Submit the following:

1. Submit to ENGINEER Schedule of Values in the form and quantity required in Section 01 33 00, Submittal Procedures, and in accordance with Section 01 31 26, Electronic Communication Protocols.

2. Content of Schedule of Values submittals shall be in accordance with Article 1.3 of this Section.

3. Timing of Submittals:

a. Submit preliminary Schedule of Values within time limit indicated in the General Conditions.

b. Submittal of the Schedule of Values for acceptance by ENGINEER shall be in accordance with the General

Conditions. ENGINEER will not accept Applications for Payment without an acceptable Schedule of Values.

c. When required by ENGINEER, promptly submit updated Schedule of Values to include cost breakdowns for changes in the Contract Price.

1.3 SCHEDULE OF VALUES FORMAT AND CONTENT

A. Organization and Major Elements of Schedule of Values

1. Prepare Schedule of Values on the "progress estimate" or "continuation sheets", as applicable, of the Application for Payment form indicated in Section 01 29 76, Progress Payment Procedures.

2. Organization in Accordance with Specification Sections:

a. Within each work area, organize the Schedule of Values by the various Specifications Section numbers and titles included in the Contract Documents.

b. Label each row in the Schedule of Values with the appropriate Specifications Section number. Include an amount for each row in the Schedule of Values.

c. List sub-items of major products or systems, as appropriate or when requested by ENGINEER.

3. Include in Schedule of Values unit price payment items with their associated quantity. Provide in the Schedule of Values detailed breakdown of unit prices when required by ENGINEER.

B. Requirements for preliminary Schedule of Values and Schedule of Values are:

1. Subcontracted Work:

a. Schedule of Values shall show division of Work between CONTRACTOR and Subcontractors.

b. Line items for Work to be done by Subcontractor shall include the word, "(SUBCONTRACTED)".

2. Apportionment between Materials and Equipment, and Installation:

a. Schedule of Values shall include breakdown of costs for materials and equipment, installation, and other costs used in preparing the Bid by CONTRACTOR and each Subcontractor.

b. List purchase and delivery costs for materials and equipment for which CONTRACTOR may apply for payment as stored materials.

3. Sum of individual values shown on the Schedule of Values shall equal the total of associated payment item. Sum of payment item totals in the Schedule of Values shall equal the Contract Price.

4. Overhead and Profit: Include in each line item a directly proportional amount of CONTRACTOR's overhead and profit. Do not include overhead and profit as separate item(s).

5. Include separate line item for each allowance, and for each unit price item.

6. Bonds and Insurance Costs: Include line item for bonds and insurance in payment item for (TBD), in amount not exceeding 2.0 percent of the Contract Price. This amount may be applied for in the first Application for Payment.

7. Include relevant items for the General Conditions, permits (when applicable), construction Progress Schedule, and other items required by ENGINEER. Include such items in Applications for Payment on payment schedule acceptable to ENGINEER.

8. Line items for Site maintenance such as dust control, snow removal, compliance with storm water pollution prevention plans and permits, spill prevention control and countermeasures plans, and for construction photographic documentation; temporary utilities and temporary facilities, field offices, temporary controls, field engineering, and similar Work shall be included in the Schedule of Values and proportioned in Applications for Payment throughout duration of the Work.

9. Mobilization and Demobilization:

    a. Include separate line items under each appropriate payment item for mobilization and demobilization. Document for ENGINEER the activities included in mobilization and demobilization line items.

    b. Mobilization will be limited to 2percent of the Contract Price, and will be paid in (TBD) payments, each of (TBD)percent of total amount for mobilization.

    c. Demobilization shall be not less than 1%percent of the Contract Price and shall be included with the Application for Payment following Substantial Completion, or other schedule acceptable to ENGINEER.

10. Costs for Shop Drawings, Samples, and other submittals; operations and maintenance manuals; field testing; and training of operations and maintenance personnel shall be as follows, unless otherwise accepted by ENGINEER:

a. Up to eight percent of cost (including all associated overhead and profit) of each equipment item, exclusive of transportation and installation costs associated with that item, may be allocated to preparation of Shop Drawings, Samples ,and other submittals and may be included in the Application for Payment following ENGINEER's approval of Shop Drawings (and acceptance of other submittals, as applicable) required for fabricating or purchasing for that item for the Work.

b. Up to three percent of total cost of each item (including all associated overhead and profit), including materials and equipment, and installation, may be apportioned to testing and included in the Application for Payment following ENGINEER's acceptance of the associated written field testing report(s).

c. Up to a total of four percent of equipment cost (including all associated overhead and profit), exclusive of transportation and installation costs, may be apportioned to operations and maintenance manuals and training of operations and maintenance personnel, which may be included in the Application for Payment following completion of training for that item.

11. Project Record Documents:

a. Include in the Schedule of Values a line item with appropriate value for Project record documents.

b. If adequate record documents are maintained, up to 50 percent of the value of the record documents line item will be eligible for payment, spread evenly over those progress payments in which construction at the Site is performed.

c. Remainder of Project record documents line item will be eligible for payment when complete record documents are submitted in accordance with the Contract Documents. If record documents submitted are unsatisfactory to ENGINEER, amount may be reduced via set-offs in accordance with the Contract Documents.

12. Schedule of Values shall include an itemized list of Work by work area, as applicable, for Work included in Section 01 14 16, Coordination with Owner's Operations.

13. Coordinate Schedule of Values with cost-loading of the Progress Schedule, in accordance with Section 01 32 16, Progress Schedule.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 29 76

PROGRESS PAYMENT PROCEDURES

PART 1 – GENERAL

1.1 PROGRESS PAYMENTS

A. Scope:
   1. CONTRACTOR's requests for payment shall be in accordance with the Agreement, General Conditions and Supplementary Conditions, and the Specifications.

   2. Form: Applications for Payment shall be in the form of Engineers Joint Contract Documents Committee (EJCDC) document EJCDC® C-620, "Contractor's Application for Payment", 2013 edition or later.

B. Procedure:
   1. Review with Resident Project Representative (RPR) quantities and the Work proposed for inclusion in each progress payment. Application for Payment shall cover only the Work and quantities recommended by the RPR.
   2. CONTRACTOR will be required to review with ENGINEER or RPR the status of record documents in connection with ENGINEER's review of each Application for Payment. Failure to maintain record document current will be just cause for ENGINEER to recommend a reduction in payment for record documents in accordance with Section 01 29 73, Schedule of Values, and will entitle OWNER to set-offs in accordance with the Contract Documents.

   3. Submit to ENGINEER printed originals, each with CONTRACTOR's original, "wet" signature, of each complete Application for Payment and other documents to accompany the Application for Payment.
   4. ENGINEER will act on request for payment in accordance with the General Conditions and Supplementary Conditions.

C. Each request for progress payment shall include:
   1. Completed Application for Payment form, including summary/signature page, progress estimate sheets, and stored materials summary. Progress estimate sheets shall have the same level of detail as the Schedule of Values.
   2. Documentation for Stored Materials and Equipment:
      a. For materials and equipment not incorporated in the Work but suitably stored, submit documentation in accordance with the General Conditions and Supplementary Conditions.

b. UCC-1 Financial Statement:
   1) For each lot or delivery of stored materials and equipment for which payment is requested prior to installation of the item(s) at the Site, complete UCC-1, "Financial Statement" form. On UCC-1 form, indicate OWNER as "security party"; indicate Supplier as "debtor" when stored item(s) are in Supplier's custody, and indicate CONTRACTOR as "debtor" when stored item(s) are in CONTRACTOR's custody; and clearly indicate in detail all stored item(s) included in the filing as "collateral" on the form. Include attachments to the form when necessary to clearly and fully indicate in detail the associated "collateral".
   2) File completed UCC-1 form with the secretary of state in the state where the subject item(s) are stored.
   3) Include with Application for Payment the completed UCC-1 form together with evidence of filing with the required state(s). Submit UCC-1 form and related documentation once for each lot or delivery of stored items.

c. Photographs of the stored items at the storage location, in accordance with requirements for progress photographs in Section 01 32 33, Photographic Documentation. Submit photographs sufficient to clearly indicate each stored item, clearly showing marking of OWNER's property in accordance with Paragraph 1.2.C.1 of this section. Such photographs do not count as photographs required under Section 01 32 33, Photographic Documentation. For each month that such item(s) are stored, take and submit monthly new photographs of each stored item.

d. Legibly indicate on invoice or bill of sale the specific stored materials or equipment included in the payment request and corresponding bid/payment item number for each and the Supplier price for each item.

3. For Payment on the Basis of Cost of the Work Plus a Fee.
   a. When Work included in an Application for Payment will be compensated on the basis of Cost of the Work plus a fee, whether when the entire Contract is compensated on the basis of Cost of the Work plus a fee or when the Application for Payment includes Change Order Work to be compensated on the basis of Cost of the Work plus a fee, the Application for Payment shall include documentation of the costs, including not less than the following:
      1) Number and labor classifications of workers employed and hours worked.
      2) Construction equipment used including manufacturer, model, and year of manufacture, and number of hours such equipment was onsite and used for the Work compensated on the basis of Cost of the Work.
      3) Consumables and similar materials used.
      4) Receipts, bills, or invoices for and descriptions of materials and equipment incorporated into the Work.

5) Invoices and labor and equipment breakdowns for Subcontractors, and Suppliers' onsite time, if any.
6) Invoices for other expenses included in the Application for Payment, such as travel and subsistence expenses, costs for bonds and insurance, and all other costs and expenses for which compensation is sought in the subject Application for Payment on the basis of Cost of the Work.
7) Other information required by OWNER or ENGINEER,

b. Costs for which progress payment is requested on the basis of Cost of the Work plus a fee and for which documentation acceptable to ENINEER is not submitted will not be eligible for payment.

5. Listing of Subcontractors and Suppliers:
   a. In accordance with the General Conditions, submit not less than monthly updated listing of all Subcontractors and Suppliers known to CONTRACTOR, whether or not such entities have a contract directly with CONTRACTOR.
   b. Submit complete information using the form attached to this Section.
6. Allowance Work:
   a. For payment requests that include payment for Work under an allowance, include with the progress payment request copy of OWNER's authorization of the associated allowance Work, in accordance with Section 01 21 00, Allowances.
7. Partial Release or Reduction of Retainage:
   a. For each Application for Payment where CONTRACTOR requests partial release or reduction of retainage in any amount (other than request for final payment), submit with associated progress payment request consent of surety to partial release or reduction of retainage, duly completed by CONTRACTOR and surety.
   b. Acceptable form includes AIA® G707A™, "Consent of Surety to Reduction in or Partial Release of Retainage", 1994 or later edition, or other form acceptable to OWNER.
   c. For payment requests that include reduction in or payment of retainage in an amount greater than that required by the Contract Documents, obtain OWNER's concurrence for partial release or reduction in retainage prior to submitting such Application for Payment.

D. Final Payment:
   1. Requirements for request for final payment are in the General Conditions, as may be modified by the Supplementary Conditions, and Section 01 77 19, Closeout Requirements.

1.2 PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Restrictions:
   1. Provisions of the General Conditions, as may be modified by the Supplementary Conditions, notwithstanding, only the following items of

materials or equipment will be eligible for payment when suitably stored, prior to incorporation into the Work.

B. Observation of Stored Materials and Equipment Prior to Application for Payment:
   1. General:
      a. Prior to materials or equipment suitably stored but not yet incorporated into the Work can be eligible for payment, ENGINEER or Resident Project Representative (RPR) shall visit the storage location and verify the extent, condition, and storage environment of the stored items.
      b. When the same material or equipment item is stored for more than two months, such visits to storage location shall be not less than once every two months.
   2. Cost Responsibility for Observations:
      a. When storage location is less than 20 miles from the Site or less than 20 miles from ENGINEER's office, CONTRACTOR is not responsible for reimbursing OWNER for cost of ENGINEER's time and expenses for observing stored materials and equipment.
      b. When storage location is more than 20 miles from the Site and more than 20 miles from ENGINEER's office, CONTRACTOR shall reimburse OWNER, via a set-off under the Contract Documents, for cost of ENGINEER's time and expenses, including travel time, to visit the storage location and observe the stored materials and equipment.

C. Other Requirements for Stored Items: Regardless of storage location, perform the following for stored materials and equipment for which payment is sought:

   1. Clearly mark each stored container, crate, or item as follows: "Property of Gwinnett County DWR" using permanent marking. Such marking shall not blemish or deface the finish of items that will be exposed to view after installation at the Site.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 ATTACHMENTS

A. The forms listed below, following this Section's "End of Section" designation, are part of this Specification Section:

   1. List of Subcontractors and Suppliers form (two pages).

+ + END OF SECTION + +

LIST OF SUBCONTRACTORS AND SUPPLIERS

Owner: _____
Project Name: _____

Contractor: _____ Date: _____
Contract Designation: _____

Indicate below complete information for each Subcontractor and Supplier known to Contractor, regardless of whether the firm has a direct contract with Contractor. Include all lower-tier Subcontractors and associated Suppliers. Copy and paste the paragraphs below as required to indicate all Subcontractors and Suppliers.

SUBCONTRACTORS

1. **Subcontractor Name**:
   - *Address*:
   - *Contact Person*:
   - *Telephone No.*:
   - *E-mail Address*:
   - *Work Under Specifications Section Nos.*:
   - *Brief Description of Work*:
   - *Current Subcontract Price*:
   - *Approximate Subcontract Start Date*:
   - *Approximate Subcontract End Date*:

2. **Subcontractor Name**:
   - *Address*:
   - *Contact Person*:
   - *Telephone No.*:
   - *E-mail Address*:
   - *Work Under Specifications Section Nos.*:
   - *Brief Description of Work*:
   - *Current Subcontract Price*:
   - *Approximate Subcontract Start Date*:
   - *Approximate Subcontract End Date*:

3. **Subcontractor Name**:
   - *Address*:
   - *Contact Person*:
   - *Telephone No.*:
   - *E-mail Address*:
   - *Work Under Specifications Section Nos.*:
   - *Brief Description of Work*:
   - *Current Subcontract Price*:
   - *Approximate Subcontract Start Date*:
   - *Approximate Subcontract End Date*:

Total of Subcontract Prices for all subcontracts equals approximately ___ percent of the Contract Price *(Contractor to fill in blank monthly)*

SUPPLIERS

1. **Supplier Name**:
   - *Address*:
   - *Contact Person*:
   - *Telephone No.*:
   - *E-mail Address*:
   - *Furnishing Items Under Specifications Section Nos.*:
   - *Brief Description of Items*:
   - *Current Purchase Order Amount*:
   - *Approximate Purchase Order Date*:
   - *Approximate Purchase Order End Date*:

2. **Supplier Name**:
   - *Address*:
   - *Contact Person*:
   - *Telephone No.*:
   - *E-mail Address*:
   - *Furnishing Items Under Specifications Section Nos.*:
   - *Brief Description of Items*:
   - *Current Purchase Order Amount*:
   - *Approximate Purchase Order Date*:
   - *Approximate Purchase Order End Date*:

3. **Supplier Name**:
   - *Address*:
   - *Contact Person*:
   - *Telephone No.*:
   - *E-mail Address*:
   - *Furnishing Items Under Specifications Section Nos.*:
   - *Brief Description of Items*:
   - *Current Purchase Order Amount*:
   - *Approximate Purchase Order Date*:
   - *Approximate Purchase Order End Date*:

SECTION 01 31 13

PROJECT COORDINATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall coordinate the Work, including testing agencies whether hired by CONTRACTOR, OWNER, or others; Subcontractors, Suppliers, and others with whom coordination is necessary, in accordance with the General Conditions, Supplementary Conditions, and this Section, to perform the Work within the Contract Times and in accordance with the Contract Documents.

B. Coordination:
   In accordance with the General Conditions as may be modified by the Supplementary Conditions, CONTRACTOR shall cooperate with and coordinate the Work with other contractors, utility owners, utility service companies, OWNER's and facility manager's employees working at the Site, and other entities working at the Site, in accordance with Section 01 11 13, Summary of Work.
   2. CONTRACTOR will not be responsible or liable for damage unless damage is through negligence of CONTRACTOR, or Subcontractors, Supplier, or other entity employed by CONTRACTOR.
   3. Attend and participate in all project coordination and progress meetings, and report on the progress of the Work and compliance with the Progress Schedule.

C. Layout and Coordination Drawings:
   1. Maintain sufficient competent personnel, drafting and computer-aided drafting/design (CADD) equipment, software, systems, and supplies for preparing layout drawings, coordination drawings, and record documents.
   2. With the Contract Documents and Shop Drawings, use such coordination drawings as tools for coordinating the Work of various trades.
   3. Where such coordination drawings are to be prepared by mechanical, electrical, plumbing, or heating-ventilating-air conditioning Subcontractors and other Subcontractors, ensure that each Subcontractor maintains required personnel and facilities at the Site.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 31 18

PRE-CONSTRUCTION CONFERENCE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. A pre-construction conference will be held for the Project.

2. CONTRACTOR shall attend the conference prepared to discuss all items on the pre-construction conference agenda.

3. ENGINEER will distribute an agenda, preside at conference, and prepare and distribute minutes to all conference participants and others as requested.

B. Purpose of Pre-construction Conference:

1. Purpose of conference is to designate responsible personnel, establish working relationships, discuss preliminary schedules submitted by CONTRACTOR, and review administrative and procedural requirements for the Project.

2. Matters requiring coordination will be discussed and procedures for handling such matters will be established.

3. Unless otherwise indicated in the Contract Documents or otherwise agreed to by the entities involved, Site mobilization meeting will be part of the pre-construction conference.

1.2 PREPARATION FOR PRE-CONSTRUCTION CONFERENCE

A. Date, Time, and Location:

1. Conference will be held after execution of the Contract and before Work starts at the Site.

2. ENGINEER will establish the date, time, and location of conference and notify the interested and involved entities.

B. Submittals Required Prior to Pre-construction Conference:

1. Not less than three days prior to pre-construction conference, submit the following preliminary schedules in accordance with the General Conditions and other requirements of the Contract Documents:

a. Preliminary Progress Schedule.

b. Preliminary Schedule of Submittals.

c. Preliminary Schedule of Values.

d. Listing of identity and general scope of Work or supply (as applicable) of planned Subcontractors and Suppliers. Indicate extent of each Subcontract proposed and overall percentage of Contract Price to be subcontracted.

C. CONTRACTOR shall furnish information required and contribute appropriate items for discussion at the pre-construction conference.

D. Handouts for Pre-Construction Conference:

1. CONTRACTOR shall bring to the conference the following, with sufficient number of copies for each attendee:

a. Preliminary Progress Schedule, as submitted to ENGINEER.

b. Preliminary Schedule of Submittals, as submitted to ENGINEER.

c. Preliminary Schedule of Values, as submitted to ENGINEER.

d. Listing of identity and general scope of Work or supply of planned Subcontractors and Suppliers.

e. List of emergency contact information, in accordance with Section 01 35 23, Safety Requirements.

1.3 REQUIRED ATTENDEES

A. Representative of each entity attending the conference shall be authorized to act on that entity's behalf.

B. Contractor Attendance: Conference shall be attended by CONTRACTOR's:

1. Project manager.

2. Site superintendent

3. Project managers for major Subcontractors, and major equipment Suppliers as CONTRACTOR deems appropriate.

C. Other attendees will be representatives of:

1. OWNER.

2. ENGINEER.

3. Resident Project Representative (RPR), if available.

4. Authorities having jurisdiction over the Work, if available.

5. Utility owners, as applicable.

6. Others as requested by OWNER, CONTRACTOR, or ENGINEER.

1.4 AGENDA

A. Preliminary Agenda: Be prepared to discuss in detail the topics indicated below. Revisions, if any, to the agenda below will be furnished to required attendees prior to the pre-construction conference.

1. Procedural and Administrative:
    a. Personnel and Teams:
        1) Designation of roles and personnel.
        2) Limitations of authority of personnel, including personnel who will sign Contract modifications and make binding decisions.
        3) Subcontractors and Suppliers in attendance.
        4) Authorities having jurisdiction.
    b. Procedures for communications and correspondence, including electronic communication protocols.
    c. Copies of the Contract Documents and availability.
    d. Subcontractors and Suppliers.
        1) Lists of proposed Subcontractors and Suppliers.
    e. The Work and Scheduling:
        1) General scope of the Work.
        2) Contract Times, including Milestones (if any).
        3) Phasing and sequencing.
        4) Preliminary Progress Schedule.
        5) Critical path activities.
    f. Safety:
        1) Responsibility for safety.
        2) Contractor’s safety representative.
        3) Emergency procedures and accident reporting.
        4) Emergency contact information.
        5) Confined space entry permits.
        6) Hazardous materials communication program.
        7) Impact of Project on public safety.
    g. Permits.
    h. Review of insurance requirements and insurance claims.
    i. Coordination:
        1) Project coordination, and coordination among contractors.
        2) Construction coordinator.
        3) Coordination with Owner’s operations.

4) Progress meetings.

5) Preliminary Schedule of Submittals.

6) Procedures for furnishing and processing submittals.

7) Work not eligible for payment until submittals are approved or accepted (as required).

8) Construction photographic documentation.

j. Submittals:

1) Preliminary Schedule of Submittals.

2) Submittal procedures.

3) Contractor coordination and approval stamp.

4) Meaning of Engineer's actions/submittal disposition.

5) Preliminary discussion of initial, critical submittals.

6) Construction photographic documentation.

k. Substitutes and "Or-Equals":

1) Product options.

2) Procedures for proposing "or-equals".

3) Procedures for proposing substitutes.

l. Contract Modification Procedures

1) Requests for interpretation

2) Written clarifications

3) Field Orders

4) Proposal Requests

5) Change Proposals

6) Work Change Directives.

7) Change Orders.

8) Procedure for Claims and dispute resolution

m. Payment:

1) Owner's Project financing and funding, as applicable.

2) Owner's tax-exempt status.

3) Preliminary Schedule of Values

4) Procedures for measuring for payment.

5) Retainage.

6) Progress payment procedures.

7) Prevailing wage rates and payrolls.

n. Testing and inspections, including notification requirements.

o. Disposal of demolition materials.

p. Record documents.

q. Preliminary Discussion of Contract Closeout:

1) Procedures for Substantial Completion.

2) Contract closeout requirements.

3) Correction period.

4) Duration of bonds and insurance.

2. Site Mobilization (if not covered in a separate meeting):

a. Working hours and overtime.

b. Field offices, storage trailers, and staging areas.

c. Temporary facilities.

d. Temporary utilities and limitations on utility consumption (where applicable).

e. Utility company coordination (if not done as a separate meeting).

f. Access to Site, access roads, and parking for construction vehicles.

g. Maintenance and protection of traffic.

h. Use of Site and premises.

i. Protection of property.

j. Security.

k. Temporary controls, such as sediment and erosion controls, noise controls, dust control, storm water controls, and other such measures.

l. Site barriers and temporary fencing.

m. Storage of materials and equipment.

n. Reference points and benchmarks; surveys and layouts.

o. Site maintenance during the Project.

p. Cleaning and removal of trash and debris.

q. Restoration.

3. General discussion and questions.

4. Next meeting.

5. Site visit, if required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 31 19

PROGRESS MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Progress meetings will be held throughout the Project. CONTRACTOR shall attend each progress meeting prepared to discuss in detail all items on the agenda.

2. ENGINEER will preside at progress meetings and will prepare and distribute minutes of progress meetings to all meeting participants and others as requested.

1.2 PREPARATION FOR PROGRESS MEETINGS

A. Date and Time:

1. Regular Meetings: Monthly on a day and time agreeable to OWNER, ENGINEER, and CONTRACTOR.

2. Other Meetings: As required.

B. Location:

1. CONTRACTOR's field office at the Site or other location mutually agreed upon by OWNER, CONTRACTOR, and ENGINEER.

C. Handouts:

1. CONTRACTOR shall bring to each progress meeting not less than five (5) copies of each of the following:

a. List of Work accomplished since the previous progress meeting.

b. Up-to-date Progress Schedule.

c. Up-to-date Schedule of Submittals.

d. Detailed "look-ahead" schedule of Work planned through the next progress meeting, with specific starting and ending dates for each activity, including shutdowns, deliveries of important materials and equipment, Milestones (if any), and important activities affecting the OWNER, Project, and Site.

e. When applicable, list of upcoming, planned time off (with dates) for personnel with significant roles on the Project, and the designated contact person in their absence. s

1.3 REQUIRED ATTENDANCE

A. Representatives present for each entity shall be authorized to act on that entity's behalf.

B. Required Attendees:

1. CONTRACTOR:

a. Project manager.

b. Site superintendent.

c. Safety representative.

d. When needed for the discussion of a particular agenda item, representatives of Subcontractors and Suppliers shall attend meetings.

2. Construction coordinator (if any).

3. ENGINEER:

a. Project manager or designated representative

b. Resident Project Representative (if any).

c. Others as required by ENGINEER.

4. OWNER's representative(s), as required.

5. Testing and inspection entities, as required.

6. Others, as appropriate.

1.4 AGENDA

A. Preliminary Agenda: Be prepared to discuss in detail the topics listed below. Revised agenda, if any, will be furnished to CONTRACTOR prior to first progress meeting. Progress meeting agenda may be modified by ENGINEER during the Project as required.

1. Review, comment, and amendment (if required) of minutes of previous progress meeting.

2. Review of progress since the previous progress meeting.

3. Planned progress through next progress meeting.

4. Review of Progress Schedule

a. Contract Times, including Milestones (if any)

b. Critical path.

c. Schedules for fabrication and delivery of materials and equipment.

d. Corrective measures, if required.

5. Submittals:
    a. Review status of critical submittals.
    b. Review revisions to Schedule of Submittals.
6. Contract Modifications
    a. Requests for interpretation
    b. Written clarifications
    c. Field Orders
    d. Proposal Requests
    e. Change Proposals
    f. Work Change Directives.
    g. Change Orders.
    h. Claims.
7. Applications for progress payments.
8. Problems, conflicts, and observations.
9. Quality standards, testing, and inspections.
10. Coordination between parties.
11. Site management issues, including access, security, maintenance and protection of traffic, maintenance, cleaning, and other Site issues.
12. Safety.
13. Permits.
14. Construction photographic documentation.
15. Record documents status.
16. Punch list status, as applicable.
17. Other business.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 31 26

ELECTRONIC COMMUNICATION PROTOCOLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section establishes the procedures with which the parties will comply regarding transmission or exchange of electronic data for the Project.
2. CONTRACTOR shall provide labor, materials, tools, equipment, services, utilities, and incidentals shown, specified, and required for complying with this Section throughout the Project.
3. This Section does not supersede the General Conditions, as may be modified by the Supplementary Conditions, regarding transmitting of the Contract Documents to CONTRACTOR after the Effective Date of the Contract.
4. In addition to the requirements of this Section, comply with requirements for exchange of electronic data in the following:
    a. Section 01 32 16, Progress Schedule.
    b. Section 01 32 33, Photographic Documentation.
    c. Section 01 33 00, Submittal Procedures.
    d. Section 01 78 39, Project Record Documents.

B. Coordination:

1. CONTRACTOR shall require all Subcontractors and Suppliers to comply with the electronic communication protocols established in this Section.

C. Related sections:

1. Section 01 32 16, Progress Schedule.
2. Section 01 32 33, Photographic Documentation.
3. Section 01 33 00, Submittal Procedures.
4. Section 01 78 39, Project Record Documents.

1.2 TERMINOLOGY

A. The following words or terms are not defined but, when used in this section, have the following meaning:

1. "Electronic data" means information, communications, drawings, or designs created or stored for the Project in electronic or digital form.

2. "Confidential information" means electronic data that the transmitting party has designated as confidential and clearly marked with an indication such as "Confidential", "Business Proprietary", or similar designation.

3. "Written" or "in writing" means any and all communications, including without limitation a notice, consent, or interpretation, prepared and sent to an address provided in the Contract Documents or otherwise agreed upon by the parties and ENGINEER using a transmission method sent forth in this Section that allows the recipient to print or store the communication. Communications transmitted electronically are presumed received when sent in conformance with this Article 0.A.3.

1.3 TRANSMISSION OF ELECTRONIC DATA

A. Transmission of electronic data constitutes a warrant by the transmitting party to the receiving party that the transmitting party is one or more of the following:

1. The copyright owner of the electronic data.

2. Has permission from the copyright owner to transmit the electronic data for its use on the Project.

3. Is authorized to transmit confidential information.

B. Receiving party agrees to keep confidential information confidential and not to disclose it to another person except to (1) its employees, (2) those who need to know the content of the confidential information to perform services or construction solely and exclusively for the Project, or (3) its consultants, contractors, Subcontractors, and Suppliers whose contracts include similar restrictions on the use of electronic data and confidential information.

C. Transmitting party does not convey any right in the electronic data or in the software used to generate or transmit such data. Receiving party may not use electronic data unless permission to do so is provided in the Contract Documents, or in a separate license.

D. Unless otherwise granted in a separate license, receiving party's use, modification, or further transmission of electronic data, as provided the Contract Documents, is specifically limited to the design and construction of the Project in accordance with this Section, and nothing contained in this Section conveys any other right to use the electronic data for any other purpose.

E. To the fullest extent permitted by Laws and Regulations, receiving party shall indemnify and defend the transmitting party from and against all claims arising from or related to receiving party's modification to, or unlicensed use of, electronic data.

F. Means of Transmitting Electronic Data: Unless otherwise indicated in Table 01 31 26-A of this Section or elsewhere in the Contract Documents, transmission of electronic data for the Project will generally be via:

1. E-mail and files attached to e-mail. Maintain e-mail system capable of transmitting and receiving files not less than 20 megabytes (MB) file size.

1.4 ELECTRONIC DATA PROTOCOLS

A. Comply with the data formats, transmission methods, and permitted uses set forth in table 01 31 26-a, electronic data protocol table, below, when transmitting or using electronic data on the project. Where a row in the table has no indicated means of transmitting electronic data, use for such documents only printed copies transmitted to the receiving party via appropriate delivery method.

TABLE 01 31 26-A
ELECTRONIC DATA PROTOCOL TABLE (E-MAIL ATTACHMENTS)

Electronic Data	Data Format	Transmitting Party	Transmission Method	Receiving Party	Permitted Uses	Notes
1.04.A.1. Project communications						
General communications & correspondence	EM, PDF	O, E, C	EM, EMA	O, E, C	R	
Meeting notices and agendas	EM, PDF	E	EM, EMA	O, C	R	
Meeting minutes	PDF	E	EM, EMA	O, C	R	
1.04.A.2. Contractor's submittals to Engineer						
Shop Drawings	PDF	C	EMA	E	M (1)	(1)
Product data	PDF	C	EMA	E	M (1)	(1)
Informational and closeout submittals:	PDF	C	EMA	E	M (1)	(1) (6)
Documentation of delivery of maintenance materials submittals	PDF	C	EMA	E	M (1)	
1.04.A.3. Engineer's return of reviewed submittals to Contractor						
Shop Drawings	PDF	E	EMA	O., C	R	
Product data	PDF	E	EMA	O., C	R	
Informational and closeout submittals:	PDF	E	EMA	O., C	R	(6)
Documentation of delivery of maintenance materials submittals	PDF	E	EMA	O. C	R	
1.04.A.4. Contract Modifications Documents						
Requests for interpretation to Engineer	PDF	C., O	EMA	E	M (1)	(1)
Engineer's interpretations (RFI responses)	PDF	E	EMA	C, O	R	
Engineer's clarifications to Contractor	EM, PDF	E	EM, EMA	C, O	R	
Engineer's issuance of Field Orders	PDF	E	EMA	C, O	R	
Proposal Requests	PDF	E, O	EMA	C	R	
Change Proposals – submitted to Engineer	PDF	C	EMA	O, E	S	
Change Proposals – Engineer's response	PDF	E	EMA	C. O		
Work Change Directives (for Contractor signature)	PDF	E	EMA	C	R	(2)
Change Orders (for Contractor signature)	PDF	E	EMA	C	R	(2)
1.04.A.5. Applications for Payment						(3)
1.04.A.6. Claims and other notices						(4)
1.04.A.7. Closeout Documents						
Record drawings	DWG and PDF	C	EMA	E, O	M (5)	(5)
Other record documents	PDF	C	EMA	E. O	M (5)	(5)

Electronic Data	Data Format	Transmitting Party	Transmission Method	Receiving Party	Permitted Uses	Notes
Contract closeout documents						

A. Key to Electronic Data Protocol Table:
Data Format:

EM	.msg, .htm, .txt, .rtf, e-mail text
W	.docx, Microsoft® Word 2007 or later
EX	.xlsx, Microsoft® Excel 2007 or later
PDF	.pdf. Portable Document Format
DWG	.dwg. Autodesk AutoCAD 2013 drawing.

Transmitting Party:

O	OWNER
C	CONTRACTOR
E	ENGINEER

Transmission Method:

EM	Via e-mail
EMA	As an attachment to an e-mail transmission

Receiving Party:

O	OWNER
C	CONTRACTOR
E	ENGINEER

Permitted Uses:

S	Store and view only
R	Reproduce and distribute
I	Integrate (incorporate additional electronic data without modifying data received)
M	Modify as required to fulfill obligations for the Project

Notes:

(1) Modifications by ENGINEER to CONTRACTOR's submittals and requests for interpretations are limited to printing out, marking-up, and adding comment sheets.

(2) May be distributed only to affected Subcontractors and Suppliers. Print out, sign document, and return executed printed copy originals to ENGINEER.

(3) Submit printed Applications for Payment with original ("wet") signatures.

(4) Submit notices, including Claims, in accordance with the notice provisions of the General Conditions, as may be modified by the Supplementary Conditions.

(5) Submit record drawings in native CAD format indicated when CONTRACTOR has executed ENGINEER's standard agreement for release of electronic files. In addition, always submit record drawings as a PDF file. Comply with requirements of Section 01 78 39, Project Record Documents.

(6) For operation and maintenance data, also submit printed copies as required by Section 01 78 23, Operations and Maintenance Data.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 32 16

PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall prepare and submit Progress Schedules and related documents in accordance with the General Conditions, as may be modified by the Supplementary Conditions, and this Section, unless otherwise accepted by ENGINEER.

2. Maintain and update Progress Schedules and related documents.

3. Progress Schedule shall be resource- and cost-loaded CPM Progress Schedule.

4. ENGINEER's acceptance of the Progress Schedule or related documents, and comments or opinions concerning activities in the Progress Schedule and related documents shall not control CONTRACTOR's independent judgment concerning means, methods, techniques, sequences and procedures of construction, unless the associated means, method, technique, sequence, or procedure is directed by the Contract Documents. CONTRACTOR is solely responsible for complying with the Contract Times.

B. Use of float:

1. Float belongs to the Project and may be used by OWNER or CONTRACTOR to accommodate changes in the Work, or to mitigate the effect of events that delay performance or compliance with the Contract Times.

2. Changes or delays that influence Activities that have float and that do not extend the Critical Path are not justification for an extension of the Contract Times.

C. Factors Affecting the Progress Schedule:

1. In preparing the Progress Schedule, take into consideration submittal requirements and submittal review times, time for fabricating and delivering materials and equipment, source quality control (including shop testing) and field quality control (including testing at the Site), Subcontractors' work, availability and abilities of workers, availability of construction equipment, weather conditions, restrictions in operations at the Site and coordination with OWNER's operations, and other factors

that have the potential to affect completion of the Work within the Contract Times.

2. Comply with sequencing requirements indicated in the following:

   a. Section 01 11 13, Summary of Work.

   b. Section 01 13 13, Milestones.

   c. Section 01 14 16, Coordination with Owner's Operations.

1.2 DEFINITIONS

A. The following terms are defined for this Section and supplement the terms defined in the General Conditions and Supplementary Conditions:

1. Activity: An element of the construction work that has the following specific characteristics: consumes time, consumes resources, has a definable start and finish, is assignable, and is measurable.

2. Constraint: An imposed date on the Progress Schedule or an imposed time between Activities. The Contract Times are Constraints.

3. CPM Progress Schedule: Computerized Progress Schedule in Critical Path Method (CPM) format which accounts for the entire Work, defines the interrelationships between elements of the Work, reflects the uncompleted Work, and indicates the sequence with which the Work has been completed, indicates the sequence in which uncompleted Work will be completed, and indicates the duration of each Activity.

4. Critical Path: The continuous chain of Activities with the longest duration for completion within the Contract Times.

5. Early Start: The earliest possible date an Activity can start according to the assigned relationships among Activities.

6. Early Finish: The earliest date an Activity can finish according to the assigned relationships among the Activities.

7. Late Finish: The latest date an Activity can finish without extending the Contract Times.

8. Late Start: The latest date an Activity can start without extending the Contract Times.

9. Float: The time difference between the calculated duration of the Activity chain and the Critical Path.

10. Total Float: The total number of days that an Activity (or chain of Activities) can be delayed without affecting the Contract Times.

11. Network Diagram: A time-scaled logic diagram depicting the durations and relationships of the Activities.

12. Work Areas, Area, or System: A logical breakdown of the Project elements or a group of Activities which, when collectively assembled, are readily identifiable on the Project (for example: yard piping, a structure or building, a treatment process, or other logical grouping).

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Progress Schedule Preparer:

a. CONTRACTOR shall self-prepare and maintain the Progress Schedule using qualified employee with experience in scheduling, and experienced with the scheduling software required for the Project, and experience serving as Progress Schedule preparer on construction projects of similar type, size, and scope to this Project.

b. Progress Schedule preparer shall have not less than five years experience using the schedule software required on construction projects of similar type, size, and scope as the Project.

c. Prior to engaging a scheduling consultant or using a qualified employee, submit to ENGINEER the following:

1) Name and address of proposed Progress Schedule preparer and the names of personnel who will be assigned to scheduling the Project.

2) Information sufficient to demonstrate that proposed Progress Schedule preparer and scheduling personnel to be assigned to the Project possess qualifications complying with this Section. For each person assigned, submit list of similar type, size, contract value of projects, names and contact information of engineer or architect and owner.

d. Engineer's Review of Qualifications:

1) ENGINEER will respond to CONTRACTOR whether proposed scheduling personnel are acceptable within five (5) days after ENGINEER's receipt of complete qualifications.

2) If qualifications are not acceptable, submit qualifications of acceptable personnel within five (5) days of receipt of ENGINEER's non-acceptance.

3) ENGINEER's acceptance or non-acceptance of qualifications does not release CONTRACTOR from its obligations under the Contract Documents.

B. Scheduling Workshop Conferences:

1. Prior to preparing the preliminary Progress Schedule, CONTRACTOR shall meet with ENGINEER and OWNER for one (1) workshop conference, up to four (4) hours in duration, to review technical requirements and Progress Schedule development methods and procedures.
2. Required Attendance:
    a. CONTRACTOR's project manager, site superintendent, and Progress Schedule preparer.
    b. ENGINEER
    c. OWNER may attend one or more scheduling workshop conferences.
3. ENGINEER will prepare minutes of the scheduling workshop conferences and distribute minutes to each attendee.

1.4 SUBMITTALS

A. Quantity of each submittal required and timing of submittals are in this Section.

B. Informational Submittals: Submit the following:

1. Initial Progress Schedules:
    a. Preliminary Progress Schedule with associated Network Diagrams and narrative report.
    b. Acceptable Progress Schedule with associated Network Diagrams and narrative report.
    c. Preliminary resource- and cost-loaded Progress Schedule and associated reports.
    d. Acceptable resource- and cost-loaded Progress Schedule and associated reports.
    e. Submit each Progress Schedule submittal with letter of transmittal complying with requirements of Section 01 33 00, Submittal Procedures.
2. Progress Schedule Updates.
    a. Progress Schedule updates shall comply with requirements of this Section, and shall include updated Progress Schedule, narrative report, updated Network Diagram when relationships among Activities are changed, and updated mathematical tabulations.
    b. Submit updated Progress Schedule prior to each progress meeting. When a Progress Schedule remains unchanged from one progress meeting to the next, submit a written statement to that effect. In addition to monthly Progress Schedule submittals, also bring to

progress meeting the number of printed copies of the updated Progress Schedule indicated in Section 01 31 19, Progress Meetings.

3. Look-Ahead Schedules

   a. Furnish 15-day look-ahead schedule at each progress meeting.

4. Time Impact Analyses: Submit in accordance with this Section.

5. Recovery Schedule: Submit in accordance with this Section.

6. Qualifications:

   a. Submit qualifications of Progress Schedule preparer, and other personnel that will assist Progress Schedule preparer in preparing and maintaining the Progress Schedule.

1.5 INITIAL PROGRESS SCHEDULES

A. Type and Organization of Progress Schedules:

1. Prepare Progress Schedule using Oracle Primavera P6 software, unless other scheduling software is acceptable to OWNER.

2. Sheet Size: 22 inches by 34 inches, unless otherwise accepted by ENGINEER.

3. Time Scale: Indicate first date of each work week.

4. Activity Designations: Indicate title and related Specifications Section number.

5. Progress Schedules shall be CPM Progress Schedules.

6. Organization:

   a. Indicate on the separate Schedule of Submittals dates for submitting and reviewing Shop Drawings, Samples, and other submittals.

   b. Group deliveries of materials and equipment into a separate sub-schedule that is part of the Progress Schedule.

   c. Group construction into Work Area sub-schedules (that are part of the Progress Schedule) by Activity.

   d. Clearly indicate the Critical Path on the Progress Schedule.

   e. Organize each Work Area sub-schedule by Specifications Section number.

C. Preliminary Progress Schedule:

1. Within fifteen (15) days after the Contract Times commence running, CONTRACTOR shall submit to ENGINEER the preliminary Progress Schedule covering the entire Project, with associated Network Diagrams.
2. Submit preliminary Progress Schedule in accordance Section 01 33 00, Submittal Procedures.
3. ENGINEER will conduct a timely review of the preliminary Progress Schedule.
4. Preliminary Progress Schedule shall comply with the Contract Documents relative to Progress Schedules, but need not be resource- or cost-loaded.

D. Initial Acceptance of Progress Schedule:

1. Not less than ten (10) days before submission of the first Application for Payment, a scheduling conference attended by CONTRACTOR, Progress Schedule preparer, ENGINEER, and others as appropriate will be held at the Site to review for acceptability to ENGINEER the preliminary Progress Schedule and associated Network Diagram and other reports and schedule-related documents required. Following the scheduling conference, CONTRACTOR shall have five (5) days to make corrections and adjustments and to complete and resubmit the Progress Schedule and associated Network Diagram. No progress payment will be made to CONTRACTOR until acceptable Progress Schedule, Network Diagram, and other reports and schedule-related documents required are submitted to ENGINEER.
2. Submit acceptable Progress Schedule, together with Network Diagram, reports, and other schedule-related documents required to accompany the initial acceptable Progress Schedule, in accordance with the Submittals Article of this Section, Section 01 31 26, Electronic Communication Protocols, and Section 01 33 00, Submittal Procedures. Also submit acceptable form of Progress Schedule in its native format generated by the scheduling software, transmitted using the transmission method indicated in Section 01 31 26, Electronic Communication Protocols.
3. The Progress Schedule will be acceptable to ENGINEER if it provides an orderly progression of the Work to completion within the Contract Times, in accordance with the Contract Documents. Such acceptance will not impose on ENGINEER responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility therefor.
4. Initially-accepted Progress Schedule shall be identified as the baseline Progress Schedule.

E. Resource- and Cost-Loaded Progress Schedule:

1. Not more than ten (10) days after ENGINEER's acceptance of the Progress Schedule, submit to ENGINEER resource- and cost-loaded Progress Schedule complying with resource- and cost-loading requirements in this Section.
2. Submit of the preliminary and the acceptable resource- and cost-loaded Progress Schedules and associated reports to accompany the initial submittals of resource (and cost-loaded Progress Schedules in accordance with the Submittals Article of this Section, Section 01 31 26, Electronic Communication Protocols, and Section 01 33 00, Submittal Procedures. Also submit preliminary and acceptable form of resource- and cost-loaded Progress Schedules in its native format generated by the scheduling software, transmitted using the transmission method indicated in Section 01 31 26, Electronic Communication Protocols.
3. Resource- and cost-loaded Progress Schedules will be reviewed by ENGINEER within ten (10) days of ENGINEER's receipt, and ENGINEER's comments will be transmitted to CONTRACTOR.
4. Make revisions required in accordance with ENGINEER's comments and resubmit to ENGINEER within five (5) days of CONTRACTOR's receipt of ENGINEER's comments.
5. Resource- and cost-loaded Progress Schedule accepted by ENGINEER shall be the basis for determining the amount of each CONTRACTOR progress payment.

F. If the Progress Schedule reflects completion date(s) different than the Contract Times, the Contract Times are not thereby voided, nullified, or affected. The Contract Times govern. Where the Progress Schedule reflects completion date(s) that are earlier than the Contract Times, ENGINEER may accept such Progress Schedule with CONTRACTOR to specifically understand that no Change Request or Claim for additional Contract Times or additions to the Contract Price shall be brought against OWNER resulting from CONTRACTOR's failure to complete the Work by the earlier date(s) indicated on the accepted Progress Schedule.

1.6 PROGRESS SCHEDULE UPDATES

A. Updates:

1. Update the Progress Schedule not less-often than once per month. If during progress of the Work events develop that necessitate changes in the initially accepted Progress Schedule (e.g., baseline Progress Schedule), identify updated Progress Schedules sequentially as "Progress Schedule Revision 1", "2", "3", and continuing in sequence as required. Number the Progress Schedule submittals in accordance with Section 01 33 00, Submittal Procedures.

2. CONTRACTOR's Progress Schedule update shall include a narrative report in accordance with this Section. Narrative report shall include description of current progress and status of each Area of the Project, a description of progress for the period, a description of the Critical Path, a discussion of current or potential delays, Change Orders (pending and approved in since the previous Progress Schedule update), and other problems associated with maintaining the Work on schedule.

3. The update to the Progress Schedule shall be based on retained logic. Progress override logic is not allowed.

4. Required scheduling software, and schedule organization, format, and content for updated Progress Schedules are identical to that required in this Section for initial Progress Schedules.

5. Submit to ENGINEER updated Progress Schedule, together with Network Diagram (when required), reports, and other schedule-related documents required to accompany the updated Progress Schedule, in accordance with Section 01 31 26, Electronic Communication Protocols, and Section 01 33 00, Submittal Procedures. Also submit updated Progress Schedule in its native format generated by the scheduling software, transmitted using the transmission method indicated in Section 01 31 26, Electronic Communication Protocols.

6. Submit updated Network Diagrams when revisions are proposed to the logic. Indicate in the narrative report delays that have occurred since the previous updated Progress Schedule. ENGINEER will not recommend payment by OWNER of progress payments until updated Progress Schedule is received, reviewed, and accepted by ENGINEER. Payment for out-of-sequence Work is not allowed.

B. Monthly Schedule Meeting:

1. During the month, utilizing the previous month's 15-day look-ahead schedule. CONTRACTOR shall record the percent complete, start and finish dates of each scheduled Activity with the remaining duration for each Activity started but not completed, including Activities associated with procurement of materials and equipment.

2. On the same day each month, not less than one week prior to a progress meeting, CONTRACTOR, Progress Schedule preparer, ENGINEER, and others as appropriate shall meet at the Site and tour the Work to review and update the schedule and progress information gathered by CONTRACTOR during the month. After acceptance of CONTRACTOR's updated data, Progress Schedule preparer shall use this information to update the Progress Schedule.

1.7 NETWORK DIAGRAMS (PERT CHARTS)

A. Network Diagrams – General:

1. Prepare and submit Network Diagrams, as generated using the scheduling software suitable for printing on paper of the size indicated for Progress Schedules in this Section.
2. Group Network Diagrams by Area and show the order and interdependence of Activities and sequence and quantities in which the Work will be accomplished.
3. Do not use match lines on Network Diagrams. Depict interrelationships to or from Activities outside the Area shown using an Activity symbol with Activity number and description.
4. In preparing Network Diagrams, comply with the basic concept of precedence diagramming method (PDM) network scheduling to show how start of a given Activity depends on completion of preceding Activities, and how the Activity's completion may affect the start of subsequent Activities.
5. Level of schedule detail shall define the day-to-day Activities of the Work.

B. Network Diagram Content:

1. Clearly indicate the Critical Path and distinguish the Critical Path from other paths on the network.
2. Organize Network Diagrams by grouping into major Work Areas, including one for procurement of materials and equipment, and by specific Activity within each Area.
3. Logic diagrams shall include the following:
    a. Activity number.
    b. Activity description.
    c. Activity duration (in work days).
    d. Critical Path denoted.
    e. Float for each Activity.
    f. Activity or System designation.
    g. Coded Area designation.
    h. Responsibility code (e.g., CONTRACTOR, Subcontractor, trade, operation, Suppliers, or other entity responsible for accomplishing an Activity).
    i. Shift number (if more than one shift per day is to be employed).

C. Network Diagram Revisions:

1. General:

   a. When conditions develop that require revisions to logic or durations of the Network Diagram associated with the initially accepted Progress Schedule (e.g., baseline Progress Schedule), identify updates to the Network Diagram in the same manner required in this Section for Progress Schedule updates.

   b. Revision of the logic or durations from the baseline Progress Schedule initially accepted by ENGINEER shall be submitted to ENGINEER for acceptance.

   c. Incorporate into the Progress Schedule revisions to logic or duration accepted by ENGINEER, and include in monthly narrative report both a description of revisions and listing of Activities affected by revisions.

   d. Changes resulting from Change Orders, Work Change Directives, Field Orders, allowance authorizations, and other additions or deletions, shall be fully incorporated into the Progress Schedule and Network Diagram on the first update after the associated Change Orders, Work Change Directive, or allowance authorization is approved by OWNER, or Field Order issued by ENGINEER, including adjustments to the Contract Price (if any).

2. Submit revised Network Diagrams with updated Progress Schedule submittals.

1.8 RESOURCE AND COST LOADING REPORTS

A. Resource Loading:

1. After ENGINEER's initial acceptance of the Progress Schedule, CONTRACTOR shall assign resources for personnel labor-hours, materials, and equipment to each construction Activity within each responsibility code. Submit resource schedule reports with each updated Progress Schedule.

B. Cost Loading:

1. Assign to each Activity a total dollar amount commensurate with its value relative to the associated line item in the Schedule of Values accepted by the ENGINEER. Submit cost reports for the initially accepted cost-loaded Progress Schedule and each subsequent update of the Progress Schedule.

2. After the cost-loaded Progress Schedule is accepted by ENGINEER, each Application for Payment will be on the basis of earned revenue as indicated in updates of the Progress Schedule.

1.9 NARRATIVE REPORT

A. Prepare and include with the preliminary Progress Schedule and each subsequent Progress Schedule submittal, written narrative report describing the schedule-related requirements of the Contract Documents and CONTRACTOR's plan and schedule for complying with such requirements. Narrative report shall describe the methods of sequencing and operation, resources to be employed, time frames for the construction of each of the major Systems on the Project, and time frames for complying with the Contract Times and CONTRACTOR's interim schedule milestones.

1.10 TIME IMPACT ANALYSIS

A. Time Impact Analyses – General:

1. Prepare and submit a time impact analysis when one or more of the following occurs: a Change Proposal is prepared, a Work Change Directive is issued that will affect the Progress Schedule, or when delays are experienced. Time impact analysis shall illustrate the influence of each Change Order, Work Change Directive, allowance authorization, or delay, as applicable, on the Contract Times and schedule milestones.

2. Each time impact analysis shall include a sketch (fragnet) demonstrating how CONTRACTOR proposes to incorporate the changes in the Work or, as applicable, delays into the Progress Schedule. Fragnet shall include all logic, resource and cost changes, and additions required as result of said Change Order, Work Change Directive, allowance authorization, or delay.

3. Fragnet shall show all CPM logic revisions for the Work associated with the Change Order, Work Change Directive, allowance authorization, or delay and its relationship to other Activities in the Network Diagram.

4. Time impact analysis shall demonstrate the time impact, based on date the Change Order, Work Change Directive, or allowance authorization was given to CONTRACTOR, or as applicable the date the delay was implemented; the status of the Work at that point in time; and the Activity duration of affected Activities. Activity duration used in the time impact analysis shall be those included in the latest update of the Progress Schedule accepted by ENGINEER, closest to the time of the start of the delay or start of the Change Order, Work Change Directive, or allowance authorization as adjusted by mutual, written agreement of the parties and ENGINEER.

5. Timing of Time Impact Analysis:

a. Submit each time impact analysis within five (5) days after the following, as applicable:

1) Start of the delay.

2) After the submittal of Change Proposal.

3) After CONTRACTOR receipt of Work Change Directive.

b. When CONTRACTOR does not submit time impact analysis for a specific change or delay, within the specified period of time for such submittal, such non-submittal shall be construed that no extension of the Contract Times is required.

B. Evaluation by Engineer and Acceptance:

1. ENGINEER's evaluation of each time impact analysis comprised of complete information will be completed in timely manner after ENGINEER's receipt. Changes in the Contract Times will be made only by Change Order.

2. When mutual agreement is reached between the parties on effect of the change or delay in the Project, incorporate into the next Progress Schedule update the associated fragnets illustrating the influence of changes and delays.

1.11 RECOVERY SCHEDULES

A. Recovery Schedules – General:

1. When updated Progress Schedule indicates that the ability to comply with the Contract Times falls fifteen (15) or more days behind schedule, and there is no excusable delay, Change Order, or Work Change Directive to support an extension of the Contract Times, CONTRACTOR shall prepare and submit a Progress Schedule demonstrating CONTRACTOR's plan to accelerate the Work to achieve compliance with the Contract Times ("recovery schedule") for ENGINEER's acceptance.

2. Submit recovery schedule within five (5) days after submittal of updated Progress Schedule where need for recovery schedule is indicated.

B. Implementation of Recovery Schedule:

1. At no additional cost to OWNER, do one or more of the following: furnish additional labor, provide additional construction equipment, provide suitable materials, employ additional work shifts, expedite procurement of materials and equipment to be incorporated into the Work, and other measures necessary to complete the Work within the Contract Times.

2. Upon acceptance of recovery schedule by ENGINEER, incorporate recovery schedule into the next Progress Schedule update.

C. Lack of Action:

1. CONTRACTOR's refusal, failure, or neglect to take appropriate recovery action, or to submit a recovery schedule, shall constitute reasonable evidence that CONTRACTOR is not prosecuting the Work or separable part thereof with the diligence that will ensure completion within the Contract Times. Such lack of action shall constitute sufficient basis for

OWNER to exercise remedies available to OWNER under the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all equipment, labor, materials required to provide the OWNER services specified, including:

a. Digital photography.

b. Digital videography.

2. Furnish photographic documentation for the following:

a. Pre-construction.

b. Construction progress.

c. Final.

B. Image Quality:

1. Photographic documentation shall be in color.

2. Photographic images shall be suitably staged and set up ("framed"), focused, and shall have adequate lighting to illuminate the Work and conditions that are the subject of the photograph.

3. For still photographs, use camera with minimum 16.0-megapixel resolution.

1.2 QUALITY ASSURANCE

A. At the Site, ENGINEER or Resident Project Representative will indicate the views to be taken and will select time at which images will be taken. Photographic subjects, views, and angles will vary with progress of the Work.

1.3 SUBMITTALS

A. Informational Submittals: Submit the following:

1. Pre-construction Photographic Documentation: Submit acceptable spre-construction photographic documentation (digital files) prior to mobilizing to and disturbing the Site. Submit pre-construction photographic documentation not later than the first Application for Payment, unless other schedule for pre-construction photographic documentation is accepted by ENGINEER.

2. Construction Progress Photographic Documentation: Submit acceptable construction progress photographic documentation (digital files) not less-often than monthly. Submit with each Application for Payment, unless otherwise agreed to by ENGINEER.

B. Closeout Submittals: Submit the following:

1. Final Photographic Documentation: Submit acceptable final photographic documentation (digital files) prior to requesting the final inspection by ENGINEER.

1.4 PHOTOGRAPHIC DOCUMENTATION – GENERAL

A. Digital Files of Photographs:

1. For each photograph taken, furnish high-quality digital image in "JPG" file format compatible with Microsoft Windows 7 and higher operating systems.

2. Image resolution shall be sufficient for clear, high-resolution prints. Minimum resolution shall be 150 dots per inch (dpi).

3. Do not imprint date and time in the image.

4. Electronic image filename shall describe the image; do not submit filenames automatically created by digital camera. For example, an acceptable electronic filename would be, "Dewatering Building – Looking West at Centrifuge No. 2.jpg".

5. Form of Digital Submittal – Image File Upload:

a. Upload digital files of Project photographic documentation to the Project website

b. Upload files to new directory each time files are uploaded. Directory name shall be the date the photographs were taken (in the form of YEAR-MO-DAY), with brief general description of subject matter. Example: "2013-09-10 – Concrete Reinforcing in Slab".

B. Videography:

1. Video shall be high-definition (HD), high-quality video of the Site and Project work.

2. All video files for the entire Project shall be submitted in one container file format. Video files shall be in one of the following container file formats:

a. AVI (Microsoft systems).

b. Flash Video (F4V, FLV; Adobe systems).

c. QuickTime File Format (MOV, QT; Apple, Inc.).

d. MP4 (“MPEG-4 Part 14”).

3. Video image shall have imprinted date and time that video was taken.

4. Include audio narration sufficient to explain the scenes shown.

5. Form of Digital Submittal – Video File Upload:

a. Upload digital files of Project photographic documentation to the Project website

b. Upload files to new directory each time files are uploaded. Directory name shall be the date the video was taken (in the form of YEAR-MO-DAY), with brief general description of subject matter. Example: “2013-09-10 – Pouring Concrete Slab”.

1.5 PRE-CONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

A. Pre-construction Photographic Documentation:

1. Obtain and submit sufficient pre-construction photographic documentation to record Site conditions prior to construction. Photographs shall document work areas of all prime contracts under the Project.

2. Pre-construction photographs are not part of required number of construction progress photographs

3. Furnish pre-construction video of all work areas included in all prime contracts on the Project, including indoor and outdoor work areas and staging areas.

B. If disagreement arises on the condition of the Site and insufficient pre-construction photographic documentation was submitted prior to the disagreement, restore the grounds or area in question to extent directed by ENGINEER and to satisfaction of ENGINEER.

1.6 CONSTRUCTION PROGRESS PHOTOGRAPHIC DOCUMENTATION

A. Progress Photographs:

1. Take photographs not less often than twice per month.

2. Take not less than five (5) photographs each time.

3. Minimum number of progress photographs required will be fifteen (15), based on the Contract Times to Substantial Completion of the entire Project and scope of the Project on date the Contract Times commence running. Proportionately modify the extent of photographic documentation if scope of the Project or the Contract Times are modified.

4. Obtain and submit interior and exterior photographic documentation of each structure in the work area as directed by ENGINEER at the time photographic documentation is taken.

1.7 FINAL PHOTOGRAPHIC DOCUMENTATION

A. Final Photographs:

1. Take photographs at time and day acceptable to ENGINEER. Do not take final photographs prior to Substantial Completion of the entire Project. Work documented in final photographs shall be generally complete, including painting and finishing, furnishings, landscaping, and other visible Work

2. Take not less than twenty five (25) final photographs, based on scope of the Project at the time that the Contract Times commence running. Proportionately modify the number of final photographs if scope of Project is modified. Final photographs are not part of construction progress photographs required under Paragraph 1.6.A of this Section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall prepare and furnish submittals in accordance with the General Conditions, as may be modified by the Supplementary Conditions, and this Section.

2. Provide submittals well in advance of need for the material or equipment, or procedure (as applicable), in the Work and with ample time required for delivery of materials and equipment and to implement procedures following ENGINEER's approval or acceptance of the associated submittal. Work covered by a submittal will not be included in progress payments until approval or acceptance of related submittals has been obtained in accordance with the Contract Documents.

3. CONTRACTOR is responsible for dimensions to be confirmed and corrected at the Site; quantities; information pertaining solely to fabrication processes; means, methods, sequences, procedures, and techniques of construction; safety precautions and programs incident thereto; and for coordinating the work of all trades.

4. CONTRACTOR's signature of submittal's stamp and letter of transmittal shall be CONTRACTOR's representation that CONTRACTOR has complied with his obligations under the Contract Documents relative to that submittal. ENGINEER and OWNER shall be entitled to rely on such representations by CONTRACTOR.

5. Provisions of the general conditions, as may be modified by the supplementary conditions, apply to all contractor-furnished submittals required by the contract documents, regardless of whether such submittals are other than shop drawings or samples.

B. Samples:

1. Submittal of Samples shall comply with the General Conditions, as may be modified by the Supplementary Conditions, this Section, and the Specifications Section in which the Sample is specified.

2. Furnish at the same time those Samples and submittals that are related to the same element of the Work or Specifications Section. ENGINEER will not review submittals without associated

Samples, and will not review Samples without associated submittals.

3. Samples shall clearly illustrate functional characteristics of materials, all related parts and attachments, and full range of color, texture, pattern, and materials.

C. Restrictions on Quantity of Submittals and Compensation of OWNER:

1. CONTRACTOR shall furnish required submittals with sufficient information and accuracy to obtain required approval or acceptance of submittal by ENGINEER with not more than the number of resubmittals indicated in the General Conditions (as may be modified by the Supplementary Conditions).

2. Total number of CONTRACTOR's submittals shall not exceed 25 percent above the total number of first-time submittals indicated in the Schedule of Submittals initially accepted by ENGINEER. ENGINEER will record ENGINEER's time for reviewing submittals of Shop Drawings, Samples, and other submittals and items requiring approval or acceptance, beyond the quantity of first-time submittals indicated in the Schedule of Submittals initially accepted by ENGINEER, and CONTRACTOR shall reimburse OWNER for ENGINEER's charges for such time.

3. In the event that CONTRACTOR requests a substitution for a previously approved item, Contractor shall reimburse OWNER for ENGINEER's charges for such time unless the need for such substitution is beyond the control of CONTRACTOR.

4. OWNER may impose set-offs against CONTRACTOR for the costs for which CONTRACTOR is to reimburse or compensate OWNER, in accordance with the General Conditions.

1.2 TYPES OF SUBMITTALS

A. Submittal types are classified as follows: 1) Action Submittals, 2) Informational Submittals, 3) Closeout Submittals, and 4) Maintenance Material submittals. Type of each required submittal is designated in the respective Specifications Sections; when type of submittal is not designated in the associated Specification Section, submittal will be classified as follows:

1. Action Submittals include:

a. Shop Drawings.

b. Product data.

c. Delegated design submittals, which include documents prepared, sealed, and signed by a design professional retained by CONTRACTOR, Subcontractor, or Supplier for

materials and equipment to be incorporated into the completed Work. Delegated design submittals do not include submittals related to temporary construction unless specified otherwise in the related Specifications Section. Delegated design submittals include: design drawings, design data including calculations, specifications, certifications, and other submittals prepared by such design professional.

d. Samples.

e. Testing plans, procedures, and testing limitations.

2. Informational Submittals include:

a. Certificates.

b. Design data not sealed and signed by a design professional retained by CONTRACTOR, Subcontractor, or Supplier.

c. Pre-construction test and evaluation reports, such as reports on pilot testing, subsurface investigations, testing for a potential Hazardous Environmental Condition, and similar reports.

d. Supplier instructions, including installation data, and instructions for handling, starting-up, and troubleshooting.

e. Source quality control submittals (other than testing plans, procedures, and testing limitations), including results of shop testing.

f. Field or Site quality control submittals (other than testing plans, procedures, and testing limitations), including results of operating and acceptability tests at the Site.

g. Supplier reports.

h. Sustainable design submittals (other than sustainable design closeout documentation).

i. Special procedure submittals, including plans for shutdowns and tie-ins and other procedural submittals.

j. Qualifications statements.

k. Administrative submittals including:

1) Progress Schedules.

2) Schedules of Submittals.

3) Schedules of Values.

4) Photographic documentation.

5) Coordination drawings, when submittal of such is required.

6) Copies of permits obtained by CONTRACTOR.

7) Field engineering reports, survey data, and similar information.

3. Closeout Submittals include:

a. Maintenance contracts.

b. Operations and maintenance data.

c. Bonds, such as special maintenance bonds and bonds for a specific material, equipment item, or system.

d. Warranty documentation.

e. Record documentation.

f. Sustainable design closeout documentation.

g. Software.

h. Keying.

4. Maintenance Material Submittals include:

a. Spare parts.

b. Extra stock materials.

c. Tools.

5. When type of submittal is not specified and is not included in the list above, request an interpretation from ENGINEER and ENGINEER will determine the type of submittal.

B. Fixed Asset Report Submittals

1. The contractor shall include with each month's pay application a Fixed Asset Report, which is used to officially document the installed inventory of equipment, certain material items, and the structure itself. The report is to be developed in a MS Excel spreadsheet format and will include components of each facility constructed, added, expanded, etc., on the facility site. As work is completed the report will expand, being a cumulative summary of the installed facility work. Gwinnett County has a standard Fixed Asset Form that can be utilized (see example at the end of this section). Pay applications will not be processed until an approved Fixed Asset Report is provided each month.

2. The format and content of the report to be filled out by the Contractor is as follows:

a. Description: Description of the specific asset.

b. Quantity: The specific number of units installed.

c. Unit of Measurement: The method of determining the quantity (ex. Each, LF, CY, etc.).

d. Manufacturer Column: The name of the asset manufacturer.

e. Serial Number: The specific serial number for the asset.

f. Values: The cost of the asset.

3. At the conclusion of the project, the cumulative total of cost reported under the Fixed Asset Report will be the total contract value of the work.

4. The report is to be submitted in both printed and electronic format.

C. Sales Tax Report

1. To be included with each month's pay application is a Sales Tax Report, which is used to officially document the Georgia Sales Tax expended in the procurement of treatment equipment. All equipment purchased for installation within the pump station site will be documented within this report and will be accounted for by item cost and sales tax paid to the State of Georgia. The report is to be developed in a MS Excel spreadsheet format and will include each equipment item purchased, into which facility it is installed, the cost of the individual equipment item/component/system, and the corresponding tax paid on the individual equipment item/component/system. As work is completed or equipment received, the report will be expanded, being a cumulative summary of the treatment equipment installed within the pump station site.

2. The format and content of the report is as follows:

a. The report is to be sorted by Area and Structure number in ascending order.

b. Column 1 - Labeled "Location": Identifies the location of the inventory included for that area of the facility. For this project, Location shall be designated as "Lanier Filter Plant".

c. Column 2 - Labeled "Description": Identifies the specific item being documented. This is to include the structure/facility/building itself and all equipment items within the structure/facility/building or area (e.g. heating and ventilation equipment etc.), all system components (e.g. transformers, VFD, motor control centers, etc.) and all tagged/numbered/discretely identified items or components (e.g. valves, pumps, power panels, etc.).

d. Column 3 - Labeled "Manufacturer": Identifies the manufacturer of the specific item.

e. Column 4 - Labeled "Date of Sale": Identifies the date the invoice for the particular equipment item/component/system was paid.

f. Column 5 - Labeled "Item Cost": Identifies the actual cost of the specific item prior to the application of sales tax.

g. Column 6 - Labeled "Sales Tax Paid": Identifies the actual Georgia Sales Tax paid for the specific item.

3. Each Structure and Area is to have a subtotal line wherein the individual items are summed to develop a Structure/Area value, and the Area subtotals are summed to establish a total Georgia Sales Tax value paid for the work at Lanier filter Plant.

4. The monthly reports shall be accompanied by certified copies of invoices showing the items costs and taxes paid and a copy of the checks used for payment.

5. The report is to be submitted in both printed and electronic format.

D. Not Included in this Section: Administrative and procedural requirements for following are covered elsewhere in the Contract Documents:

1. Requests for interpretations of the Contract Documents.

2. Change Orders, Work Change Directives, and Field Orders.

3. Applications for Payment

4. Reports, documentation, and permit applications required to be furnished by CONTRACTOR to authorities having jurisdiction.

1.3 REQUIREMENTS FOR SCHEDULE OF SUBMITTALS

A. Informational Submittals: Submit the following:

1. Schedule of Submittals:

a. Timing:

1) Furnish submittal within time frames indicated in the Contract Documents.

2) Submit updated Schedule of Submittals with each submittal of the updated Progress Schedule.

b. Content: In accordance with the General Conditions, as may be modified by the Supplementary Conditions, and this Section. Requirements for content of preliminary Schedule of Submittals and subsequent submittals of the Schedule of Submittals are identical. Identify on Schedule of Submittals all submittals required in the Contract

Documents. Updates of Schedule of Submittals shall show scheduled dates and actual dates for completed tasks. Indicate submittals that are on the Project's critical path. Indicate the following for each submittal:

1) Date by which submittal will be received by ENGINEER.

2) Whether submittal will be for a substitution or "or-equal". Procedures for requesting approval of substitutes and "or-equals" are specified in the General Conditions, Section 01 33 00, Substitution Procedures,

3) Date by which ENGINEER's response is required. Not less than 14 days shall be allowed for ENGINEER's review, starting upon ENGINEER's actual receipt of each submittal. Allow increased time for large or complex submittals.

4) For submittals for materials or equipment, date by which material or equipment must be at the Site to avoid delaying the Work and to avoid delaying the work of other contractors, if any.

c. Prepare Schedule of Submittals using same software, and in same format, specified for Progress Schedules in Section 01 32 16, Progress Schedule.

d. Coordinate Schedule of Submittals with the Progress Schedule.

e. Schedule of Submittals that is not compatible with the Progress Schedule, or that does not indicate submittals on the Project's critical path, or that that places extraordinary demands on ENGINEER for time and resources, is unacceptable. Do not include submittals not required by the Contract Documents.

f. In preparing Schedule of Submittals:

1) Considering the nature and complexity of each submittal, allow sufficient time for review and revision.

2) Reasonable time shall be allowed for: ENGINEER's review and processing of submittals, for submittals to be revised and resubmitted, and for returning submittals to CONTRACTOR.

3) Identify and accordingly schedule submittals that are expected to have long anticipated review times.

1.4 PROCEDURE FOR SUBMITTALS

B. Submittal Identification System: Use the following submittal identification system, consisting of submittal number and review cycle number.

1. Submittal Number: Shall be separate and unique number correlating to each individual submittal required. Assign submittal numbers as follows:

a. First part of submittal number shall be the applicable Specifications Section number, followed by a hyphen.

b. Second part of submittal number shall be a three-digit number (sequentially numbered from 001 through 999) assigned to each separate and unique submittal furnished under the associated Specifications Section.

c. Typical submittal number for the third submittal furnished for Section 40 05 53, Process Valves, would be "40 05 53-003".

2. Review Cycle Number: Shall be a letter designation indicating the initial submittal or re-submittal associated with each submittal number:

a. "A" = Initial (first) submittal.

b. "B" = Second submittal (e.g., first re-submittal).

c. "C" = Third submittal (e.g., second re-submittal).

3. Examples:

	Submittal Identification	
Example Description	Submittal No.	Review Cycle
Initial (first) review cycle of the third submittal provided under Section 40 05 53, Process Valves	40 05 53-003-	A
Second review cycle (first re-submittal) of third submittal provided under Section 40 05 53, Process Valves	40 05 53-003-	B

C. Letter of Transmittal for Submittals:

1. Furnish separate letter of transmittal with each submittal. Each submittal shall be for one Specifications Section.

2. At beginning of each letter of transmittal, include a reference heading indicating: CONTRACTOR's name, OWNER's name, Project name, Contract designation, transmittal number, and submittal number.

3. For submittals with proposed deviations from requirements of the Contract Documents, letter of transmittal shall specifically describe each proposed variation.

D. Contractor's Review and Stamp:

1. Contractor's Review: Before transmitting submittals to ENGINEER, review submittals to:

a. Ensure proper coordination of the Work;

b. Determine that each submittal is in accordance with CONTRACTOR's desires;

c. Verify that submittal contains sufficient information for ENGINEER to determine compliance with the Contract Documents.

2. Incomplete or inadequate submittals will be returned without review.

3. Contractor's Stamp and Signature:

a. Each submittal furnished shall bear CONTRACTOR's stamp of approval and signature, as evidence that submittal has been reviewed by CONTRACTOR and verified as complete and in accordance with the Contract Documents.

b. Submittals without CONTRACTOR's stamp and signature will be returned without review. Signatures that appear to be computer-generated will be regarded as unsigned and the associated submittal will be returned without review.

c. CONTRACTOR's stamp shall contain the following:

"Project Name: _____
Contractor's Name: _____
ContractDesignation:_____
Date:_____

---------- *Reference* ----------
Submittal Title: _____
Specifications:
Section: _____
Page No.: _____
Paragraph No.: _____
Drawing No.: _____ of _____
Location of Work: _____

Submittal No. and Review Cycle: _____
Coordinated by Contractor with Submittal Nos.: _____

I hereby certify that the Contractor has satisfied Contractor's obligations under the Contract Documents relative to Contractor's review and approval of this submittal.
Approved for Contractor by: _____"

E. Submittal Marking and Organization:

1. Mark on each page of submittal and each individual component submitted with submittal number and applicable Specifications paragraph. Mark each page of each submittal with the submittal page number.

2. Arrange submittal information in same order as requirements are written in the associated Specifications Section.

3. Each Shop Drawing sheet shall have title block with complete identifying information satisfactory to ENGINEER.

4. Package together submittals for the same Specifications Section. Do not furnish required information piecemeal.

F. Format of Submittal and Recipients:

1. Action Submittals and Informational Submittals: Furnish in accordance with Table 01 33 00-A, except that submittals of Samples shall be as specified elsewhere in this Section:

TABLE 01 33 00-A: SUBMITTAL CONTACTS AND REQUIRED FORMAT

	Address for Deliveries	Contact Person	E-mail Address	Format*	No. of Printed Copies
a.	Engineer: ARADIS U.S., Inc., 2839 Paces Ferry Road Suite 900 Atlanta GA	TBD	TBD@Arcadis.com	E	Zero
b.	Owner: Fayette County Water System 245 McDonough Rd, Fayetteville, GA 30214	TBD	TBD	E	Zero
* Format: E = Electronic files; P = Printed copies. TBD = To Be Determined					

2. Samples:

a. Securely label or tag Samples with submittal identification number. Label or tag shall include clear space at least four inches by four inches in size for affixing ENGINEER's review stamp. Label or tag shall not cover, conceal, or alter appearance or features of Sample. Label or tag shall not be separated from the Sample.

b. Submit quantity of Samples required in Specifications. If quantity of Samples is not indicated in the associated Specifications Section, furnish not less than two identical Samples of each item required for ENGINEER's approval. Samples will not be returned to CONTRACTOR. If CONTRACTOR requires Sample(s) for CONTRACTOR's use, so advise ENGINEER in writing and furnish additional Sample(s). CONTRACTOR is responsible for furnishing, shipping, and transporting additional Samples.

c. Deliver one Sample to ENGINEER's field office at the Site. Deliver balance of Samples to ENGINEER at address indicated in Table 01 33 00-A, unless otherwise directed by ENGINEER.

3. Closeout Submittals:

a. Furnish the following Closeout Submittals in accordance with Table 01 33 00-A: maintenance contracts; bonds for specific materials, equipment, or systems; warranty documentation; and sustainable design closeout documentation. On documents such as maintenance contracts and bonds, include on each document furnished original ("wet") signature of entity issuing said document. When original "wet" signatures are required, furnish such submittals in printed form and electronic form to ENGINEER, and to other entities furnish as indicated in Table 01 33 00-A.

b. Operations and Maintenance Data: Submit in accordance with Section 01 78 23, Operation and Maintenance Data.

c. Record Documentation: Submit in accordance with Section 01 78 39, Project Record Documentation.

d. Software: Submit number of copies required in Specifications Section where the software is specified. If number of copies is not specified, provide two copies on compact disc in addition to software loaded on OWNER's computer(s) or microprocessor(s).

4. Maintenance Material Submittals: For spare parts, extra stock materials, and tools, furnish quantity of items specified in associated Specifications Section.

G. Electronic Submittals:

1. Format: Electronic files shall be in "portable document format" (.PDF). Files shall be electronically searchable.

2. Organization and Content:

a. Each electronic submittal shall be one file; do not divide individual submittals into multiple files each.

b. When submittal is large or contains multiple parts, furnish PDF file with bookmark for each section of submittal.

c. Content shall be identical to printed submittal. First page of electronic submittal shall be CONTRACTOR's letter of transmittal.

3. Quality and Legibility: Electronic submittal files shall be made from the original and shall be clear and legible. Do not submit scans of faxed copies. Electronic file shall be full size of original, printed documents. Properly orient all pages for reading on a computer screen.

4. Provide sufficient Internet service and e-mail capability for CONTRACTOR's use in transferring electronic submittals, receiving responses to electronic submittals, and associated electronic correspondence. Check not less than once per day for distribution of electronic submittals, electronic responses of submittal, and electronic correspondence related to submittals.

5. Submitting Electronic Files:

a. Transmit electronic files in accordance with Section 01 31 26, Electronic Communication Protocols.

H. Distribution:

1. Distribution of ENGINEER's Response via Electronic Files: Upon completion of ENGINEER's review, electronic submittal response will be distributed by ENGINEER to

a. CONTRACTOR.

b. OWNER.

c. ENGINEER's file.

I. Resubmittals: Refer to the General Conditions for requirements regarding resubmitting required submittals.

1.5 ENGINEER'S REVIEW

A. Timing: ENGINEER's review will conform with timing indicated in the Schedule of Submittals accepted by ENGINEER.

B. Submittals not required by the Contract Documents will not be reviewed by ENGINEER and will not be recorded in ENGINEER's submittal log. All printed copies of such submittals will be returned to CONTRACTOR. Electronic copies of such submittals, if any, will not be retained by ENGINEER.

C. Action Submittals, Results of ENGINEER's Review: Each submittal will be given one of the following dispositions by ENGINEER:

1. Approved: Upon return of submittal marked "Approved", order, ship, or fabricate materials and equipment included in the submittal (pending ENGINEER's approval or acceptance, as applicable, of source quality control submittals) or otherwise proceed with the Work in accordance with the submittal and the Contract Documents.

2. Approved as Corrected: Upon return of submittal marked "Approved as Corrected", order, ship, or fabricate materials and equipment included in the submittal (pending ENGINEER's approval or acceptance, as applicable, of source quality control submittals) or otherwise proceed with the Work in accordance with the submittal and the Contract Documents, and in accordance with the corrections indicated in the ENGINEER's submittal response.

3. Approved as Corrected – Resubmit: Upon return of submittal marked "Approved as Corrected – Resubmit", order, ship, or fabricate materials and equipment included in the submittal (pending ENGINEER's approval or acceptance, as applicable, of source quality control submittals) or otherwise proceed with the Work in accordance with the submittal and the Contract Documents, and in accordance with corrections indicated in ENGINEER's submittal response. Furnish to ENGINEER record re-submittal with all corrections made. Receipt of corrected re-submittal is required before materials or equipment covered in the submittal will be eligible for payment.

4. Revise and Resubmit: Upon return of submittal marked "Revise and Resubmit", make the corrections indicated and re-submit to ENGINEER for approval.

5. Not Approved: This disposition indicates material or equipment that cannot be approved. "Not Approved" disposition may also be applied to submittals that are incomplete. Upon return of submittal marked "Not Approved", repeat initial submittal procedure utilizing approvable material or equipment, with a complete submittal clearly indicating all information required.

D. Informational Submittals, Results of ENGINEER's Review:

1. Each submittal will be given one of the following dispositions:

a. Accepted: Information included in submittal complies with the applicable requirements of the Contract Documents, and is acceptable. No further action by CONTRACTOR is required relative to this submittal, and the Work covered by the submittal may proceed, and materials and equipment with submittals with this disposition may be shipped or operated, as applicable.

b. Not Accepted: Submittal does not indicate compliance with applicable requirements of the Contract Documents and is not acceptable. Revise submittal and re-submit to indicate acceptability and compliance with the Contract Documents.

2. The following types of Informational Submittals, when acceptable to ENGINEER, will not receive a written response from ENGINEER. Disposition as "accepted" will be recorded in ENGINEER's submittal log. When submittals of the following are not acceptable, ENGINEER will provide written response to CONTRACTOR

a. Material safety data sheets (MSDS).

b. Compaction testing reports.

c. Concrete testing reports.

d. Manufacturer's instructions.

E. Closeout Submittals, Results of ENGINEER's Review: Dispositions and meanings are the same as specified for Informational Submittals. When acceptable, Closeout Submittals will not receive a written response from ENGINEER. Disposition as "accepted" will be recorded in ENGINEER's submittal log. When Closeout Submittal is not acceptable, ENGINEER will provide written response to CONTRACTOR.

F. Maintenance Material Submittals, Results of ENGINEER's Review: Dispositions and meanings are the same as specified for Informational Submittals. When acceptable, Maintenance Material Submittals will not receive a written response from ENGINEER. Disposition as "accepted" will be recorded in ENGINEER's submittal log. When Maintenance Material Submittal is not acceptable, ENGINEER will provide written response to CONTRACTOR, and CONTRACTOR is responsible for costs associated with transporting and handling of maintenance materials until compliance with the Contract Documents is achieved.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

3.1 ATTACHMENTS

A. The documents listed below, and attached following this Section's "End of Section" designation, are part of this Specification Section.

1. Example Fixed Asset Report Form (one page).

2. Example Sales Tax Report Form (one page).

+ + END OF SECTION + +

Example Fixed Asset Report Form

Asset Class	Description	Asset Main No Text	Account Determination	Inventory Number	Quantity	Unit of Measure	Inventory Note	Cost Center	Plant	Location	Fund
14600402	Generator				1	Each		1912006	0100	Ambercrest PS	504
14600402	Generator				1	Each		1912006	0100	Centerville PS	504
14600402	Generator				1	Each		1912006	0100	M & M Killian Hill PS	504
14600402	Generator				1	Each		1912006	0100	Magnolia Walk PS	504
14600402	Generator				1	Each		1912006	0100	Ridge Road PS	504
14600402	Generator				1	Each		1912006	0100	Sagamore Hills PS	504
14600402	Generator				1	Each		1912006	0100	Suwanee Ck PS	504
14600402	Generator				1	Each		1912006	0100	Northforke Peachtree Ck PS	504
14600402	Automatic Transfer Switch				1	Each		1912006	0100	Ambercrest PS	504
14600402	Automatic Transfer Switch				1	Each		1912006	0100	Centerville PS	504
14600402	Automatic Transfer Switch				1	Each		1912006	0100	M & M Killian Hill PS	504
14600402	Automatic Transfer Switch				1	Each		1912006	0100	Magnolia Walk PS	504
14600402	Automatic Transfer Switch				1	Each		1912006	0100	Ridge Road PS	504
14600402	Automatic Transfer Switch				1	Each		1912006	0100	Sagamore Hills PS	504
14600402	Controller				1	Each		1912006	0100	Northforke Peachtree Ck PS	504
14600103	site work							1912006	0100		504

Vendor	Manufacturer	Acquisition Method	Funding Source	WBS Element	Useful Life	Additional Text	Serial Number	Values
	Kohler			M0745-14-3-03	20		2009785	14700
	Cummins Onan			M0745-14-3-03	20		I120394426	17000
	Kohler			M0745-14-3-03	20		2009782	14700
	Cummins Onan			M0745-14-3-03	20		H030530100	15000
	Cummins Onan			M0745-14-3-03	20		L010311595	15500
	Kohler			M0745-14-3-03	20		2009756	14700
	Cummins Onan			M0745-14-3-03	20		A130441477	322000
	Cummins Onan			M0745-14-3-03	20		A130440437	170000
	Asco			M0745-14-3-03	20		885270001SE	6300
	Cummins Onan			M0745-14-3-03	20		I120391809	4000
	Asco			M0745-14-3-03	20		885271RE	6300
	Asco			M0745-14-3-03	20		885273RE	6000
	Asco			M0745-14-3-03	20		893740RE	6500
	Asco			M0745-14-3-03	20		885270002RE	6300
	Cummins Onan			M0745-14-3-03	20		1097	23106.14
				M0745-14-3-03				549791.6

Example Sales Tax Report Form

Item No.	Equipment or machinery	Function	Cost	Sales tax paid	Date paid	Pay Request No.
1	Frames	Cover for valve vault. Valves are an integral part of process piping used in the sprayfields.	$1,914.00	$114.84	11/19/1996	2
2	Reinforcing Steel	Used in construction of the irrigation pump station. This pump station pumps wastewater to the sprayfields for land treatment.	$4,590.00	$275.40	11/19/1996	2
3	PVC pipe and fittings	Onsite process piping. Piping is an integral part of the treatment process - it conveys wastewater from pump station to sprayfields.	$23,780.00	$1,426.80	11/19/1996	2
4	PVC pipe and fittings	Onsite process piping	$7,354.80	$441.29	11/19/1996	2
5	PVC pipe and fittings	Onsite process piping	$10,613.60	$636.82	11/19/1996	2
6	PVC pipe and fittings	Onsite process piping	$12,077.20	$724.63	11/19/1996	2
7	PVC pipe and fittings	Onsite process piping	$31,223.60	$1,873.42	11/19/1996	2
8	PVC pipe and fittings	Onsite process piping	$13,190.40	$791.42	11/19/1996	2
9	PVC pipe and fittings	Onsite process piping	$39,672.78	$2,380.37	11/19/1996	2
10	PVC pipe and fittings	Onsite process piping	$11,688.80	$701.33	11/19/1996	2
11	PVC pipe and fittings	Onsite process piping	$4,477.20	$268.63	11/19/1996	2
12	PVC pipe and fittings	Onsite process piping	$7,844.00	$470.64	11/19/1996	2
13	PVC pipe and fittings	Onsite process piping	$1,517.40	$91.04	11/19/1996	2
14	PVC pipe and fittings	Onsite process piping	$13,190.40	$791.42	11/19/1996	2
15	Ductile iron pipe and fittings	Onsite process piping	$32,036.99	$1,922.22	11/19/1996	2
16	Ductile iron pipe and fittings	Onsite process piping	$244.26	$14.66	11/19/1996	2
17	Ductile iron pipe and fittings	Onsite process piping	$21,760.74	$1,305.64	11/19/1996	2
18	Ductile iron pipe and fittings	Onsite process piping	$2,228.21	$133.69	11/19/1996	2
19	Ductile iron pipe and fittings	Onsite process piping	$98,561.36	$5,913.68	11/19/1996	2
20	Flange Bolt Sets	Onsite process piping	$504.68	$30.28	11/19/1996	2
21	Drain Valves	Onsite process piping - drain valves prevent freezing damage to sprinkler risers.	$2,424.40	$145.46	11/19/1996	2
22	Sprinklers	Onsite process piping - sprinklers irrigate wastewater on forested land for treatment.	$51,228.40	$3,073.70	11/19/1996	2
23	Screen	Used in the irrigation pump station to prevent clogging of sprinklers.	$1,970.00	$118.20	12/18/1996	3
24	Misc. metals	Onsite process piping - hatch for valve vault	$1,565.00	$93.90	12/18/1996	3
25	Misc. metals	Used in construction of the wastewater treatment operations bldg.	$1,937.00	$116.22	12/18/1996	3
26	Sprinklers	Onsite process piping - sprinklers irrigate wastewater on forested land for treatment.	$1,213.44	$72.81	12/18/1996	3
27	Brass adapters	Onsite process piping - adapter from ball valve to sprinkler on spray sprinkler risers	$11,151.00	$669.06	12/18/1996	3
28	Brass adapters	Onsite process piping - adapter from ball valve to sprinkler on spray sprinkler risers	$2,124.00	$127.44	12/18/1996	3
29	Tapping Saddles	Onsite process piping	$5,572.63	$334.36	12/18/1996	3
30	Gate Valves	Onsite process piping - sprayfield isolation valves	$6,221.43	$373.29	12/18/1996	3
31	Flange Bolt Sets	Onsite process piping - sprayfield isolation valves	$292.68	$17.56	12/18/1996	3
32	Ductile iron pipe and fittings	Onsite process piping	$2,777.03	$166.62	12/18/1996	3

SECTION 01 35 23

SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section augments the requirements elsewhere in the Contract Documents regarding CONTRACTOR's responsibilities for safety and protection and includes requirements for CONTRACTOR's safety representative and other safety requirements applicable to the Project.

2. CONTRACTOR shall provide labor, materials, tools, equipment, training, certifications, protective measures, and incidentals shown, specified, and required to comply with CONTRACTOR's obligations under the Contract for safety and protection of personnel and property.

B. Related sections: provisions of this section are coordinated with, but are not limited to, the following:

1. Section 01 51 05, Temporary Facilities.

2. Section 01 71 33, Protection of the Work and Property.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. CONTRACTOR's Safety Representative:

a. ENGINEER's acceptance of CONTRACTOR's safety representative's qualifications does not in any way mitigate or relieve CONTRACTOR of CONTRACTOR's safety obligations under the Contract Documents.

b. CONTRACTOR's safety representative shall possess not less than five years of experience serving as the safety representative on projects similar to or larger in size than this Contract, and for type(s) of construction similar in nature to the Work.

c. CONTRACTOR's safety representative shall be experienced in the types of Work to be performed under the Contract and shall be experienced with safety precautions, procedures, and equipment appropriate for the safe performance of the Work.

d. Prior to the Effective Date of the Contract, shall have successfully completed a 30-hour OSHA Construction Safety and Health training course, and a 40-hour OSHA Hazardous Materials training course, and training for confined space entry.

e. CONTRACTOR's safety representative shall be completely experienced with and knowledgeable of all applicable health and safety Laws and Regulations and with good safety practices and shall ensure compliance with such Laws and Regulations and practices at the Site.

f. Minimum responsibilities of CONTRACTOR's safety representative are indicated in this Section.

B. Regulatory Requirements:

1. Conform to safety provisions to the Federal and State Department of Labor Occupational Safety and Health Act (OSH Act), and all other applicable federal, state, county, and local laws, ordinances, codes, the requirements set forth herein, and any regulations that may be specified elsewhere in these Contract Documents.

2. Comply with Safety and Health Regulations for Construction, promulgated by the Secretary of Labor under Section 107 of the Contract Work Hours and Safety Standards Act, as set forth in Title 29, CFR and all other laws, codes, and standards that apply.

3. The Contractor's failure to thoroughly familiarize himself with the safety provisions shall not relieve him from compliance with the obligations or relieve him of the penalties set forth therein.

1.3 SUBMITTALS

A. Informational submittals: submit the following:

1. Emergency contact information, in accordance with Article 0 of this Section.

2. Citations:

a. Copies of safety citations from authorities having jurisdiction and insurance companies, submitted within 24 hours of CONTRACTOR's receipt of such citations.

3. Qualifications Statements:

a. CONTRACTOR's Safety Representative: Submit name and qualifications of CONTRACTOR's safety representative, including summary of experience, and training received and valid certifications and accreditations applicable to the Project.

1.4 SAFETY REPRESENTATIVE RESPONSIBILITIES

A. General:

1. CONTRACTOR's safety representative shall have appropriate space at the Site to maintain and keep available safety records, up-to-date copies of pertinent safety Laws and Regulations, Material Data Sheets, CONTRACTOR's site-specific health and safety plan, copies of

OWNER's health and safety requirements with which CONTRACTOR shall comply, and the Site safety plan including information concerning foreseeable emergency conditions, and emergency contact information as required in Article 1.5 of this Section.

B. CONTRACTOR'S safety representative's responsibilities include:

1. Duties and responsibilities in accordance with the General Conditions.
2. CONTRACTOR's safety representative shall coordinate with CONTRACTOR's "competent person" required under Laws and Regulations.
3. CONTRACTOR's safety representative shall attend progress meetings in accordance with Section 01 31 19, Progress Meetings.
4. Schedule and conduct safety meetings and safety training programs as required by Laws and Regulations, CONTRACTOR's Site-specific health and safety plan (SSHASP), and good safety practices. Include in the SSHASP a specific schedule (dates) of such meetings and an outline of materials to be covered. Advise ENGINEER prior to the time and place of such meetings. Invite OWNER's personnel to meetings. Instruct CONTRACTOR's employees (and Subcontractors, Suppliers with personnel at the Site, and others for whom CONTRACTOR is responsible) on recognition of hazards, observance of precautions, of the contents of the SSHASP and other safety programs with which CONTRACTOR shall comply, and use of personal protective equipment (PPE) and safety equipment.
5. Determine that operators of specific construction equipment (and permanent equipment used for construction operations) are qualified by training and experience before such personnel are allowed to operate such equipment.
6. Develop and implement emergency response procedures, including names, locations, and contact telephone numbers for emergency services and medical assistance as indicated in requirements for the emergency contact list in Article 1.5 of this Section.
7. Post appropriate notices regarding health and safety Laws and Regulations at locations at the Site and CONTRACTOR's office that afford maximum exposure to personnel.
8. Post appropriate instructions and warning signs in regard to all hazardous areas and hazardous conditions that cannot be eliminated. Identification of such areas shall be based on experience, site surveillance, and severity of the associated hazard. Signage shall not be used in place of appropriate workplace controls.
9. Ascertain via personal inspection that safety Laws and Regulations and safety program requirements are enforced. Make inspections at appropriate frequencies to ensure that machines, tools, and equipment are

in a safe operating condition; and that all work areas are free of hazards to the extent practicable. Implement necessary and timely corrective actions to eliminate unsafe acts and unsafe conditions and submit to ARCADIS daily copy of findings resulting from inspection, using inspection checklist forms established in CONTRACTROR's SSHASP.

10. Submit to ENGINEER copies of safety citations from authorities having jurisdiction and insurance companies within 24 hours of CONTRACTOR's receipt of such citations.

11. Provide appropriate orientation to employees, visitors, Subcontractors, and Supplier personnel at the Site.

12. Perform all related tasks necessary to achieve the highest degree of safety that the nature of the Work allows.

1.5 EMERGENCY CONTACT INFORMATION

A. CONTRACTOR shall submit list of emergency contact information for 24-hour use throughout the Project. Emergency contact information shall be updated and kept current throughout the Project. If personnel or contact information change, furnish updated emergency contact information list at the next progress meeting.

B. CONTRACTOR's list of emergency contact information shall include:

1. CONTRACTOR's project manager's office, field office, and cellular telephone numbers.

2. CONTRACTOR's Site superintendent's office, field office, and cellular telephone numbers.

3. CONTRACTOR's foreman's field office and cellular telephone numbers.

4. CONTRACTOR's safety representative's office and cellular telephone numbers.

5. Major Subcontractors' and Suppliers' office and cellular telephone numbers of project manager and foreman (when applicable).

C. Additional emergency contact information:

1. OWNER's project manager: office and cellular, telephone numbers.

2. OWNER's central 24-hour emergency telephone number.

3. ENGINEER's project manager's office and cellular telephone numbers.

4. ENGINEER's project engineer's office and cellular telephone numbers.

5. Resident Project Representative's office, field office and cellular telephone numbers.

6. Utility companies' 24-hour contact telephone number(s), including gas, water, sewer, oil, telephone, cable television/telecommunications, and other companies or concerns having utilities in the vicinity of the Work.

7. Highway and street owners' 24-hour telephone number(s).

8. Emergency telephone numbers, including: "Emergency: Dial 911", and seven-digit telephone numbers for the hospital, ambulance, police, and fire department nearest to the Site. Furnish names of each of these institutions.

9. Other involved entities as applicable.

10. Include with list of emergency contact information an 8.5-inch by 11-inch map showing route from the Site to the nearest hospital.

1.6 SAFETY EQUIPMENT

A. General:

1. CONTRACTOR shall provide proper safety and rescue equipment, adequately maintained and readily available, for any foreseeable contingency.

2. Such equipment shall include items such as safety ropes and harnesses, fall-prevention devices, stretchers, water safety devices, oxygen breathing apparatus, resuscitators, gas detectors, oxygen deficiency indicators, combustible gas detectors, fire extinguishers and first-aid equipment in accordance with the Division 01 Specifications, and similar equipment as appropriate.

3. Keep safety equipment in protected areas. Check safety equipment at scheduled intervals.

4. Temporary First-Aid Facilities: Provide and maintain in accordance with Section 01 51 05, Temporary Facilities.

B. Safety Equipment Log:

1. Maintain a log indicating the person who checked the equipment, when equipment was checked, and that equipment was acceptable.

2. Update equipment log not less-often than monthly.

3. Include in safety representative's onsite records copies of equipment calibration records.

C. Provide replacement safety equipment when primary safety equipment is unavailable due to use or when undergoing maintenance.

D. Personal Protective Equipment (PPE):

1. All persons entering the work areas shall wear appropriate PPE required for the particular area.

2. Remove from the Site any person failing to comply with this or any other safety requirement.

3. Continuously provide all necessary PPE for ENGINEER's employees, Resident Project Representative, and consultants. ENGINEER will furnish for ENGINEER's employees and consultants' protective helmets

(hard hats), safety eyewear, reflective vests, and hearing protection. CONTRACTOR shall furnish other equipment required.

1.7 EVACUATION DRILL

A. Included in CONTRACTOR's SSHASP shall be evacuation drills, conducted not less-often than once every six months, held in coordination with existing facility's alarm signal under the control of OWNER's facility manager.

B. Perform evacuation drill during regular working hours, scheduled to minimize disruption of the Work.

C. Upon evacuation, CONTRACTOR and all personnel for whom CONTRACTOR is responsible, immediately advise ENGINEER's onsite personnel and OWNER's facility manager that all personnel have been evacuated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 41 24

PERMIT REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section includes general requirements relative to permitting requirements of which OWNER and ENGINEER are aware that apply to the Project.
2. CONTRACTOR shall provide labor, materials, equipment, tools, and incidentals shown, specified, and required to obtain required permits and comply with required permits and licenses.
3. Obtain, pay for, and comply with required permits and licenses whether or not indicated in this Section or elsewhere in the Contract Documents.

B. Coordination:

1. Coordinate compliance with permit and license requirements with Work under other Sections and with other contractors, if any, working at the Site.
2. Coordinate with the Progress Schedule the time required to apply for and obtain required permits and licenses. Changes in Contract Times or Contract Price will not be authorized because of timing and costs associated with obtaining permits and licenses required for the Work.

1.2 MUNICIPAL PERMITS AND LICENSES

A. The anticipated necessary permits listed are the responsibility of the Owner and their status is as follows.:

1. Building Permit will be acquired by the Owner through Fayette County Department of Planning and Development and will be provided to the CONTRACTOR.
2. Fees for Building Permit, if necessary, are paid for by the CONTRACTOR, upon acquisition of the permit.

B. Licenses:

1. Municipal licenses are not required for the Work under this Project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 41 26

STORM WATER POLLUTION PREVENTION PLAN AND PERMIT

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. This Section includes requirements for compliance with storm water pollution prevention plans (SWPPP) and permit(s) applicable to the Project.
   2. CONTRACTOR shall comply with the Project's National Pollutant Discharge Elimination System (NPDES) Permit issued by Georgia Environmental Protection Division (EPD). Regarding this permit, CONTRACTOR shall be a co-permittee with OWNER and shall be responsible for providing necessary materials and taking appropriate measures to comply with requirements of the permit and minimize discharge of pollutants in storm water runoff from the Site.
   3. Controls – General:
      a. Prevent discharge of sediment to and erosion from the Site to surface waters, drainage routes, public streets and rights-of-way, and private property, including dewatering operations.
      b. Prevent trash and demolition and construction debris from leaving the Site via storm water runoff.
      c. Provide berms, dikes, and other acceptable methods of directing storm water around work areas to drainage routes.
      d. Prior to starting the Work associated with such discharge, construction-related discharges to publicly owned conveyance or treatment systems shall be approved by owner of system to which the discharge will be directed.
   4. Water Quality:
      a. Do not cause or contribute to a violation of water quality standards, Laws, or Regulations.
      b. Notify ENGINEER of revisions to the SWPPP necessary to protect receiving water quality and comply with applicable permits. Provide and implement measures to control pollutants in storm water runoff from the Site to prevent:
         1) Turbidity increases that will cause a substantial visible contrast to natural conditions.
         2) Increase in suspended, colloidal, and settleable solids that would cause sediment deposition or impair receiving water quality and use.
         3) Presence of residue from oil and floating substances, visible oil, and globules of grease.
   5. CONTRACTOR shall pay civil penalties and other costs incurred by OWNER, including additional engineering, RPR, and inspection services, associated with non-compliance with applicable permits related to storm water discharges

associated with construction activity and sediment and erosion controls associated with the Work. OWNER may deduct as setoffs such amounts from payments due CONTRACTOR.

6. Contract Price includes all material, labor, and other permits and incidental costs related to:
   a. Preparing SWPPP Revisions and other documents that are CONTRACTOR's responsibility, in accordance with this Section.
   b. Installing and maintaining structural and non-structural items used in complying with the SWPPP and its revisions.
   c. Clean-up, disposal, and repairs following wet weather events or spills caused by CONTRACTOR.
   d. Implementing and maintaining "best management practices", as defined in applicable permits and Laws or Regulations, to comply with requirements that govern storm water discharges at the Site.
5. Inspections of storm water, sediment, and erosion controls as specified.

C. Documents: The following are part of the Work included under this Section:
   1. Storm Water Pollution Prevention Plan (SWPPP):
      a. Prepared by OWNER and filed with authorities having jurisdiction over storm water discharges during construction. The SWPPP is part of the Contract Documents.
   2. Sediment and Erosion Control Permit:
      a. Prepared by OWNER and filed with the authority having jurisdiction over sediment and erosion control during construction. Sediment and erosion control permit is part of the Contract Documents.
   3. SWPPP Revisions:
      a. Prepared by CONTRACTOR and submitted to ENGINEER.
      b. CONTRACTOR shall file a SWPPP Revision prior to starting Work at the Site, and as required by authorities having jurisdiction.
      c. SWPPP Revision shall include CONTRACTOR's proposed temporary means for storm water control during all phases of the Work and include plans for storm water conveyance and retention, as applicable. Coordinate with excavation plan submittals required in Division 31 of the Specifications.
      d. Should CONTRACTOR-propose deviations to the SWPPP included in the Contract Documents, or if Project-specific modifications of the SWPPP are required because of field conditions, CONTRACTOR shall prepare and submit additional SWPPP Revisions as necessary, in accordance with requirements of authorities having jurisdiction and applicable permits.
      e. Comply with Article 1.4 of this Section.
      f. SWPPP Revisions shall use the SWPPP Revision form included in this Section, with supporting documents attached as required, or forms provided by authorities having jurisdiction.
      g. SWPPP Revisions that do not comply with the Contract Documents and are not required by authorities having jurisdiction will be regarded as

substitutions, in accordance with the General Conditions and substitution procedures in the Specifications.

4. Storm Water Certification Statement:
    a. To be prepared by CONTRACTOR and submitted to ENGINEER on the form included with this Section, or on a form provided by authority having jurisdiction.
    b. Do not perform Work at the Site until the Storm Water Certification has been submitted to and accepted by ENGINEER.
5. Notice of Intent (NOI):
    a. Prepared by OWNER or ENGINEER and submitted to authorities having jurisdiction following ENGINEER's receipt and acceptance of CONTRACTOR's SWPPP Revision and preliminary Progress Schedule.
    b. NOI will be filed with authorities having jurisdiction by ENGINEER within ten days of ENGINEER's acceptance of CONTRACTOR's SWPPP Revision and preliminary Progress Schedule.
    c. Do not perform Work at Site until NOI is submitted to authorities having jurisdiction.
6. Co-permittee Agreement:
    a. Prepared by CONTRACTOR using forms included with the SWPPP, and submitted to ENGINEER within five days of the date the Contract Times commence running, for signature by OWNER.
    b. ENGINEER will file co-permittee agreement with authorities having jurisdiction.
    c. Do not perform Work at the Site until co-permittee agreement is submitted to authorities having jurisdiction.
7. Storm Water Inspection Report:
    a. Prepared by ENGINEER's Resident Project Representative (RPR) using the form included with this Section, or a form provided by authority having jurisdiction.
    b. Storm water inspection reports will be filed in a log book kept at the Site by RPR. Copy of each report will be furnished to CONTRACTOR upon request.
    c. Storm water inspection report will be completed for each of the following:
        1) Pre-construction: After placement of storm water management measures, including sediment and erosion controls, and temporary field offices and other temporary facilities, prior to starting other Work at the Site.
        2) During the Work: Every seven days until Notice of Termination is completed. When the Site is stabilized relative to storm water, erosion, and discharge of sediment, inspection frequency during temporary shutdowns and seasonal shutdowns is once per month until Notice of Termination is completed.
        3) Final: Final inspection report will be prepared prior to completion of Notice of Termination.
8. Notice of Termination (NOT):

a. Prepared by CONTRACTOR on the form included with storm water permit and submitted to ENGINEER for review and signature by OWNER.
b. ENGINEER will submit the NOT to authority having jurisdiction.
c. CONTRACTOR shall submit the NOT following completion of all Work that may result in pollution in storm water discharges, including landscaping Work.
d. Final Payment will not be made until the NOT is filed with authority having jurisdiction.

D. Coordination:
1. Coordinate requirements of this Section with requirements for earthwork, erosion control, and landscaping in the Contract Documents, applicable permit requirements, and Laws and Regulations.
2. Implement SWPPP controls and practices prior to starting other Work at the Site. Each prime contractor and Subcontractor identified in the SWPPP and SWPPP Revisions shall sign a copy of the storm water certification statement.

1.2 QUALITY ASSURANCE

Qualification requirements for the CONTRACTOR'S inspector, in accordance with applicable state and local laws, regulations, and permits.

A. Regulatory Requirements: Comply with Laws and Regulations relative to environmental protection and restoration, including:
1. Storm water permit applicable to the Work and Site.
2. State and local erosion and sediment control guidelines and requirements,
3. State and local storm water regulations and guidance.

1.3 SUBMITTALS

A. Informational Submittals: Submit the following:
1. Submit the following, in accordance with Paragraph 1.1.C and Article 1.4 of this Section.
a. SWPPP Revisions.
b. Co-permittee Agreement.
c. Storm Water Certification Statement.
d. Notice of Termination
2. Approval to Discharge to Publicly-owned Treatment Works:
a. For storm water discharges associated with construction activity that are discharged to a publicly owned conveyance or treatment system, prior to commencing discharges, submit system owner's written approval for such discharges.
3. Storm Water Site Plan Updates:
a. Within three days after each storm water inspection, submit updated storm water site plan.

1.4 SWPPP REVISIONS

A. CONTRACTOR shall prepare a SWPPP Revision in accordance with the Project's storm water permit when:
   1. There is a significant change in design, construction, operation, or maintenance of the Project that significantly affects the potential of discharging pollutants to Waters of the United States and has not otherwise been addressed in the SWPPP.
   2. SWPPP proves to be ineffective relative to:
      a. eliminating or significantly minimizing pollutants from sources identified in the SWPPP required by the Project's storm water permit, or
      b. achieving general objectives of controlling pollutants in storm water discharges from permitted construction activity.
   3. Prepare and submit SWPPP Revision identifying prime contractors and Subcontractor responsible for implementing part of the SWPPP.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 INSPECTIONS AND REPAIRS

A. Perform Site inspections and assessments as required in applicable storm water permit and this Section. Inspections and assessments shall be done by CONTRACTOR's site superintendent or project manager, together with ENGINEER's RPR.

B. Inspections:
   1. During the Work, relative to the storm water permit, inspections of the Site shall be performed:
      a. Pre-Construction: After SWPPP controls are provided and prior to starting other Work at the Site.
      b. During the Work: Every seven days until Notice of Termination is completed and submitted to authority having jurisdiction. When the Site is stabilized relative to storm water, erosion, and discharge of sediment, inspection required frequency during temporary shutdowns and seasonal shutdowns is not less than once per month until Notice of Termination is completed.
      c. Prior to CONTRACTOR submitting the Notice of Termination.
   2. During each inspection, verify sediment control practices and record the approximate degree of sediment accumulation as percentage of acceptable sediment storage volume; inspect erosion and sediment control practices and record maintenance performed; observe and record deficiencies relative to implementation of the SWPPP. RPR or ENGINEER will complete Storm Water Inspection Reports and CONTRACTOR shall record and submit the following.

a. Storm Water Site Plan: On a copy of the Site plan included in the Contract Documents or other map of the Site acceptable to ENGINEER, indicate extent of all disturbed areas and drainage pathways. Indicate areas expected to undergo initial disturbance or significant site work within the next fourteen days.
b. Indicate on storm water site plan areas of Site that have undergone temporary or permanent stabilization.
c. Indicate on storm water site plan all disturbed areas that have not undergone active site Work during the previous 14 days.

C. Maintain at the Site a copy of storm water site plans from each storm water inspection and submit each storm water site plan to ENGINEER and RPR. RPR will maintain at the Site a logbook with a copy of each Storm Water Inspection Report.

D. Cooperate with representatives of authorities having jurisdiction during their periodic visits to the Site, and promptly furnish information requested by authorities having jurisdiction.

E. Perform repairs to SWPPP controls, in accordance with applicable requirements and to satisfaction of ENGINEER, within two days of each inspection.

3.2 ATTACHMENTS

A. The documents listed below, following this Section's "End of Section" designation, are part of this Specifications Section. Notice of Intent (NOI) form, Co-permittee Agreement form, and Notice of Termination (NOT) form are included with storm water permit.
1. Storm Water Inspection Report form (two pages).
2. Storm Water Permit Certification form (one page).
3. SWPPP Revision Form (one page).
4. Storm Water Permit.
5. Sediment and Erosion Control Permit.

+ + END OF SECTION + +

STORM WATER INSPECTION REPORT

Owner:
Site:
Project:
Contractor:

Date of Inspection:_____
Day of Week:

S	M	T	W	T	F	S

Sheet No. _____ of _____ Sheets

If pertinent to the Operation	
Weather	
Temperature	

This inspection and maintenance form is to be used when the Work is subject to a Storm Water General Permit for Construction Activity. Inspections shall be performed not less than once every seven calendar days; for sites that are stabilized and temporarily shut down inspections may be reduced to once per month. Each erosion and sediment control measure installed on the Site is to be inspected and the Contractor must complete all required maintenance within two calendar days from the date of inspection.

Reason for this inspection:
- ☐ Pre-construction Site assessment
- ☐ Seven calendar day inspection
- ☐ Monthly inspection (when Site is stabilized and shut down)
- ☐ Post-construction inspection prior to Notice of Termination

Key for erosion and sediment control measures to be inspected: [Use the following designations in the table below] (1) mulch, (2) seed and mulch, (3) check dams, (4) hay bale/straw bales, (5) silt fence, (6) sediment trap, (7) turbidity curtains, (8) pipe slope drains, (9) drainage structure inlet protection, (10) rolled erosion control products, (11) soil stabilizers, (12) construction entrances, (13) pipe inlet/outlet protection, (14) water diversion structures, (15) sedimentation basins, (16) cofferdams, (17) Other _____.

ID	Location	Disturbance		Measure		Remarks (Evaluate integrity of measure, describe evidence of erosion)	Approximate Sediment Accumulation (% of Depth)	Maintenance Required? (Y or N) (If Yes, Describe Below)
		Existing? (Y or N)	Next 14 Days? (Y or N)	Code #	Temp or Perm? (T, P or NA)			
1								
2								
3								
4								
5								
6								
7								
8								

ID	Location	Disturbance		Measure		Remarks (Evaluate integrity of measure, describe evidence of erosion	Approximate Sediment Accumulation (% of Depth)	Maintenance Required? (Y or N) (If Yes, Describe Below)
		Existing? (Y or N)	**Next 14 Days?** (Y or N)	**Code #**	**Temp/Perm or N/A?** (T, P or NA)			
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

DESCRIPTION OF REQUIRED MAINTENANCE AND ANY EXISTING DEFICIENCIES IN THE SWPPP: Specify for each location using row ID number.

I certify under penalty of Law that this document and all attachments were prepared under my direction or supervision in accordance with a system to ensure that qualified personnel property gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that false statements made herein may be punishable by Law.

Signature: _____ Prepared: _____ Copy to Contractor: _____
Resident Project Representative (Date) (Date)

Qualified Professional Name _____
(w/Firm Name, if Consultant)

STORM WATER PERMIT CERTIFICATION

Contract Number:_____ Project:_____

Owner:_____

Each Contractor and Subcontractor identified in the Storm Water Pollution Prevention Plan (SWPPP) must certify that they understand the permit conditions and their responsibilities. Every Contractor and Subcontractor performing an activity that involves soil disturbance shall sign this certification and submit it to the Engineer prior to performing the Work. This certification shall be signed by an owner, principal, president, secretary, or treasurer of the firm.

> I certify under penalty of law that I understand and agree to comply with the terms and conditions of the SWPPP for the construction Site identified in such SWPPP as a condition of authorization to discharge storm water. I also understand that my firm and its employees and Subcontractors shall comply with the terms and conditions of Owner's general permit for storm water discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards, Laws, or Regulations.

Firm: _____

Address: _____

City:_____ State_____ Zip_____

_____ _____ _____

Name (Print) Signature Date

_____

Title

STORM WATER POLLUTION PREVENTION PLAN (SWPPP) REVISION

Date of Inspection: _____

Sheet No. _____ of _____ Sheets

Owner:
Site:
Project:
Contractor:

This form shall be used when revisions to the current Storm Water Pollution Prevention Plan (SWPPP) are required by the Storm Water General Permit for Construction Activity or the Contract Documents.

Reason for the Revision(s): Revisions were requested by State: ☐ Yes ☐ No

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Describe the Revision(s) to the SWPPP: _____

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

I certify under penalty of Law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that false statements made herein may be punishable by Law.

Signature: _____ Prepared: _____ (Date) Submitted: _____ (Date)

Copy to: ☐ Engineer ☐ Contractor _____

SECTION 01 41 27

EARTHMOVING PERMIT AND DUST CONTROL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. This Section includes requirements for controlling fugitive dust emissions resulting from construction activities, including earthmoving, in coordination with Laws and Regulations.
   2. CONTRACTOR shall obtain, pay for, and comply with permits required for earthmoving and dust control required because of dust-generating operations related to the Work, and shall develop and comply with provisions of dust control plan.
   3. Obtain earthmoving permit from required jurisdiction.
   4. Provide necessary labor, materials, equipment, tools, services, and incidentals to: apply sufficient dust suppressants; properly clean all track-out areas to driveways, roadways, and highways; and provide adequate physical stabilizations of soils to comply with earthmoving permits and accepted dust control plan.
   5. Control fugitive dust generation from CONTRACTOR's operations including the following:
      a. Construction areas.
      b. Vehicle and equipment parking areas.
      c. Material and equipment storage areas.
      d. Field office area(s) and staging areas.
      e. Haul and access roadways.
      f. Track-out areas.
      g. Other areas where CONTRACTOR will work, store materials or equipment, or park vehicles and equipment.
   6. Do not cause or allow dust-generating operations, earthmoving operations, use of property, or other operations that result in fugitive dust emissions that exceed limits prescribed by authorities having jurisdiction.
   7. Pay fines and civil penalties incurred by OWNER because of CONTRACTOR's actions or violations of earthmoving permits and dust control plan. OWNER may deduct as set-offs such amounts from payments due CONTRACTOR.

1.2 SUBMITTALS

A. Informational Submittals: Submit the following:
   1 Dust Control Plan:
      a. Prepare and submit to ENGINEER and OWNER in accordance with Article 1.4 of this Section. Submit within the earlier of 30 days after

the Contract Times commence running or prior to commencing earth-disturbing operations at the Site.

2. Earthmoving Permit:
   a. Submit copy of permits obtained from authorities having jurisdiction, within seven days of CONTRACTOR's receipt of such permits. Do not commence earthmoving operations at the Site until required permits are obtained and submitted to ENGINEER.
3. Daily Logs and Reasonably-Available Control Measures (RACM) Records:
   a. Submit upon request of OWNER or ENGINEER.
4. Field Quality Control Submittals:
   a. When opacity monitoring is required, submit results not later than two days following completion of observations.

1.3 POSTING AND RECORDKEEPING

A. Post copy of earthmoving permit and accepted dust control plan at conspicuous location at the Site.

B. Recordkeeping:
   1. Maintain daily written log to record the actual application or implementation of reasonably-available control measures (RACM) described in the accepted dust control plan.
   2. Maintain the written log and supporting documentation at the Site, and submit copies to ENGINEER or OWNER upon request.
   3. Retain copies of dust control plan, RACM implementation records, and supporting documentations for not less than three years after Substantial Completion of the entire Project.

1.4 DUST CONTROL PLAN

A. Prepare and submit to ENGINEER and OWNER a dust control plan that includes the following:
   1. Names, address, office and cellular telephone numbers, and e-mail address of person(s) responsible for preparing and overseeing implementation of dust control plan. Designate one person responsible for overseeing implementation of dust control plan for the Project.
   2. Name(s), address(es), office and cellular telephone numbers, and e-mail addresses of person(s) responsible for dust generating operations.
   3. Site plan delineating total area of land surface to be disturbed. Delineate each area of phased disturbances, when applicable.
   4. Total disturbed area in acres; earthmoving and dust-generating operations and activities to be performed at the Site; actual and potential sources of fugitive dust emissions; and delivery, transportation, and storage areas for the Site, including types of materials stored and appropriate size of material stockpiles.

5. Description of reasonably-available control measures (RACM) to be implemented during dust-generating operations at actual and potential sources of fugitive dust.
6. Description of dust suppressants to be used including product data and material safety data sheets (MSDS); method, frequency, and intensity of application; type, number, and capacity of application equipment; and certifications related to the suppressant's appropriate and safe use.
7. Description of specific surface treatment(s) or RACM proposed for controlling material deposition along paved surfaces (e.g., "track-out" areas) where unpaved Site surfaces or Site access points meet paved surfaces.
8. As contingency measure, designate and include description of not less than one alternative RACM for each actual and potential fugitive dust source.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing and Monitoring.
   1. Upon direction of OWNER or ENGINEER, obtain opacity observations for visible emissions of fugitive dust.
   2. Opacity Monitoring Method:
      a. USEPA Method 9, Visual Determination of Opacity of Emissions from Stationary Sources (Emission Measurement Technical Information Center Test Method 009).
   3. Location and Frequency of Opacity Observations:
      a. Obtain opacity observations from not less than six locations at downwind perimeter of the Site during construction operations.
      b. Perform opacity monitoring at frequency required by applicable earthmoving/dust control permit, unless more-frequent monitoring is required by OWNER or ENGINEER.
   4. Qualifications: Opacity monitoring observations shall be by person trained and experienced with the opacity monitoring method specified.
   5. Prepare and submit to ENGINEER written report of results of opacity monitoring and observations.
   6. No additional compensation or addition to the Contract Times will be authorized for opacity observations.

+ + END OF SECTION + +

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Section includes the following:

a. Definitions and terminology in general use in the Contract Documents.

b. Applicable codes.

c. Abbreviations in general use throughout the Contract Documents.

d. General requirements regarding reference standards, including a listing of standard-issuing organizations (and their acronyms) used in the Contract Documents.

1.2 DEFINITIONS AND TERMINOLOGY

A. Definitions and terminology applicable to all the contract documents are included in the general conditions, as may be modified by the supplementary conditions.

B. Additional terminology used in the Contract Documents includes the following:

1. “Indicated” refers to graphic representations, notes, or schedules on the Drawings, or to other paragraphs, provisions, tables, or schedules in the Specifications and similar locations in the other Contract Documents. Terminology such as “shown”, “noted”, “scheduled”, and “specified” are used to help the user locate the reference without limitation on the location.

2. “Installer”, “applicator”, or “erector” is CONTRACTOR or another person or entity engaged by CONTRACTOR, either as an employee or Subcontractor, to perform a particular construction activity, including installation, erection, application, or similar Work. Installers shall be experienced in the Work that installer is engaged to perform.

a. The term “experienced”, when used in conjunction with the term “installer”, means having successfully completed not less than five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated and required; being familiar with Laws and Regulations; and having complied with requirements of

authorities having jurisdiction, and complying with requirements of the Supplier of the material or equipment being installed, unless other experience requirements specific to that element of the Work are indicated elsewhere in the Contract Documents.

3. Trades: Use of terms such as “carpentry” does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as “carpenter”, unless otherwise indicated in the Contract Documents or required by Laws or Regulations. Such terminology also does not imply that specified requirements apply exclusively to trade personnel of the corresponding generic name.

1.3 APPLICABLE CODES

A. References in the Contract Documents to local code(s) shall mean the following:

1. National Electric Code in effect at the location of the Project.
2. NFPA 101, Life Safety Code.

1.4 ABBREVIATIONS

A. Common abbreviations that may be found in the Contract Documents are indicated below, alphabetically by their written-out meaning:

alternating current	a-c
ampere	A
antemeridian	a.m.
Architectural Barriers Act	ABA
Americans with Disabilities Act	ADA
Americans with Disabilities Act Accessibility Guidelines	ADAAG
average	avg
biochemical oxygen demand	BOD
five-day biochemical oxygen demand	BOD5
brake horsepower	bhp
British thermal unit	Btu
building information model	BIM
carbonaceous biochemical oxygen demand	CBOD
five-day carbonaceous biochemical oxygen demand	CBOD5
chemical oxygen demand	COD
Centigrade (or Celsius)	C

chlorinated polyvinyl chloride	CPVC
chlorofluorocarbons	CFC
Code of Federal Regulations	CFR
computer-aided drafting and design	CADD, or CAD
cubic inch	cu in
cubic foot	cu ft
cubic yard	cu yd, or CY
cubic feet per minute	cfm
cubic feet per second	cfs
decibel	db
degree Centigrade (or Celsius) (Write)	degrees C, oC, or deg C
degrees Fahrenheit	degrees F, oF, or deg F
diameter	dia
direct current	d-c
dollars	$
each	ea
efficiency	eff
Fahrenheit	F
feet	ft
feet per hour	fph, or ft/hr
feet per minute	fpm
feet per second	fps, or ft/min
figure	fig
flange	flg
foot-pound	ft-lb
gallon	gal
gallons per hour	gph, or gal/hr
gallons per minute	gpm
gallons per second	gps
gram	g
grams per liter	g/L
Hertz	Hz
horsepower	hp or HP
hour	hr
human-machine interface	HMI
inch	in.
inches of mercury	in. Hg
inches water gage	in. w.g.
inch-pound	in.-lb
inside diameter	ID

iron pipe size	IPS
thousand pounds	kips
thousand pounds per square inch	ksi
kilovolt-ampere	kva
kilowatt	kw
kilowatt-hour	kwhr or kwh
linear foot	lin ft or LF
liter	L
Leadership in Energy and Environmental Design (USGBC)	LEED
maximum	max
mercury	Hg
milligram	mg
milligrams per liter	mg/l or mg/L
milliliter	ml
millimeter	mm
million gallons per day	mgd or MGD
million gallon	MG
minimum	min
national pipe threads	NPT
net positive suction head	NPSH
net positive suction head available	NPSHA
net positive suction head required	NPSHR
nitrogen oxide (total concentration of mono-nitrogen oxides such as nitric oxide (NO) and nitrogen dioxide (NO2))	NOx
nominal pipe size	NPS
number	no.
operator interface terminal	OIT
ounce	oz
ounce-force	ozf
outside diameter	OD
parts per hundred	pph
parts per million	ppm
parts per billion	ppb
polyvinyl chloride	PVC
post meridian	p.m.
pound	lb
pounds per square inch	psi
pounds per square inch absolute	psia
pounds per square inch gauge	psig

pounds per square foot	psf
process control system	PCS
programmable logic controller	PLC
revolutions per minute	rpm
second	sec
specific gravity	sp gr, or SG
square	sq
square foot	sq ft, sf, or ft2
square inch	sq in., or in2
square yard	sq yd, or SY
standard	std
standard cubic feet per minute	scfm
total dynamic head	TDH
totally-enclosed fan-cooled	TEFC
volt	V
volts alternating current	vac
volts direct current	vdc
volatile organic compounds	VOC

1.5 REFERENCE STANDARDS

A. Copies of Standards: Each entity engaged in the Work shall be familiar with reference standards applicable to its construction activity. Copies of applicable reference standards are not bound with the Contract Documents. Where reference standards are needed for a construction activity, obtain copies of standards from the publication source.

B. Abbreviations and Names: Where reference standards, specifications, codes, manuals, Laws or Regulations, or other published data of international, national, regional or local organizations are referred to in the Contract Documents, the organization issuing the standard may be referred to by their acronym or abbreviation only. The following acronyms or abbreviations that may appear in the Contract Documents shall have the meanings indicated below. Listing is alphabetical by acronym.

Standard	**Title**
AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACS	American Chemical Society
ADSC-IAFD	International Association of Foundation Drilling.

Standard	Title
AEIC	Association of Edison Illuminating Companies
AF&PA	American Forest and Paper Association
ABMA	American Bearing Manufacturers Association (formerly Anti-Friction Bearing Manufacturers Association (AFBMA))
AGMA	American Gear Manufacturers Association
AI	Asphalt Institute
AIA	American Institute of Architects
AIChE	American Institute of Chemical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALSC	American Lumber Standards Committee
AMA	Acoustical Materials Association
AMCA	Air Movement and Control Association
AMP	National Association of Architectural Metal Manufacturers, Architectural Metal Products Division
ANSI	American National Standards Institute
APA	The Engineered Wood Association
APHA	American Public Health Association
API	American Petroleum Institute
AREA	American Railway Engineering Association
ARI	Air Conditioning and Refrigeration Institute
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society for Non-Destructive Testing
ASQ	American Society for Quality
ASSE	American Society of Safety Engineers
ASTM	American Society for Testing and Materials
AWCI	Association of the Wall and Ceiling Industry
AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BAAQMD	Bay Area Air Quality Management District
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association
CBMA	Certified Ballast Manufacturers Association

Standard	Title
CDA	Copper Development Association
CEMA	Conveyor Equipment Manufacturers Association
CGA	Compressed Gas Association
CISCA	Ceilings and Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CMAA	Crane Manufacturers Association of America
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
DIN	Deutsches Institut fur Normung eV (German Institute for Standardization)
DIPRA	Ductile Iron Pipe Research Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ETL	Intertek Testing Services, Inc. (formerly ETL Testing Laboratories, Inc.)
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FM	Factory Mutual (FM Global)
FRPI	Fiberglass Reinforced Plastics Institute
FS	Federal Specification
GA	Gypsum Association
GANA	Glass Association of North America
HEW	United States Department of Health, Education and Welfare
HI	Hydraulic Institute
HMI	Hoist Manufacturers Institute
HUD	United States Department of Housing and Urban Development
IBC	International Building Code
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
IFI	Industrial Fasteners Institute
IRI	Industrial Risk Insurers
ISA	Instrumentation, Systems, and Automation Society (formerly Instrument Society of America)
ISO	Insurance Services Office
ISO	International Organization for Standardization
LPI	Lightning Protection Institute

Standard	Title
MIA	Marble Institute of America
ML/SFA	Metal Lath/Steel Framing Association
MS	Military Specifications
MSS	Manufacturers' Standardization Society
MMA	Monorail Manufacturers Association
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NAPF	National Association of Pipe Fabricators, Inc.
NARUC	National Association of Regulatory Utilities Commissioners
NBHA	National Builders Hardware Association
NBS	United States Department of Commerce, National Bureau of Standards
NCMA	National Concrete Masonry Association
NEC	National Electric Code
NELMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NHPMA	Northern Hardwood and Pine Manufacturers Association
NIST	United States Department of Commerce, National Institute of Standards and Technology
NLGA	National Lumber Grades Authority
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	National Sanitation Foundation
NSSGA	National Stone, Sand, and Gravel Association
NTMA	National Terrazzo and Mosaic Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PEI	Porcelain Enamel Institute
PFI	Pipe Fabrication Institute
PPI	Plastics Pipe Institute
PGMC	Primary Glass Manufacturers Council
PS	Product Standards Section, United States Department of Commerce

Standard	Title
RCSC	Research Council on Structural Connections (part of AISC)
RMA	Rubber Manufacturers Association
SAE	Society of Automotive Engineers
SCAQMD	Southern California Air Quality Management District
SCPRF	Structural Clay Products Research Foundation
SCTE	Society of Cable Telecommunications Engineers
SDI	Steel Deck Institute
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturing Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SPI	Society of the Plastics Industry
SPIB	Southern Pine Inspection Bureau
SSPC	Society for Protective Coatings
SWI	Steel Window Institute
TCNA	Tile Council of North America
TEMA	Tubular Exchanger Manufacturers Association
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
UL	Underwriters Laboratories, Inc.
USAB	United States Access Board
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USGBC	United States Green Building Council
USGS	United States Geological Survey
USPHS	United States Public Health Service
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association
WCMA	Wood Component Manufacturers Association
WDMA	Window and Door Manufacturers Association
WEF	Water Environment Federation
WWEMA	Water and Wastewater Equipment Manufacturers Association
WWPA	Western Wood Products Association

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 43 00

QUALITY ASSURANCE

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section covers Quality Assurance and Quality Control requirements for this contract.

B. The Contractor is responsible for controlling the quality of work, including work of its subcontractors, and suppliers and for assuring the quality specified in the Technical Specifications is achieved.

C. Refer to the General Conditions Article 6 - Contractor's Responsibilities, paragraphs 6.01, 6.02, and 6.03.

1.2 SUMMARY:

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and control procedures that facilitate compliance with the Contract Document requirements.

3. Requirements for Contractor to provide quality-assurance and control services required by, including but not limited to, Engineer, Owner, or authorities having jurisdiction, are not limited by provisions of this Section.

C. Related Requirements:

1. Divisions 01 through 46 Sections for specific test and inspection requirements.

1.3 REFERENCES:

A. American Society for Testing and Materials (ASTM):

1. E329: Standard Specification for Agencies Engaged in Construction Inspection and/or Testing

1.4 DEFINITIONS:

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.

C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

D. Product Testing: Tests and inspections that are performed by a Nationally Recognized Testing Laboratory (NRTL), an (National Voluntary Laboratory Accreditation Program (NVLAP), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five (5) previous projects similar in nature, size,

and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.5 CONFLICTING REQUIREMENTS:

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.6 SUBMITTALS:

A. Shop Drawings: Provide plans, sections, dimensions, and elevations, indicating materials and size of proposed construction.

1. Indicate manufacturer and model number of individual components.

2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

C. Qualification Data: For Contractor's quality-control personnel.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.

2. Entity responsible for performing tests and inspections.

3. Description of test and inspection.

4. Identification of applicable standards.

5. Identification of test and inspection methods.

6. Number of tests and inspections required.

7. Time schedule or time span for tests and inspections.

8. Requirements for obtaining samples.

9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN:

A. Quality Control Plan, General: Submit quality-control plan within thirty (30) days of Notice to Proceed. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor- elected tests and inspections.

2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."

3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and accepted mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of accepted and rejected results. Include work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS:

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.

2. Project title and number.

3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector, as applicable.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE:

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.

b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

c. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.

d. When testing is complete, remove test specimens, assemblies; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Codes and Standards: Refer to General Conditions Article 3 - Contract Documents: Intent, Amending, Reuse, paragraph 3.02 of the General Conditions.

L. Copies of applicable referenced standards are not included in the Contract Documents. Where copies of standards are needed by the Contractor for superintendence and quality control of the work, the Contractor shall obtain a copy or copies directly from the publication source and maintain at the jobsite, available to the Contractor's personnel, subcontractors, and Engineer

M. Quality of Materials: Unless otherwise specified, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and specifications and shall be new, unused, and free from defects and imperfections, when installed or otherwise incorporated in the Work. The Contractor shall not use material and equipment for any purpose other than that intended or specified unless the Engineer authorizes such use.

N. Where so specified, products or workmanship shall also conform to the additional performance requirements included within the Contract Documents to establish a higher or more stringent standard or quality than that required by the referenced standard.

1.10 OFFSITE INSPECTION:

A. When the specifications require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services shall be performed by the Owner’s independent testing laboratory, or inspection organization acceptable to Engineer in conjunction with or by the Engineer.

A. The Contractor shall give appropriate written notice to the Engineer not less than thirty (30) days before offsite inspection services are required, and shall provide for the

producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.

1.11 MATERIALS AND EQUIPMENT:

A. The Contractor shall maintain control over procurement sources to ensure that materials and equipment conform to specified requirements in the Contract Documents.

B. The Contractor shall comply with manufacturer's printed instructions regarding all facets of materials and/or equipment movement, storage, installation, testing, startup, and operation. Should circumstances occur where the contract documents are more stringent than the manufacturer's printed instructions, the Contractor shall comply with the specifications. In cases where the manufacturer's printed instructions are more stringent than the contract documents, the Contractor shall advise the Engineer of the disparity and conform to the manufacturer's printed instructions. In either case, the Contractor is to apply the more stringent specification or recommendation, unless accepted otherwise by the Engineer.

1.12 QUALITY CONTROL:

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. The Contractor shall furnish a construction schedule and a minimum of 48 hour notice of readiness for testing and inspection of the work. The Engineer shall determine the exact time and location of field sampling and testing, and may require such additional sampling and testing to determine that materials and equipment conform with data previously furnished by Contractor and with the Contract Documents.

3. The Contractor shall schedule the work to permit adequate time for testing and re- testing should test results not conform to the contract documents. Lack of testing or inspection which is attributable to insufficient notice by the Contractor or failure of the Contractor to cooperate, will be cause for rejection of the work.

4. The Contractor shall deliver materials in sufficient quantities to the Owner's testing agency as may be required. Laboratory testing shall be performed within a reasonable time, consistent with the specified standards.

5. The Contractor shall furnish material samples and cooperate in the field sampling and testing activities, interrupting the work when necessary. The Contractor shall furnish personnel, facilities and access to assist in the sampling and testing activities.

6. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

3. Comply with manufacturers' instructions, including each step in sequence.

4. When manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

5. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

6. Perform Work by persons qualified to produce required and specified quality.

7. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

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

9. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner

10. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspecting will be performed.

11. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

12. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

13. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Tolerances:

1. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

2. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

3. Adjust products to appropriate dimensions; position before securing products in place.

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections.

E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

F. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

G. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

H. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as

requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

I. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

J. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.13 SPECIAL TESTS AND INSPECTIONS:

A. Special Tests and Inspections: Owner will engage a qualified agency to conduct special tests and inspections required, as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Engineer and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality- control service to Engineer with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract

Documents.

6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION:

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

3.3 QUALITY CONTROL:

A. Quality control is the responsibility of the Contractor, and the Contractor shall maintain control over construction and installation processes to assure compliance with specified requirements.

B. Certifications for personnel, procedures, and equipment associated with special processes (e.g., welding, cable splicing, surveying) shall be maintained by the Contractor, available for inspection by the Engineer. Copies shall be made available to the Engineer upon request.

C. Means and methods of construction and installation processes are the responsibility of the Contractor, and at no time is it the intent of the Engineer to supersede or void that responsibility.

3.4 TEST AND INSPECTION LOG:

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.

2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Engineer.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

3.5 REPAIR AND PROTECTION:

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 29 Cutting and Patching.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

+ + END OF SECTION + +

SECTION 01 45 29

TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.1 SCOPE:

A. This Section includes testing which the Owner may require, beyond that testing required of the manufacturer, to determine if materials provided for the Project meet the requirements of these Specifications.

B. This work also includes all testing required by the Owner to verify work performed by the Contractor is in accordance with the requirements of these Specifications, i.e., concrete strength, slump testing, soil compaction, etc.

C. This work does not include materials testing required in various sections of these Specifications to be performed by the manufacturer.

D. The testing laboratory or laboratories will be selected by the Owner. The testing laboratory or laboratories will work for the Owner.

1.2 PAYMENT FOR TESTING SERVICES:

A. Testing services will be directed by the owner and paid by the Contractor. Testing services to be completed by Owner selected testing provider.

B. The cost of material testing described in various sections of these Specifications or as required in referenced standards to be provided by a material manufacturer, shall be included in the price bid for that item and shall not be paid for by the Owner.

C. The cost of retesting any item that fails to meet the requirements of these Specifications shall be paid for by the Contractor. Retesting shall be performed by the testing laboratory working for the Owner.

1.3 LABORATORY DUTIES:

A. Cooperate with the Owner, Engineer and Contractor.

B. Provide qualified personnel promptly on notice.

C. Perform specified inspections, sampling and testing of materials.

1. Comply with specified standards, ASTM, other recognized authorities, and as specified.

2. Ascertain compliance with requirements of the Contract Documents.

D. Promptly notify the Engineer and Contractor of irregularity or deficiency of work which are observed during performance of services.

E. Promptly submit three (3) copies of report of inspections and tests in addition to those additional copies required by the Contractor; one (1) copy to the Owner, one

(1) copy to the Engineer, and one (1) copy to the Contractor, with the following information included:

1. Date issued
2. Project title and number
3. Testing laboratory name and address
4. Name and signature of inspector
5. Date of inspection or sampling
6. Record of temperature and weather
7. Date of test
8. Identification of product and Specification section
9. Location of Project
10. Type of inspection or test
11. Results of test
12. Observations regarding compliance with the Contract Documents

F. Perform additional services as required.

G. The laboratory is not authorized to release, revoke, alter or enlarge on requirements of the Contract Documents, or approve or accept any portion of the Work.

1.5 CONTRACTOR RESPONSIBILITIES:

A. Cooperate with laboratory personnel; provide access to Work and/or manufacturer's requirements.

B. Provide to the laboratory, representative samples, in required quantities, of materials to be tested.

C. Furnish copies of mill test reports.

D. Furnish required labor and facilities to:

1. Provide access to Work to be tested;
2. Obtain and handle samples at the site;
3. Facilitate inspections and tests;
4. Provide a clear, level and unobstructed location for placement of concrete curing box(es) adjacent to the work area as agreed upon with the testing laboratory and the Engineer. Provide power and lighting at the curing box location.

E. Furnish climatically controlled curing box(es) for field storage of cast concrete cylinders or other samples. Multiple boxes shall be furnished when concrete placement activities are being performed at multiple locations across the project site. Curing box shall be manufactured and marketed for the specific purpose described

herein and shall meet standards ASTM C31, C192 and C511. Curing box shall be used to maintain temperature and humidity of the concrete cylinder specimens for 48 hours. Cure box shall feature a digital thermometer, heat/cool indicator lights; temperature set buttons and a capacity of 22 standard 6" x 12" cylinders. Use of field constructed curing boxes will not be acceptable.

F. Notify the laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.

G. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample(s) shall be selected by such laboratory or agency, or the Engineer, and shipped to the laboratory by the Contractor at Contractor's expense.

H. Copies of all correspondence between the Contractor and testing agencies shall be provided to the Engineer.

1.5 QUALITY ASSURANCE:

A. Testing shall be in accordance with all pertinent codes and regulations and with procedures and requirements of the American Society for Testing and Materials (ASTM).

1.6 PRODUCT HANDLING:

A. Promptly process and distribute all required copies of test reports and related instructions to insure all necessary retesting or replacement of materials with the least possible delay in the progress of the Work.

1.7 FURNISHING MATERIALS:

A. The Contractor shall be responsible for furnishing all materials necessary for testing.

1.8 CODE COMPLIANCE TESTING:

A. Inspections and tests required by codes or ordinances or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of, and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.9 CONTRACTOR'S CONVENIENCE TESTING:

A. Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.10 SCHEDULES FOR TESTING:

A. Establishing Schedule

1. The Contractor shall, by advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements

for the testing laboratory to be on site to provide the required testing.

2. Provide all required time within the construction schedule.

B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

C. When the testing laboratory is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the Owner.

1.11 TAKING SPECIMENS:

A. Unless otherwise provided in the Contract Documents, all specimens and samples for tests will be taken by the testing laboratory or the Engineer.

1.12 TRANSPORTING SAMPLES:

A. The Contractor shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 51 05

TEMPORARY UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all temporary utilities and temporary facilities required for the Project, including the following:
   a. Electricity.
   b. Lighting.
   c. Heating, cooling, ventilating, and temporary enclosures.
   d. Water.
   e. Sanitary facilities.
   f. First-aid facilities.
   g. Fire protection.
2. Make all arrangements with utility owners for temporary utilities and with others as appropriate for temporary facilities. Obtain required permits and approvals for temporary utilities and temporary facilities.
3. Pay all service costs for utilities and facilities indicated in this Section as CONTRACTOR's responsibility, including cost of electricity, water, fuel, and other utility services and temporary facilities required for the Work.
4. Continuously maintain adequate temporary utilities and temporary facilities for all purposes for the Project, until removal of temporary utilities and temporary facilities. At minimum, provide and maintain temporary utilities and temporary facilities through Substantial Completion and removal of temporary field offices and sheds unless otherwise approved in writing by ENGINEER.
5. Should OWNER occupy part of the Work prior to Substantial Completion of the entire Work, cost of utilities consumed via temporary utilities serving the portion occupied by OWNER will be shared proportionately by OWNER and CONTRACTOR as mutually agreed to by the parties.
6. Maintain, including cleaning, temporary utilities and temporary facilities, and continuously provide consumables as required.
7. Temporary utilities and temporary facilities shall be adequate for personnel using the Site and the needs of the Project.

8. Provide temporary utilities and temporary facilities in compliance with Laws and Regulations and, when applicable, requirements of utility owners.

1.2 REQUIREMENTS FOR TEMPORARY UTILITIES AND TEMPORARY FACILITIES

A. Electrical:

1. Provide temporary electrical service required for the Work, including continuous power for temporary field offices and sheds. Provide temporary outlets with circuit breaker protection and ground fault protection.

2. Furnish, locate and install area distribution boxes such that the individual trades may use their own construction type extension cords to obtain adequate power, and artificial lighting where required by inspectors and for safety.

3. Provide all temporary electrical services, wire, generators, etc. required for performance of the Work inclusive of maintaining existing facilities in service during required primary electrical service shutdowns.

4. Pay all bills for temporary power required for the performance of the Work where required during shutdowns, bypass pumping etc.

5. Use of Owner's existing standby generator facilities will not be allowed.

B. Lighting.

1. Provide lighting at the Site of not less than five foot-candles for open areas and not less than ten foot-candles for stairs and shops. Provide not less than one, 300-watt lamp every 15 feet in indoor work areas. Provide night security lighting of not less than five foot-candles within 50 feet of all parts of the Site during hours of darkness, controlled by photocell.

2. Do not work in areas with insufficient lighting. Where lighting is insufficient for the work activities to be performed, provide additional temporary lighting.

3. Provide temporary lighting sufficient for observation of the Work by ENGINEER and inspection by CONTRACTOR and authorities having jurisdiction. Where required by ENGINEER, provide additional temporary lighting.

C. Heating, Ventilating, and Enclosures.

1. Provide sufficient temporary heating, cooling, ventilating, and enclosures to ensure safe working conditions and prevent damage to existing facilities and the Work.

2. Except where otherwise specified, temporary heating shall maintain temperature of the space served between 50 degrees F and maximum design temperature of building or facility and its contents.

3. Maintain temperature of areas occupied by OWNER's personnel or electronic equipment, including offices, lunch rooms, locker rooms, toilet rooms, and rooms containing computers, microprocessors, and control equipment, between 65 degrees F and 80 degrees F with relative humidity less than 75 percent.

4. Required temperature range for storage areas and certain elements of the Work, including preparation of materials and surfaces, installation or application, and curing as applicable, shall be in accordance with the Contract Documents for the associated Work and the Supplier's recommended temperature range for storage, application, or installation, as appropriate.

5. Provide temporary ventilation sufficient to prevent accumulation in construction areas and areas occupied by OWNER of hazardous and nuisance levels or concentrations of dust and particulates, mist, fumes or vapors, odors, and gases, associated with construction.

6. Provide temporary enclosures and partitions required to maintain required temperature and humidity.

D. Water:

1. General:

a. OWNER will provide a place of temporary connection for construction water at site. Obtain and install a meter from the Owner and pay for water used at Owner's current rate.

b. Provide temporary water facilities approved by OWNER including piping, valves, , backflow preventers, pressure regulators, and other appurtenances. Provide freeze-protection as required.

c. Continuously maintain adequate water flow and pressure for all purposes during the Project, until removal of temporary water systems.

2. Water for Construction Purposes:

a. Provide water for Site maintenance and cleaning and, water necessary for construction activities, and water for disinfecting and testing of systems.

b. Contractor may use existing hose bibbs for short-term wash-downs and intermittent use of water for work areas in the existing building. Obtain consent of ENGINEER and OWNER if connections to existing hose bibbs and similar existing connections will be used for more than one day at a time.

3. Water for Human Consumption and Sanitation:

a. Provide potable water in accordance with Laws and Regulations for consumption by personnel at the Site, for field offices, and for sanitary facilities.

b. When necessary, provide bottled, potable water for use and consumption by personnel at the Site, including CONTRACTOR, ENGINEER, and visitors to the Site.

E. Sanitary Facilities.

1. Prior to starting the Work, provide suitably-enclosed chemical or self-contained toilets for CONTRACTOR's employees, Subcontractors, Suppliers, ENGINEER, and visitors to the Site. Location of temporary toilets shall be acceptable to OWNER and ENGINEER.

2. Refer to Paragraph 0.D. of this Section for requirements for water intended for human consumption during construction.

3. Provide suitable temporary washing facilities for employees and visitors.

4. Keep all facilities, regardless of type, in a clean and sanitary condition and comply with the requirements and regulations of the area in which the Work is performed.

F. First-aid Facilities.

1. Provide temporary first-aid stations at or immediately adjacent to the Site's work areas, and inside CONTRACTOR's temporary field office. Locations of first-aid stations shall be determined by CONTRACTOR's safety representative. Replenish supplies in first-aid stations as items are used, prior to expiration of items, and as necessary. Monitor and log inventory of supplies in first-aid stations in accordance with requirements for monitoring and logging safety equipment as indicated in Section 01 35 23, Safety Requirements.

2. Provide list of emergency telephone numbers at each hardwired telephone at the Site. List shall be in accordance with the list of emergency contact information required in Section 01 35 23, Safety Requirements.

G. Fire Protection.

1. Provide temporary fire protection, including portable fire extinguishers rated not less than 2A or 5B in accordance with NFPA 10, Portable Fire Extinguishers, for each temporary building and for every 3,000 square feet of floor area under construction.

2. Provide Class A (ordinary combustibles), Class B (combustible liquids and gases), and Class C (electrical equipment) fire extinguishers as necessary.

3. Comply with NFPA 241, Standard for Safeguarding Construction, Alternation, and Demolition Operations, and requirements of fire marshals and authorities having jurisdiction at the Site.

1.3 USE OF OWNER'S SYSTEM

A. Existing Utility Systems: Do not use systems in existing buildings or structures for temporary utilities without OWNER's written permission and mutually acceptable basis agreed upon by the parties for proportionate sharing of costs between OWNER and CONTRACTOR.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for temporary utilities and temporary facilities may be new or used, but shall be adequate for purposes intended and shall not create unsafe conditions, and shall comply with Laws and Regulations.

B. Provide required materials, equipment, and facilities, including piping, cabling, controls, and appurtenances.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install temporary utilities and temporary facilities in neat, orderly, manner, and make structurally, mechanically, and electrically sound throughout.

B. Location of Temporary Utilities and Temporary Facilities:

1. Locate temporary systems for proper function and service.

2. Temporary systems shall not interfere with or provide hazards or nuisances to: the Work under this and other contracts, movement of personnel, traffic areas, materials handling, hoisting systems, storage areas, finishes, and work of utility owners and others.

3. Do not install temporary utilities on the ground, with the exception of temporary extension cords, hoses, and similar systems in place for short durations.

C. Modify and extend temporary systems as required by progress of the Work.

3.2 USE

A. Maintain temporary systems to provide safe, continuous service as required.

B. Properly supervise operation of temporary systems:

1. Enforce compliance with Laws and Regulations.

2. Enforce safe practices.

3. Prevent abuse of services.

4. Prevent nuisances and hazards caused by temporary systems and their use.

5. Prevent damage to finishes.

6. Ensure that temporary systems and equipment do not interrupt continuous progress of construction.

C. At end of each work day, check temporary systems and verify that sufficient consumables are available to maintain operation until work is resumed at the Site. Provide additional consumables if the supply on hand is insufficient.

3.3 REMOVAL

A. Completely remove temporary utilities, temporary facilities, equipment, and materials when no longer required. Repair damage caused by temporary systems and their removal and restore the Site to condition required by the Contract Documents; if restoration of damaged areas is not specified, restore to preconstruction condition.

B. Where temporary utilities are disconnected from existing utility, provide suitable, watertight or gastight (as applicable) cap or blind flange, as applicable, on service line, in accordance with requirements of utility owner.

C. Where permanent utilities and systems were used for temporary utilities, upon Substantial Completion replace all consumables such as filters and light bulbs and parts used during the Work.

+ + END OF SECTION + +

SECTION 01 52 13

CONTRACTOR'S FIELD OFFICE AND SHEDS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide a temporary field office for CONTRACTOR's use with not less than the minimum facilities specified.
2. Provide required temporary storage and work sheds.
3. Obtain and pay for required permits and utilities. Field offices and sheds shall comply with Laws and Regulations.

B. Coordination:

1. Coordinate with OWNER, facility manager, other contractors, and others using the Site the location of field offices and sheds, including contracts indicated in Section 01 11 13 Summary of Work.

C. Location:

1. Locate field offices and sheds in accordance with the Contract Documents and in accordance with the Site mobilization discussions at the preconstruction conference.

D. Furnish in CONTRACTOR's field office one complete set of the Contract Documents for ready reference by interested persons. In addition to the reference set, comply with Section 01 78 39, Project Record Documents and related provisions of the General Conditions, as may be modified by the Supplementary Conditions.

PART 2 – PRODUCTS

2.1 FIELD OFFICE AND SHEDS – FURNISHINGS, AND EQUIPMENT

A. Contractor's Field Office and Furnishings:

1. Construction: As required by CONTRACTOR and sufficient for Project meetings.
2. Utilities and Services: Provide the following:

a. Telephone service.

b. Computer network and related facilities as required for CONTRACTOR's needs.

c. Utilities and related facilities for lighting and maintaining temperature in accordance with the requirements below:

1. Electrical System and Lighting:

   a. Electric service as required, including paying all costs. Provide electrical submeter if electrical service is obtained from OWNER's system.

   b. Interior lighting of not less than 50 foot-candles at desktop height.

   c. Minimum of eight 120-volt, wall-mounted, duplex convenience electrical receptacles.

   d. Exterior, wall-mounted lighting at each entrance to field office, not less than 250 watts each.

   e. Exterior security light for ENGINEER's field office parking area. Provide one 1000-watt, pole-mounted fixture with photocell control.

2. Heating, Ventilating, and Air Conditioning System:

   a. Provide automatic heating to maintain indoor temperature in field office of not less than 65 degrees F in cold weather. Furnish all fuel and pay all utility costs.

   b. Automatic cooling to maintain indoor temperature in field office of not warmer than 75 degrees F in warm weather.

3. Furnishings:

   a. Conference Facilities: General CONTRACTOR shall provide conference area with conference table and chairs sufficient for 20 people. Conference facilities and furnishings shall be provided with suitable utilities, lighting, ventilation, and temperature controls prior to the first progress meeting, unless otherwise approved by ENGINEER.

   b. Other furnishings required by CONTRACTOR.

4. Provide on field office's exterior an identification sign displaying CONTRACTOR's company name. Maximum size of sign shall be four feet by eight feet. Sign shall be suitable for outdoor use for the duration of the Project.

5. Furnish and maintain at CONTRACTOR's field office 12 protective helmets ("hard hats") for use by visitors to the Site.

B. Contractor's Storage and Work Sheds:

1. Provide storage and work sheds sized, furnished, and equipped to accommodate personnel, materials, and equipment involved in the Work, including temporary utility services and facilities required for environmental controls sufficient for personnel, materials, and equipment.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Installation:

1. Install CONTRACTOR's temporary field offices, sheds, and related facilities in accordance with Laws and Regulations.

2. Install materials and equipment, including prefabricated structures, in accordance with manufacturer's instructions.

3.2 MAINTENANCE AND REMOVAL

A. Maintenance:

1. Clean and maintain field offices and sheds as required.

2. Provide consumables as required.

B. Removal:

1. Do not remove temporary field offices and sheds until after Substantial Completion of the entire Work, unless otherwise approved by ENGINEER.

2. Remove field offices and sheds and restore areas prior to final inspection.

+ + END OF SECTION + +

SECTION 01 55 13

ACCESS ROADS AND PARKING AREAS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide temporary construction roads, walks, parking areas, and appurtenances required during the Project for use by CONTRACTOR, other contractors employed on the Project, OWNER's, facility managers, and emergency vehicles.
   2. Temporary roads and parking areas shall be designed and maintained by CONTRACTOR and shall be fully passable to vehicles in all weather conditions.

B. Use of Existing Access Roads:
   1. CONTRACTOR is allowed to use OWNER's existing roads starting on the Effective Date of the Contract and satisfying other Contract requirements relative to starting the Work.
   2. Prevent interference with traffic on existing roads and parking areas. Always keep access roads and entrances serving the Site clear and available to OWNER, facility manager, and their respective employees; emergency vehicles; and other contractors. Do not use access roads or Site entrances for parking or storage of materials or equipment.
   3. CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER from expenses and losses caused by CONTRACTOR's operations over existing roads, drives, and parking areas.
   4. Schedule deliveries to minimize use of driveways and Site entrances.

1.2 SITE ACCESS

A. Site Access:
   1. CONTRACTOR access to the Site shall be via Trilith Studios entrance.

1.3 CONTRACTOR PARKING

A. CONTRACTOR employee vehicles shall park in construction staging area(s).

B. Park construction vehicles and equipment in work areas off permanent roads and parking areas, in areas of the Site designated for CONTRACTOR staging.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Materials for temporary roads and parking areas shall comply with the Contract Documents' requirements for permanent roads, drives, and parking areas.

B. Traffic controls shall comply with requirements of authorities having jurisdiction. When such authority is the OWNER or facility manager, and no requirements are indicated, comply with the standard specifications of the state department of transportation in the area of the Project.

PART 3 – EXECUTION

3.1 TEMPORARY ROADS AND PARKING AREAS

A. Temporary Roads and Parking in Same Areas as Permanent Pavement:
   1. Provide temporary roads and parking areas adequate to support and withstand traffic and construction loads during the Project. Locate temporary roads and parking areas in same location as permanent roads and parking areas. Extend temporary roads and parking areas, within construction limits indicated, as required for construction operations.
   2. Coordinate elevations of temporary roads and parking areas with permanent roads and parking areas.
   3. Prepare subgrade, subbase, and base for temporary roads and parking areas in accordance with the Contract Documents requirements for permanent roads, drives, and parking areas.
   4. Where required by subgrade conditions and construction loads and traffic, provide geosynthetic separation fabric as required on compacted subgrade for subbase support and separation of subbase and subgrade materials.
   5. Re-condition granular subbase of temporary roads and parking areas, including removing and properly disposing of granular material that has become intermixed with soil, re-grading, proof-rolling, compacting, and testing.

3.2 TRAFFIC CONTROLS

A. Traffic Controls:
   1. Provide temporary traffic controls at intersections of temporary roads with each other and with parking areas, including intersections with other temporary roads, intersections with public roads, and intersections with permanent access roads at the Site.
   2. Provide temporary warning signs on permanent roads and drives and provide temporary "STOP" signs for traffic on temporary roads where required and at entrances to permanent pavement.
   3. Comply with requirements of authorities having jurisdiction. When such authority is the OWNER or facility manager, and no requirements are

indicated, comply with the standard specifications of the state department of transportation in the area of the Project

3.3 MAINTENANCE OF ROADS

A. General:
   1. Maintain temporary roads and parking to continuously provide at the Site access for construction vehicles and trucks, OWNER and facility manager vehicles, deliveries for OWNER and facility manager, emergency vehicles, and parking areas for OWNER's and facility manager's personnel.
   2. Public roads shall be passable at all times unless a road closure is allowed in writing by authority having jurisdiction.
   3. When granular material of temporary roads and parking without hard surfacing become intermixed with soil or when temporary roads otherwise create a nuisance, remove intermixed granular-and-soil material, and replace with clean granular material as required.
   4. Provide snow and ice removal for temporary roads and parking areas.

B. Cleaning and Dust Control:
   1. Cleaning: Clean paved surfaces over which construction vehicles travel. Perform cleaning not less often than the frequency indicated in Section 01 74 05, Cleaning, or more frequently as directed by ENGINEER, by mechanical sweeping or other means acceptable to ENGINEER.
   2. Clean the following surfaces:
      a. Roads within limits of the Project.
      b. Permanent roads at the Site between the Site entrance and the work areas, and between the Site entrance and construction parking and staging areas.
      c. Public roads that require sweeping and cleaning due to construction operations.
   3. Dust Control:
      a. Control dust resulting from construction activities to prevent nuisances at the Site and in nearby areas.
      b. Comply with Section 01 41 27, Earthmoving and Dust Control, and Section 01 57 00, Temporary Controls.

C. Protection of Underground Facilities: Comply with the General Conditions, as may be modified by the Supplementary Conditions, Section 01 71 33, Protection of the Work and Property, and other requirements of the Contract Documents.

3.4 REMOVALS AND RESTORATION

A. Removals:
   1. Remove temporary roads, drives, walks, and parking areas that are not intended for, or acceptable for, integration into permanent pavement. Return areas of temporary roads, drives, walks, and parking to pre-construction condition unless otherwise required by the Contract Documents.

2. Remove temporary gates, fencing, and traffic controls associated with temporary roads and parking areas.
3. Where areas of temporary roads and parking will be permanently landscaped, remove pavement, granular subbase, geosynthetic (where required by ENGINEER), soil, and other materials that do not comply with the Contract Documents regarding fill, subsoil, and landscaping.
4. Remove and properly dispose of materials contaminated with oil, bitumen, and other petrochemical compounds resulting from CONTRACTOR's operations, and other substances that might impair growth of plants and lawns.

B. Restoration:
1. Repair or replace paving, curbs, gutters, and sidewalks affected by temporary roads and parking, and restore to required conditions in accordance with authorities having jurisdiction.
2. Restore to pre-construction conditions existing roads, walks, and parking areas damaged by CONTRACTOR, subject to approval of the owner of affected roads, drives, walks, and parking areas.

+ + END OF SECTION + +

SECTION 01 57 05

TEMPORARY CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide and maintain methods, materials, equipment, and temporary construction as required for controlling environmental conditions at the Site and adjacent areas during construction.
   2. Maintain controls until no longer required. Provide temporary controls at all times when CONTRACTOR is working at the Site.
   3. Temporary controls include, but are not limited to, the following:
      a. Erosion and sediment controls.
      b. Noise controls.
      c. Dust controls.
      d. Pest and rodent controls.
      e. Control of water, including storm water runoff.
      f. Pollution controls.

B. Related Sections:
   1. Section 01 41 26, Storm Water Pollution Prevention Plan and Permit.
   2. Section 01 41 27, Earthmoving Permit and Dust Control.
   3. Section 01 55 13 Access Roads and Parking Areas.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions and recommendations of the following:
   1. Procedural Submittals:
      a. Proposed dust control measures, when submittal is requested by ENGINEER.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Plan for construction staging and maintenance of the Site relative to erosion and sediment controls. Indicate on a site plan approximate areas of planned disturbance of soils and soil cove over time during the Project. For areas not indicated in the Contract Documents as being disturbed and that CONTRACTOR proposes to disturb, Shop Drawing shall include proposed erosion and sediment control measures for the additional area.
      b. Location and details of temporary settlement basin(s).

2. Product Data:
    a. Silt fencing materials.

B. Informational Submittals: Submit the following:
    1. Procedural Submittals:
        a. Proposed dust control measures, when submittal is requested by ENGINEER.

PART 2 – PRODUCTS

2.1 MATERIALS FOR TEMPORARY EROSION AND SEDIMENT CONTROLS

A. Materials for temporary erosion and sediment controls shall be as shown or indicated on the Drawings.

PART 3 – EXECUTION

3.1 NOISE CONTROL

A. Noise Control – General:
    1. CONTRACTOR's vehicles and equipment shall minimize noise emissions to greatest degree practicable. When necessary, provide mufflers and silencers on construction equipment, and provide temporary sound barriers onsite when necessary.
    2. Noise levels shall comply with Laws and Regulations, including OSHA requirements and local ordinances.
    3. Noise emissions shall not interfere with the work of OWNER, facility manager, or others.

3.2 DUST CONTROL

A. Dust Control – General:
    1. Control objectionable dust caused by CONTRACTOR's operation of vehicles and equipment, clearing, demolition, cleaning, and other actions. To minimize airborne dust, apply water or use other methods subject to acceptance of ENGINEER and approval of authorities having jurisdiction.
    2. CONTRACTOR shall prevent blowing and movement of dust from exposed soil surfaces and access roads to reduce onsite and off-Site damage, nuisances, and health hazards associated with dust emissions.
    3. Comply with Section 01 41 27, Earthmoving Permit and Dust Control.

B. Dust Control Methods:
    1. Dust control may be achieved by irrigation in which the dust-prone area of the Site shall be sprinkled with water until the surface is moist.

2. Apply dust controls as frequently as required without creating nuisances such as excessive mud and ponding of water at the Site. Do not use water for dust control when water will cause hazardous or objectionable conditions such as ice, mud, ponds, and pollution.
3. Provide dust control that is non-polluting and does not contribute to tracking-out of dirt and dust onto pavement.

C. Removal of Dust and Dirt from Travelled Surfaces:
1. Remove dust and dirt from roadways, drives, parking areas, and other travelled surfaces not less than the frequency indicated in Section 01 74 05, Cleaning.
2. Perform dust and dirt removals from travelled surfaces by mechanical sweeping or other method acceptable to ENGINEER.

3.3 PEST AND RODENT CONTROL

A. Pest and Rodent Control – General:
1. Provide pest and rodent controls as required to prevent infestation of the Site and storage areas.
2. Employ methods and use materials that do not adversely affect conditions at the Site or on adjoining properties.
3. In accordance with Laws and Regulations, promptly and properly dispose of pests and rodents trapped or otherwise controlled.

3.4 WATER CONTROL

A. Water Control – General:
1. Provide methods to control surface water and water from excavations and structures to prevent damage to the Work, the Site, and adjoining properties.
2. Control fill, grading, and ditching to direct water away from excavations, pits, tunnels and other construction areas and to direct drainage to proper runoff courses to prevent erosion, damage, or nuisance. Avoid directing to adjoining properties runoff from the Site and construction operations.

B. Equipment and Facilities for Water Control:
1. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.

C. Discharge and Disposal:
1. Dispose of storm water and ground water in manner to prevent flooding, erosion, and other damage to any and all parts of the Site and adjoining areas, and that complies with Laws and Regulations.

3.5 POLLUTION CONTROL

A. Pollution Control – General:

1. Provide means, methods, and facilities required to prevent contamination of soil, water, and atmosphere caused by discharge of noxious substances from or caused by construction operations.
2. Equipment used during construction shall comply with Laws and Regulations.
3. Comply with Section 01 35 43.13, Environmental Procedures for Hazardous Materials.

B. Spills and Contamination:
1. Provide equipment and personnel to perform emergency measures required to contain spills and to remove contaminated soils and liquids.
2. Excavate contaminated material and properly dispose of off-Site and replace with suitable compacted fill and topsoil.
3. Comply with Section 01 35 44, Spill Prevention Control and Countermeasures Plan, and OWNER's and facility manager's hazard control procedures as indicated in Section 01 35 23, Safety Requirements.

C. Protection of Surface Waters and Ground Water:
1. Provide and maintain special measures to prevent harmful substances from entering surface waters and ground water. Prevent disposal of wastes, effluents, chemicals, and other such substances in or adjacent to surface waters and open drainage routes, in sanitary sewers, or in storm sewers, and in ground water.

D. Atmospheric Pollutants:
1. Provide and maintain systems for controlling atmospheric pollutants related to the Work.
2. Prevent toxic concentrations of chemicals and vapors.
3. Prevent harmful dispersal of pollutants into atmosphere.

E. Solid Waste:
1. Provide and maintain systems for controlling and managing solid waste related to the Work.
2. Prevent solid waste from becoming airborne, and from discharging to surface waters and drainage routes.
3. Properly handle and dispose of solid waste.
4. Comply with requirements for cleaning and disposal of debris in the General Conditions, as may be modified by the Supplementary Conditions, and Section 01 74 05, Cleaning.

3.6 EROSION AND SEDIMENT CONTROLS

A. Installation and Maintenance of Erosion and Sediment Controls – General:
1. General:
a. Provide temporary erosion and sediment controls as shown and indicated on the Drawings and as indicated elsewhere in the Contract Documents. Provide erosion and sediment controls as the Work progresses into previously undisturbed areas.

b. Installation of erosion and sediment controls shall be in accordance with the applicable regulatory requirements indicated in Article 1.2 of this Section, unless more-stringent methods are otherwise shown or indicated in the Contract Documents.
c. Use necessary methods to successfully control erosion and sedimentation, including ecology-oriented construction practices, vegetative measures, and mechanical controls. Use best management practices (BMP) in accordance with Laws and Regulations, and regulatory requirements indicated in Article 1.2 of this Section, to control erosion and sedimentation during the Project.
d. Plan and execute construction, disturbances of soils and soil cover, and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation. Provide temporary measures for controlling erosion and sedimentation, as indicated in the Contract Documents and as required for the Project.
e. Where areas must be cleared for storage of materials or equipment, or for temporary facilities, provide measures for regulating drainage and controlling erosion and sedimentation, subject to the ENGINEER'S approval.
f. Provide erosion and sediment controls, including stabilization of soils, at the end of each workday.

2. Coordination:
   a. Coordinate erosion and sediment controls with this Section's requirements on water control, and with Section 01 41 26, Storm Water Pollution Prevention Plan and Permit.
   b. Coordinate temporary erosion and sediment controls with construction of permanent drainage facilities and other Work to the extent necessary for economical, effective, and continuous erosion and sediment controls.
3. Before commencing activities that will disturb soil or soil cover at the Site, provide all erosion and sediment control measures required by the Contract Documents for the areas where soil or soil cover will be disturbed.
4. In general, implement construction procedures associated with, or that may affect, erosion and sediment control to ensure minimum damage to the environment during construction. CONTRACTOR shall implement all additional measures required to comply with Laws and Regulations, and Section 01 41 26, Storm Water Pollution Prevention Plan and Permit.
5. Vegetation Removal: Remove only those shrubs, grasses, and other vegetation that must be removed for construction. Protect remaining vegetation.
6. Access Roads and Parking Areas: When possible, access roads and temporary roads and parking shall be located and constructed to avoid adverse effects on the environment. Provide measures to regulate drainage, avoid erosion and sedimentation, and minimize damage to vegetation.
7. Earthwork and Temporary Controls:
   a. Perform excavation, fill, and related operations in accordance with Section 31 20 00, Earth Moving.

b. Control erosion to minimize transport of silt from the Site into existing waterways and surface waters. Such measures shall include, but are not limited to, using berms, silt fencing, baled straw silt barriers, gravel or crushed stone, mulching and soil stabilization, slope drains, and other methods. Apply such temporary measures to erodible materials exposed by activities associated with the construction of the Project.
c. Hold to a minimum the areas of bare soil exposed at one time.
d. Construct fills and waste areas by selectively placing fill and waste materials to eliminate surface silts and clays that will erode.
e. In performing earthwork, eliminate depressions that could serve as mosquito breeding pools.
f. CONTRACTOR shall provide special care in areas with steep slopes, where disturbance of vegetation shall be minimized to maintain soil stability.

8. Inspection and Maintenance:
   a. Periodically inspect areas of earthwork and areas where soil or soil cover are disturbed to detect evidence of the start of erosion and sedimentation; promptly implement corrective measures as required to control erosion and sedimentation. Continue inspections and corrective measures until soils are permanently stabilized and permanent vegetation has been established.
   b. Inspect not less often than the frequency indicated in Section 01 41 26, Storm Water Pollution Prevention Plan and Permit.
   c. Repair or replace damaged erosion and sediment controls within 24 hours of CONTRACTOR becoming aware of such damage.
   d. Periodically remove silt and sediment that has accumulated in or behind sediment and erosion controls. Properly dispose of silt and sediment.
9. Duration of Erosion and Sediment Controls:
   a. Maintain erosion and sediment controls in effective working condition until the associated drainage area has been permanently stabilized.
   b. Maintain erosion and sediment controls until the Site is restored and site improvements including landscaping, if any, are complete with underlying soils permanently stabilized.
10. Work Stoppage:
    a. If the Work is temporarily stopped or suspended for any reason, CONTRACTOR shall provide additional temporary controls necessary to prevent environmental damage to the Site and adjacent areas while the Work is stopped or suspended.
11. Failure to Provide Adequate Controls:
    a. In the event CONTRACTOR repeatedly fails to satisfactorily control erosion and sedimentation, OWNER reserves the right to employ outside assistance or to use OWNER's own forces for erosion and sediment control.
    b. Cost of such work by OWNER, plus engineering and inspection costs, will be deducted from amounts due CONTRACTOR, as set-offs in accordance with the Contract Documents.

B. Erosion and Sediment Control Permit:
   1. Comply with permit requirements indicated in Section 01 41 24, Permit Requirements.

C. Silt Fencing:
   1. Install and maintain silt fencing in a vertical plane, at the location(s) shown or indicated in the Contract Documents and where required.
   2. Locations of Silt Fencing:
      a. Where possible, install silt fencing along contour lines so that each given run of silt fencing is at the same elevation.
      b. On slopes, install silt fencing at intervals that do not exceed the maximum intervals indicated in the following table:

Slope (percent)	Maximum Length of Slope Above Each Silt Fence (feet)
2 and less	150
2.1 to 5	100
5.1 to 10	50
10.1 to 20	25
20.1 to 25	20
25.1 to 40	15
40.1 to 50	10

      c. Provide silt fencing around perimeter of each stockpile of topsoil, general fill material, and excavated material. Install silt fencing before expected precipitation and maintain until stockpile is removed.
      d. Do not install silt fencing at the following types of locations:
         1) Area of concentrated storm water flows such as ditches, swales, or channels.
         2) Where rock or rocky soils prevent full and uniform anchoring of silt fencing.
         3) Across upstream or discharge ends of storm water piping or culverts.
   3. Installation:
      a. Securely fasten wire mesh to posts, and securely fasten filter cloth to wire mesh.
      b. When two sections of filter cloth abut each other, fold over edges and overlap by not less than six inches and securely fasten to wire mesh.
      c. Embed posts in the ground to the depth necessary for proper controls; embed posts to not less than 16 inches below ground.
      d. Filter cloth and wire mesh shall extend not less than eight inches below ground and not less than 16 inches above ground.
      e. Remove sediment accumulated at silt fencing as required. Repair and reinstall silt fencing as required.
   4. Maintenance:
      a. Do not allow formation of concentrated storm water flows on slopes above silt fencing unless so shown or indicated in the Contract Documents. If unauthorized concentrated storm water flows occur,

stabilize the slope via earthmoving and other stabilization measures as required to prevent flow of concentrated storm water flows toward silt fencing.

D. Straw Bale Dike.
   1. Install straw bale dikes where shown or indicated, including in swales, along contours, and along toe of slopes.
   2. Install straw bales in shallow excavation as wide as the bale and approximately four to six inches below surrounding grade.
   3. Ends of straw bales shall tightly abut ends of adjacent straw bales.
   4. Securely install straw bales using two support posts per straw bale, driven into the ground not less than 1.5 to two feet below bottom of straw bale. Top of post shall be flush with top of straw bale. Angle first post for each straw bale toward the previously installed straw bale.
   5. Frequently inspect straw bales and repair or replace as required. Remove accumulated silt and debris from behind straw bales.

E. Mulching and Soil Stabilization:
   1. Use mulching to temporarily stabilize exposed soil and fill material.
      a. Immediately following final grading, provide mulch and stabilize with mats or netting, or sprayed soil stabilization emulsion with fiber additive.
      b. Application of mulching for soil stabilization shall be as follows.
         1) Unrotted Straw or Salt Hay: 1.5 to two tons per acre.
         2) Soil stabilization emulsions, when used, shall be applied in accordance with manufacturer's instructions, and shall be applied with mulch or stabilization fibers.
         3) Wood-fiber or Paper-fiber Application: 1,500 lbs. per acre, installed by hydroseeding.
      c. Where mats or netting are used:
         1) Cover entire area to be stabilized with mats or netting.
         2) Provide anchoring trenches at the top and bottom of slopes to receive mats or netting. Bury at least the top and bottom ends of mat or netting, four inches or more wide, at top and bottom of slope. Tamp trench full of soil. Four inches from trench, secure mat or netting with appropriate staples spaced at intervals of 10 inches.
         3) Overlap adjacent strips of mat or netting by not less than four inches.

F. Protection of Storm Water Drainage Inlets and Catch Basins:
   1. Protect each drainage inlet and catch basin that has the potential to receive storm water runoff from exposed soils and does not discharge into a storm water settlement basin.
   2. Install inlet filter bags inside of drainage inlet or catch basin in accordance with manufacturer's instructions. Secure inlet filter bag with the structure's grate or by other acceptable means.
   3. Inlet filter bags shall not pose any obstruction above the pre-construction elevation of the drainage inlet or catch basin grate requiring barricades or flashers.

4. When removing silt and sediment from inlet filter bag, do not dump filter bag's contents into the drainage inlet or catch basin.
5. Remove silt and sediment from inlet filter bag, or replace inlet filter bag, when inlet filter bag is not more than half full.

G. Temporary Settlement Basin:
1. For constructing embankments comply with requirements in Division 31 Sections on earthwork, embankments, excavation, and fill.
2. Overflow Weir and Discharge Pipe:
   a. Install piping in accordance with manufacturer's instructions.
   b. Install overflow weirs at elevations shown or indicated on the Drawings or approved Shop Drawings, as applicable, to avoid overtopping and overfilling of settlement basin without short-circuiting the settlement basin's hydraulic performance.
   c. Wrap and secure geotextile material specified for silt fencing around discharge structures of temporary settlement basins
3. Crushed Stone and Riprap: Install in accordance with Division 31 Sections on earthwork, fill, and riprap. Provide in areas of temporary settlement basin subject to erosion, and at upstream and downstream ends of discharge piping.
4. Remove sediment when required based on accumulation of material.
5. When temporary settlement basin is no longer required, remove the temporary settlement basin discharge weir, discharge piping, and spillway, fill the temporary settlement basin to required grade in accordance with requirements of Division 31 Section on excavation and fill, and provide landscaping in accordance with Division 32 Sections on landscaping.

H. Filter Bag on Dewatering Pump Discharge:
1. Provide dewatering of excavations in compliance with Division 31 Sections on earthmoving, excavation, and fill.
2. Locate filter bags and temporary pump discharge lines to avoid interfering with the public, use of private property, and OWNER's and facility manager’s operations. Relocate filter bags and appurtenances when required.
3. Filter bag discharge shall be directed to appropriate storm water drainage route. Do not discharge into roadways, driveways, access roads, parking areas, or overland. When temporary settlement basin is used, locate filter bags to discharge to temporary settlement basin when practicable.
4. Provide filter bag on discharge of each dewatering pump drawing from an excavation.
5. Securely attach filter bag to pump discharge pipe or hose.
6. Maintain, clean out, and replace filter bags as required.

I. Temporary Stone Construction Entrance:
1. Where shown on the Drawings, and where construction vehicles will regularly transit to paved surfaces from unstabilized surfaces, provide temporary stone construction entrance. CONTRACTOR vehicles shall use temporary stone construction entrances.

2. Provide temporary stone construction entrances of the width, length, and thickness shown or indicated on the Drawings. When not shown or indicated on the Drawings, temporary stone construction entrance shall be not less than 50 feet long, by 20 feet wide, by eight inches deep.
3. Installation:
    a. Ensure that subgrade under each temporary stone construction entrance is suitably dense for the intended purpose. Suitably prepare subgrade as required for temporary stone construction entrance.
    b. Provide on subgrade a layer of geotextile separation fabric, installed in accordance with geotextile separation fabric manufacturer's recommendations for separation.
    c. Provide stone on installed geotextile separation fabric. Grade the stone for passage of vehicles.
4. Maintenance:
    a. Maintain temporary stone construction entrance at not less than the minimum required thickness. Add stone as required to maintain thickness.
    b. When upper layer of temporary stone construction entrance becomes contaminated with soil, remove the contaminated material and replace with clean stone.
    c. Using water to wash down temporary construction entrance or paved areas onto which soil material has been tracked is unacceptable.

3.7 REMOVAL OF TEMPORARY CONTROLS

A. Removals – General:
1. Upon completion of the Work, remove temporary controls and restore Site to specified condition; if condition is not specified, restore Site to pre-construction condition.
2. After soils are permanently stabilized, remove from the Site temporary erosion and sediment controls.

+ + END OF SECTION + +

SECTION 01 57 33

SECURITY

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. This Section includes general requirements for security at the Site, including accessing the Site, securing the Work, temporary fencing, and other requirements.
   2. CONTRACTOR shall safely guard all the Work, the Project, materials, equipment, and property from loss, theft, damage, and vandalism until Substantial Completion, unless otherwise agreed upon by the parties.
   3. CONTRACTOR's duty includes safely guarding OWNER's property in vicinity of the Work and Project, and other private property in the vicinity of the Project from injury and loss in connection with performance of the Project.
   4. Employ watchmen as required to provide required security and prevent unauthorized entry.
   5. Costs for security required under this Section shall be paid by CONTRACTOR.
   6. Make no claim against OWNER for damage resulting from trespass.
   7. Remedy damage to property of OWNER and others arising from failure to furnish adequate security.
   8. Provide temporary fencing in accordance with the Contract Documents.
   9. CONTRACTOR's security measures shall be at least equal to those usually provided by OWNER or facility manager to protect existing facilities during normal operation.

1.2 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Temporary Fencing: Submit site plan drawings showing proposed locations and extent of temporary site security fencing and each breach therein.
   2. Product Data:
      a. Temporary Fencing: Manufacturer's literature, specifications, and installation instructions for temporary site security fencing proposed.

B. Informational Submittals: Submit the following:
   1. Employee Information: Submit to OWNER the following; do not submit to ENGINEER:
      a. Format of employee background data.

b. Background data for employees to whom identification badges will be furnished.
c. Updated listing of personnel to whom identification badges have been issued. Submit updated listing within 24 hours of a change in the list or change in an employee's Site access status.

1.3 CONTRACTOR'S SITE ACCESS AND SECURITY PROCEDURES

A. Comply with Section 01 55 13, Access Roads and Parking Areas.

B. Comply with OWNER's security procedures and access restrictions at the Site throughout the Project. Comply with the following:
1. Personnel Identification and Background Checks:
a. All CONTRACTOR personnel, including Subcontractors, Suppliers, and others associated with the Project shall wear, in a visible location, at all times at the Site a durable, waterproof badge with wearer's photograph, name, signature, and, as applicable employee number; CONTRACTOR's name; employer (if other than CONTRACTOR), and Project name.
b. Prior to issuing badge, submit to OWNER copy of background data sheet for each person to whom badge may be issued for OWNER acceptance; do not issue badge without OWNER acceptance of background data for that person.
c. Submit for OWNER's acceptance the proposed format of employee background data sheet.
2. General Provisions Regarding Personnel Identification:
a. Prerequisites to Issuance of Personnel Identification Badges:
1) Do not issue personnel identification badge until the person receiving the badge is documented by CONTRACTOR as:
a) Being eligible to perform work in the jurisdiction where the Project is located.
b) Has received all required safety instructions, training, and equipment.
c) Is known to CONTRACTOR as being qualified to perform the Work to which the person will be assigned.
b. Listing of Personnel to Whom Badges are Issued:
1) Maintain and continuously update a listing or log of all personnel to whom personnel identification badges have been issued.
2) Listing or log shall indicate each person's full name, home address, personal telephone number, employer name, and employer address and telephone number.
3) Submit copy of listing or to OWNER in accordance with Article 1.2 of this Section.
3. Vehicle Identification:
a. While on-Site, all CONTRACTOR vehicles, including employee vehicles, shall display vehicle identification tag.
b. Vehicle tag shall include the following information: Site name, CONTRACTOR name, contract designation, vehicle license plate

number and state of registration, name and employer of vehicle owner, and vehicle owner contact telephone number.

4. Parking:
    a. Do not park outside of designated CONTRACTOR parking area to be determined by Trilith Studios. Prepare and maintain parking area as required.
    b. Personal vehicles are not allowed outside the contractor parking area.

PART 2 – PRODUCTS

2.1 TEMPORARY FENCING

A. When security fencing or barriers are breached or temporarily removed for the Project, provide and maintain temporary security fencing equal to existing, unless otherwise specified, in manner satisfactory to ENGINEER and OWNER.

A. Erect and maintain temporary fencing where shown on the drawings, and at locations where permanent security fencing or barriers are breached or temporarily removed for the Work.

PART 3 – EXECUTION

3.1 TEMPORARY FENCING

A. Installation:
    1. Provide temporary fencing for site security so that integrity of site security is maintained throughout the Project.
    2. Install temporary fencing used for site security in accordance with the Contract Documents and fence manufacturer's instructions.

B. Maintenance:
    1. Maintain temporary fencing throughout the Project.
    2. Repair damage to temporary fencing and replace fencing when required to preserve Site security.

C. Removal:
    1. Remove temporary fencing when permanent site security fencing is in place and fully functional, or when otherwise directed or ENGINEER.

+ + END OF SECTION + +

SECTION 01 61 00

COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section includes:

a. Common requirements for materials and equipment.

b. Compatibility of materials and equipment.

1.2 REQUIREMENTS FOR MATERIALS AND EQUIPMENT

A. Unless otherwise indicated in the Contract Documents, furnish materials and equipment that:

1. Have not previously been incorporated into another project or facility; and

2. Have not changed ownership after initial shipment from the manufacturer's factory or facility; and

3. If stored since their manufacture or fabrication, have, while in storage, been properly maintained and serviced in accordance with the manufacturer's recommendations for long-term storage; submit documentation as required by ENGINEER that such maintenance and service has been performed; and

4. That the item(s) have not been subject to degradation or deterioration since manufacture; and

5. Are the current model(s) or type(s) furnished by the Supplier.

B. To the extent possible, furnish from a single source those materials and equipment that are of the same generic kind.

C. Furnish materials and equipment complete with accessories, trim, finish, fasteners, and other items shown, indicated, or required for a complete installation for the indicated use and performance.

D. Standard Items: When available, and unless custom or nonstandard options are specified or indicated, furnish standard materials and equipment of types that have been produced and used successfully in similar situations on other projects.

E. Visual Matching: Where required in the Contract Documents, furnish materials and equipment that match (as determined by ENGINEER) referenced existing construction, and mock-ups and Sample(s) approved by ENGINEER.

F. Where the Contract Documents include the phrase “as selected” for color of materials or equipment, finish pattern, option, or similar phrase, provide materials and equipment selected by ENGINEER as follows:

1. Standard Range: Where the Contract Documents include the phrase “standard range of colors, patterns, textures” or similar wording, provide color, pattern, density, or texture selected by ENGINEER from manufacturer’s product line that does not include premium items.

2. Full Range: Where the Contract Documents include the phrase “full range of colors, patterns, textures” or similar wording, ENGINEER will select color, pattern, density, or texture from manufacturer’s entire product line, including standard and premium items.

1.3 COMPATIBILITY

A. Similar materials and equipment by the same Supplier shall be compatible with each other, unless otherwise indicated in the Contract Documents or approved by ENGINEER.

B. Provide materials and equipment compatible with items previously selected or installed on the Project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 65 00

PRODUCT DELIVERY REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section includes the general requirements for preparing for shipping, delivering, and handling materials and equipment.
2. CONTRACTOR shall make all arrangements for transporting, delivering, and handling of materials and equipment required for prosecution and completion of the Work.
3. When required, move stored materials and equipment without additional compensation and without changes to the Contract Times.

1.2 SUBMITTALS

A. Refer to individual Specification Sections for submittal requirements relative to delivering and handling materials and equipment.

1.3 PREPARING FOR SHIPMENT

A. When practical, factory-assemble materials and equipment. Match mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable, protective coating.

B. Package materials and equipment to facilitate handling, and protect materials and equipment from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate the associated purchase order number, bill of lading number, contents by name, OWNER’s contract name and number, CONTRACTOR name, equipment number, and approximate weight. Include complete packing lists and bills of materials with each shipment.

C. Protect materials and equipment from exposure to the elements and keep thoroughly dry and dust-free at all times. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Lubricate bearings and other items requiring lubrication in accordance with manufacturer’s instructions.

D. Advance Notice of Shipments:

1. Keep ENGINEER informed of delivery of all materials and equipment to be incorporated in the Work.

2. Upon receipt of Supplier's advance notice of shipment, at least seven days prior to delivery of materials and equipment, provide ENGINEER written notification of anticipated date and place of arrival of the following:

    a. All construction materials including water quality instrumentation.

E. Do not ship materials and equipment until:

1. Related Shop Drawings, Samples, and other submittals have been approved or accepted (as applicable) by ENGINEER, including, but not necessarily limited to, all Action Submittals associated with the materials and equipment being delivered.

2. Manufacturer's instructions for handling, storing, and installing the associated materials and equipment have been submitted to and accepted by ENGINEER in accordance with the Specifications.

3. Results of source quality control testing (factory testing), when required by the Contract Documents for the associated materials or equipment, have been reviewed and accepted by ENGINEER.

4. Facilities required for handling materials and equipment in accordance with manufacturer's instructions are in place and available.

5. Required storage facilities have been provided.

1.4 DELIVERY

A. Scheduling and Timing of Deliveries:

1. Arrange deliveries of materials and equipment in accordance with the accepted Progress Schedule and in ample time to facilitate inspection prior to installation.

2. Schedule deliveries to minimize space required for and duration of storage of materials and equipment at the Site or delivery location, as applicable.

3. Coordinate deliveries to avoid conflicting with the Work and conditions at Site, and to accommodate the following:

    a. Work of subcontractors and OWNER.

    b. Storage space limitations.

    c. Availability of equipment and personnel for handling materials and equipment.

    d. OWNER's use of premises.

4. Deliver materials and equipment to the Site during regular working hours.

5. Deliver materials and equipment to avoid delaying the Work and the Project, including work of other contractors, as applicable. Deliver anchor system materials, including anchor bolts to be embedded in concrete or masonry, in ample time to avoid delaying the Work.

B. Deliveries:

1. Shipments shall be delivered with CONTRACTOR's name, Subcontractor's name (if applicable), Site name, Project name, and contract designation (example: "ABC Construction Co., City of Somewhere, Idaho, Wastewater Treatment Plant Primary Clarifier Improvements, Contract 25, General Construction") clearly marked.

2. Site may be listed as the "ship to" or "delivery" address; but OWNER shall not be listed as recipient of shipment unless otherwise directed in writing by ENGINEER.

3. Provide CONTRACTOR's telephone number to shipper; do not provide OWNER's telephone number.

4. Arrange for deliveries while CONTRACTOR's personnel are at the Site. CONTRACTOR shall receive and coordinate shipments upon delivery. Shipments delivered to the Site when CONTRACTOR is not present will be refused by OWNER and/or ENGINEER, and CONTRACTOR shall be responsible for the associated delays and additional costs, if incurred.

C. Containers and Marking:

1. Have materials and equipment delivered in manufacturer's original, unopened, labeled containers.

2. Clearly mark partial deliveries of component parts of materials and equipment to identify materials and equipment, to allow easy accumulation of parts, and to facilitate assembly.

D. Inspection of Deliveries:

1. Immediately upon delivery, inspect shipment to verify that:

a. Materials and equipment comply with the Contract Documents and approved or accepted (as applicable) submittals.

b. Quantities are correct.

c. Materials and equipment are undamaged.

d. Containers and packages are intact and labels are legible.

e. Materials and equipment are properly protected.

2. Promptly remove damaged materials and equipment from the Site and expedite delivery of new, undamaged materials and equipment,

and remedy incomplete or lost materials and equipment to furnish materials and equipment in accordance with the Contract Documents, to avoid delaying progress of the Work.

3. Advise ENGINEER in writing when damaged, incomplete, or defective materials and equipment are delivered, and advise ENGINEER of the associated impact on the Progress Schedule.

1.5 HANDLING OF MATERIALS AND EQUIPMENT

A. Provide equipment and personnel necessary to handle materials and equipment, including those furnished by OWNER, by methods that prevent soiling or damaging materials and equipment and packaging.

B. Provide additional protection during handling as necessary to prevent scraping, marring, and otherwise damaging materials and equipment and surrounding surfaces.

C. Handle materials and equipment by methods that prevent bending and overstressing.

D. Lift heavy components only at designated lifting points.

E. Handle materials and equipment in safe manner and as recommended by the manufacturer to prevent damage. Do not drop, roll, or skid materials and equipment off delivery vehicles or at other times during handling. Hand-carry or use suitable handling equipment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 66 00

PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section includes general requirements for storing and protecting materials and equipment.

1.2 STORAGE

A. Store and protect materials and equipment in accordance with manufacturer's recommendations and the Contract Documents.

B. CONTRACTOR shall make all arrangements and provisions necessary for, and pay all costs for, storing materials and equipment. Excavated materials, construction equipment, and materials and equipment to be incorporated into the Work shall be placed to avoid injuring the Work and existing facilities and property, and so that free access is maintained at all times to all parts of the Work and to public utility installations in vicinity of the Work. Store materials and equipment neatly and compactly in locations that cause minimum inconvenience to OWNER, other contractors, public travel, and owners, tenants, and occupants of adjoining property. Arrange storage in manner to allow easy access for inspection.

C. Areas available at the Site for storing materials and equipment are shown or indicated in the Contract Documents, or as approved by ENGINEER.

D. Store materials and equipment to become OWNER's property to facilitate their inspection and ensure preservation of quality and fitness of the Work, including proper protection against damage by freezing, moisture, and high temperatures with ambient temperatures as high as 100 degrees F. Store in indoor, climate-controlled storage areas all materials and equipment subject to damage by moisture, humidity, heat, cold, and other elements, unless otherwise acceptable to OWNER. When placing orders to Suppliers for equipment and controls containing computer chips, electronics, and solid-state devices, CONTRACTOR shall obtain, coordinate, and comply with specific temperature and humidity limitations on materials and equipment, because temperature inside cabinets and components stored in warm temperatures can approach 200 degrees F.

E. CONTRACTOR shall be fully responsible for loss or damage (including theft) to stored materials and equipment.

F. Do not open manufacturer's containers until time of installation, unless recommended by the manufacturer or otherwise specified in the Contract Documents.

G Do not store materials or equipment in structures being constructed unless approved by ENGINEER in writing.

H. Do not use lawns or other private property for storage without written permission of the owner or other person in possession or control of such premises.

1.3 PROTECTION

A. Equipment to be incorporated into the Work shall be boxed, crated, or otherwise completely enclosed and protected during shipping, handling, and storage, in accordance with Section 01 65 00, Product Delivery Requirements.

B. Store all materials and equipment off the ground (or floor) on raised supports such as skids or pallets.

C. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Painted equipment surfaces that are damaged or marred shall be repainted in their entirety in accordance with equipment manufacturer and paint manufacturer requirements, to the satisfaction of ENGINEER.

D. Protect electrical equipment, controls, and instrumentation against moisture, water damage, heat, cold, and dust. Space heaters provided in equipment shall be connected and operating at all times until equipment is placed in operation and permanently connected.

1.4 UNCOVERED STORAGE

A. The following types of materials may be stored outdoors without cover on supports so there is no contact with the ground:

1. No materials shall be uncovered.

1.5 COVERED STORAGE

A. The following materials and equipment may be stored outdoors on supports and completely covered with covering impervious to water:

1. Grout and mortar materials.
2. Masonry units.
3. Soil materials and granular materials such as aggregate.
4. Chemical trench box.
5. PVC and CPVC pipe.

B. Tie down covers with rope, and slope covering to prevent accumulation of water.

C. Store loose granular materials, with covering impervious to water, in well-drained area or on solid surfaces to prevent mixing with foreign matter.

1.6 FULLY PROTECTED STORAGE

A. Unless otherwise approved by ENGINEER and OWNER, store all material and equipment not named in Articles 1.4 and 1.5 of this Section on supports in buildings or trailers that have concrete or wooden flooring, roof, and fully closed walls on all sides. Covering with visquine plastic sheeting or similar material in space without floor, roof, and walls is not acceptable. Comply with the following:

1. Provide heated storage for materials and equipment that could be damaged by low temperatures or freezing.

2. Provide air-conditioned storage for materials and equipment that could be damaged by high temperatures.

3. Protect mechanical and electrical equipment from being contaminated by dust, dirt, and moisture.

4. Maintain humidity at levels recommended by manufacturers for electrical and electronic equipment.

1.7 MAINTENANCE OF STORAGE

A. On scheduled basis, periodically inspect stored materials and equipment to ensure that:

1. Condition and status of storage facilities is adequate to provide required storage conditions.

2. Required environmental conditions are maintained on continuing basis.

3. Materials and equipment exposed to elements are not adversely affected.

B. Mechanical and electrical equipment requiring long-term storage shall have complete manufacturer's instructions for servicing each item, with notice of enclosed instructions shown on exterior of container or package.

1. Comply with manufacturer's instructions on scheduled basis.

2. Space heaters that are part of electrical equipment shall be connected and operated continuously until equipment is placed in service and permanently connected.

1.8 MICROPROCESSORS, PANELS, AND INSTRUMENTATION STORAGE

A. Store panels, microprocessor-based equipment, electronics, and other devices subject to damage or decreased useful life because of temperatures below 40 degrees F or above 100 degrees F, relative humidity above 90 percent, or exposure to rain or exposure to blowing dust in climate-controlled storage space.

B. Requirements:

1. Storage shall be fully protected and climate controlled storage as specified in Article 1.6 of this section.

2. OWNER and ENGINEER have the right to inspect materials and equipment during normal working hours.

3. Placed inside each panel or device a desiccant, volatile corrosion inhibitor blocks (VCI), moisture indicator, and maximum-minimum indicating thermometer.

4. Check panels and equipment at least once per month. Replace desiccant, VCI, and moisture indicator as often as required, or every six months, whichever occurs first.

5. Certified record of daily maximum and minimum temperature and humidity in storage facility shall be available for inspection by OWNER and ENGINEER. Certified record of monthly inspection, noting maximum and minimum temperature for month, condition of desiccant, VCI, and moisture indicator, shall be available for inspection by OWNER and ENGINEER.

C. Costs for storing climate-sensitive materials and equipment shall be paid by CONTRACTOR. Replace panels and devices damaged during storage, or for which storage temperatures or humidity range has been exceeded, at no additional cost to OWNER. Delays resulting from such replacement are causes within CONTRACTOR's control.

D. Do not ship panels and equipment to the Site until conditions at the Site are suitable for installation, including slabs and floors, walls, roofs, and environmental controls. Failure to have the Site ready for installation shall not relieve CONTRACTOR from complying with the Contract Documents.

1.9 RECORDS

A. Keep up-to-date account of materials and equipment in storage to facilitate preparation of Applications for Payment, if the Contract Documents provide for payment for materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 71 23

FIELD ENGINEERING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section includes field engineering, surveying, and layouts by CONTRACTOR, and associated requirements. This Section supplements the General Conditions' provisions on reference points and other matters.

2. CONTRACTOR shall provide field engineering services, surveying and layout services, and professional services of the types indicated for the Project, including:

   a. Furnishing civil, structural, and other professional engineering services specified or required to execute CONTRACTOR's construction methods.

   b. Developing and making all detail surveys and measurements required for construction; including slope stakes, batter boards, and all other working lines, elevations, and cut sheets.

   c. Providing materials required for benchmarks, control points, batter boards, grade stakes, structure and pipeline elevation stakes, and other items.

   d. Keeping a transit, theodolite, or total station (i.e., theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the Site at all times, and having a skilled instrument person available when necessary for laying out the Work.

   e. Being solely responsible for all locations, dimensions and levels. No data other than Change Order, Work Change Directive, or Field Order shall justify departure from dimensions and levels required by the Contract Documents.

   f. Rectifying all Work improperly installed because of not maintaining, not protecting, or removing without authorization established reference points, stakes, marks, and monuments.

   g. Providing such facilities and assistance necessary for ENGINEER and Resident Project Representative (if any) or

Owner's Site Representative (if any) to check lines and grade points placed by CONTRACTOR. Do not perform excavation or embankment work until all cross-sectioning necessary for determining payment quantities for Unit Price Work have been completed and accepted by ENGINEER.

B. Coordination:

1. Review requirements of this and other Sections and coordinate installation of items to be installed with or before field engineering, surveying, and layout Work.

1.2 SUBMITTALS

A. Informational Submittals: Submit the following:

1. Certificates:
   a. When requested by ENGINEER, submit certificate signed by professional engineer or professional surveyor, as applicable, certifying that elevations and locations of the Work comply with the Contract Documents. Explain each deviation, if any.
2. Field Engineering:
   a. Submit daily reports as indicated in this Section.
   b. When requested by ENGINEER, submit documentation verifying accuracy of field engineering.
3. Surveying:
   a. Complete plan for performing survey work, submitted not less than 10 days prior to beginning survey Work.
   b. Example of proposed survey field books to be maintained by CONTRACTOR's surveyor. Example shall have sufficient information and detail, including example calculations and notes, to demonstrate that field books will be organized and maintained in a professional manner in accordance with the Contract Documents.
   c. Submit original field books within two days after completing survey Work.
   d. Submit certified survey in accordance with this Section.
4. Qualifications Statements:
   a. Field Engineer: Name, employer, and professional address. When requested by ENGINEER, submit qualifications, including resume'.

b. Surveyor: Name, employer, and professional address of firm, and resumes of each professional land surveyor and crew chief that will be engaged in survey Work. Submit not less than 10 days prior to beginning survey Work. During the Project, submit resume for each new registered, licensed land surveyor and crew chief employed by or retained by CONTRACTOR not less than 10 days prior to starting on the survey Work.

1.3 CONTRACTOR'S ENGINEERS

A. Qualifications of Field Engineer:

1. Employ and retain at the Site a field engineer with experience and capability of performing all field engineering tasks required of CONTRACTOR, as indicated in this Article and elsewhere in the Contract Documents.

2. CONTRACTOR's field engineer shall possess not less than five years of experience performing duties similar in scope and extent to those required of CONTRACTOR's field engineer on this Project.

B. Responsibilities of Contractor's Field Engineer:

1. Daily Reports:

a. Prepare and maintaining daily reports of activity on the Contract. Submit reports to ENGINEER including the following information:

1) Number of employees at the Site.

2) Number employees at the Site for each Subcontractor.

3) Breakdown of employees by trades.

4) Major equipment and materials installed as part of the Work.

5) Major construction equipment utilized.

6) Location of areas in which construction was performed.

7) Materials and equipment delivered to the Site or suitable, offsite storage location.

8) Work performed, including field quality control and testing.

9) Weather conditions.

10) Safety concerns, events, and precautions taken.

11) Delays encountered, extent of delay incurred, reasons for the delay, and measures that will be taken to rectify delays encountered.

12) Acknowledgement of specific instructions received from ENGINEER or OWNER.

b. Daily reports shall be signed and dated by responsible member of CONTRACTOR's staff, such as CONTRACTOR's project manager, field engineer, or superintendent, or foreman designated by CONTRACTOR as having authority to sign daily reports.

c. Submit = CONTRACTOR's daily reports in accordance with Section 01 31 26, Electronic Communication Protocols, by 9:00 a.m. the next working day after the day covered in the associated report.

2. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment for compliance with the Contract Documents.

3. Continually inspect the Work to ensure that the quality and quantities required by the Contract Documents are provided.

4. Cooperate as required with ENGINEER and Resident Project Representative (if any) in observing the Work and performing field inspections.

5. Check and coordinate the Work for conflicts and interferences, and immediately advise ENGINEER and Resident Project Representative, if any, of all discrepancies of which CONTRACTOR is aware.

6. Maintain field office files and drawings, record documents, and coordinate field engineering services with Subcontractors and Suppliers as appropriate, and other prime contractors (if any).

7. Prepare layout and coordination drawings for construction operations.

8. Review and coordinate the Work with Shop Drawings and CONTRACTOR's other submittals approved or accepted, as applicable, by ENGINEER.

C. Professionals Retained by Contractor (whether or not stationed at the Site):

1. Professional Services that are Not Delegated Professional Design of the Completed Work:

a. Where the Contract Documents require that CONTRACTOR retain a design professional for to carry out CONTRACTOR's responsibilities for construction means, methods, techniques, sequences and procedures (including

temporary construction that will not remain as part of the completed Work), such services shall be performed by a registered professional of the discipline required for specific service on the Project, with valid license in the same jurisdiction as the Site.

b. OWNER and ENGINEER shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed by such design professionals.

1.4 CONTRACTOR'S SURVEYOR

A. Qualifications:

1. Employ or retain the services, as needed, at the Site a surveyor with experience and capability of performing surveying and layout tasks required in the Contract Documents and as required for the Work.

2. CONTRACTOR's surveyor shall possess not less than five years of experience performing duties similar in scope and extent to those required of CONTRACTOR's surveyor on this Project.

3. Surveyor shall be a professional land surveyor registered and licensed in the jurisdiction where the Project is located, or a professional engineer registered and licensed as a professional engineer in the jurisdiction where the Project is located and authorized under Laws and Regulations to practice surveying.

B. Responsibilities of Contractor's Surveyor:

1. Providing required surveying equipment, including transit, theodolite, or total station; level; stakes; and surveying accessories.

2. Establishing required lines and grades for constructing all facilities, structures, pipelines, and site improvements, including outdoor electrical equipment and feeders.

3. Preparing and maintaining professional-quality, accurate, well-organized, legible notes of all measurements and calculations made while surveying and laying out the Work.

4. Prior to backfilling operations, survey, locate, and record on a copy of the Contract Documents accurate representation of buried Work and Underground Facilities provided and encountered.

5. Locating on a site plan of the Site the actual location of above-ground Work to be indicated on record documents.

6. Complying with requirements of the Contract Documents relative to surveying and related Work, including requirements of this Section's Articles 1.5 and 3.1.

1.5 RECORDS

A. Records – General:

1. Maintain at the Site a complete and accurate log of control and survey Work as such Work progresses.

B. Field Books and Records:

1. Survey data and records shall be in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standards of practice in the locality where the Site is located.

2. Original field notes, computations, and other surveying data shall be recorded by CONTRACTOR's surveyor in CONTRACTOR-furnished hard-bound field books and shall be signed and sealed by CONTRACTOR's surveyor.

3. Completeness and accuracy of survey Work, and completeness and accuracy of survey records, including field books, shall be responsibility of CONTRACTOR.

4. Failure to organize and maintain survey records in an appropriate manner that allows reasonable and independent verification of calculations, and to allow identification of elevations, dimensions, and grades of the Work, shall be cause for rejecting the survey records, including field books.

5. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by ENGINEER.

C. Certified Survey of Surface Structures:

1. Upon completion of foundation walls and major site improvements, prepare a certified survey, signed and sealed by professional surveyor, showing or indicating dimensions, locations, angles and elevations of construction and locations and elevations of Underground Facilities installed and encountered during the Work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 SURVEYING

A. Reference Points:

1. Refer the General Conditions, as may be modified by the Supplementary Conditions, for requirements regarding reference points.

2. OWNER's established reference points that are damaged or destroyed by CONTRACTOR will be re-established by OWNER at CONTRACTOR's expense. OWNER may deduct from payments owed CONTRACTOR such amounts as set-offs in accordance with the Contract Documents.

3. From OWNER-established reference points, establish lines, grades, and elevations necessary to control the Work. Obtain measurements required for executing the Work to tolerances specified in the Contract Documents.

4. Establish, place, and replace as required, such additional stakes, markers, and other reference points necessary for control, intermediate checks, and guidance of construction operations.

B. Surveys to Determine Quantities for Payment:

1. For each application for progress payment, perform such surveys and computations necessary to determine quantities of Work performed or placed. Perform surveys necessary for ENGINEER to determine final quantities of Work in place.

2. Notify ENGINEER not less than 24 hours before performing survey services for determining quantities to be included in Application for Payment. Unless waived in writing by ENGINEER, perform quantity surveys in presence of ENGINEER or Resident Project Representative (if any).

C. Construction Surveying: Comply with the following:

1. Alignment Staking: Provide alignment stakes at 50-foot intervals on tangent, and at 25-foot intervals on curves.

2. Slope Staking: Provide slope staking at 50-foot intervals on tangent, and at 25-foot intervals on curves. Re-stake at every ten-foot difference in elevation.

3. Structure: Stake-out structures, including elevations, and check prior to and during construction.

4. Pipelines: Stake-out pipelines including elevations, and check prior to and during construction.

5. Roads, Drives, and Paved Areas: Stake-out roadway, driveway, and paved area elevations at 50-foot intervals on tangent, and at 25-foot intervals on curves.

6. Cross-sections: Provide original, intermediate, and final staking as required, for site work other locations as necessary for quantity surveys.

7. Easement Staking: Provide easement staking at 50-foot intervals on tangent, and at 25-foot intervals on curves. Also provide wooden laths with flagging at maximum intervals of 100 feet.

8. Record Staking: Provide permanent stake at each blind flange and each utility cap provided for future connections. Stakes for record staking shall be material acceptable to ENGINEER.

D. Accuracy:

1. Establish CONTRACTOR's temporary survey references points for CONTRACTOR’s use to not greater than second-order accuracy (e.g., 1:10000). Construction staking used as a guide for the Work shall be set at not greater than third-order accuracy (e.g., 1:5000). Basis on which such orders are established shall provide the absolute margin for error specified below.

2. Horizontal accuracy of easement staking shall be plus or minus 0.1 feet. Accuracy of other staking shall be plus or minus 0.04 feet horizontally and plus or minus 0.02 feet vertically.

3. Survey calculations shall include an error analysis sufficient to demonstrate required accuracy.

+ + END OF SECTION + +

SECTION 01 71 23.16

CONSTRUCTION SURVEYING

PART 1 – GENERAL

1.1 SCOPE:

A. Construction surveying shall include all of the surveying work required to layout the Work and control the location of the finished Project. The Contractor shall have the full responsibility for constructing the Project to the correct horizontal and vertical alignment, as shown on the Drawings, as specified, or as directed by the Engineer. The Contractor shall assume all costs associated with rectifying work constructed in the wrong location.

B. From the information shown on the Drawings and the information to be provided as indicated under Project Conditions below, the Contractor shall:

1. Be responsible for setting reference points and/or offsets, establishment of baselines, and all other layout, staking, and all other surveying required for the construction of the Project.

2. Safeguard all reference points, stakes, grade marks, horizontal and vertical control points, and shall bear the cost of re-establishing same if disturbed.

3. Stake out the permanent and temporary easements or the limits of construction to ensure that the Work is not deviating from the indicated limits.

4. Be responsible for all damage done to reference points, baselines, center lines and temporary bench marks, and shall be responsible for the cost of re-establishment of reference points, baselines, center lines and temporary bench marks as a result of the operations.

C. Baselines shall be defined as the line to which the location of the Work is referenced, i.e., edge of pavement, road centerline, property line, right-of-way or survey line.

D. Record Drawing surveys shall be performed in accordance with Section 01 78 39.

1.2 PROJECT CONDITIONS:

A. The Drawings provide the location and/or coordinates of principal components of the Project. The alignment of some components of the Project may be indicated in the Specifications. The Engineer may order changes to the location of some of the components of the Project or provide clarification to questions regarding the correct alignment.

B. The location and elevation of benchmarks are shown on Drawings.

C. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.

1.3 QUALITY ASSURANCE:

A. The Contractor shall furnish documentation, prepared by a surveyor currently registered in the State of Georgia, confirming that staking is being done to the horizontal and vertical alignment shown in the Contract Documents. This requires that the Contractor hire, at the Contractor's own expense, a currently registered surveyor, acceptable to the Owner, to provide ongoing construction staking or confirmation of such.

B. Any deviations from the Drawings shall be confirmed by the Engineer prior to construction of that portion of the Project.

C. Construction Verification Surveying

1. The Engineer may verify the Contractor’s reference points, centerlines and work performed. This verification activity in no way relieves the Contractor of the responsibility of installing reference points, centerlines, temporary benchmarks, verifying that the work has been performed accurately, and all other work covered by this Section.

1.4 SITE WORK:

A. Staking Precision: The precision of construction staking shall match the precision of a component’s location indicated on the Drawings. Staking of utilities shall be done in accordance with generally accepted practice for the type of utility.

B. Written certification, by a licensed surveyor, that structure base grade and structure locations match the locations shown on the Drawings is required prior to beginning construction of the structure.

C. Paved Surfaces: The Contractor shall establish a reference point for establishing and verifying the paving subgrade and finished grade elevations. Any variance with plan grades shall be identified by the Contractor and confirmed by the Engineer prior to constructing the road base.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 71 33

PROTECTION OF THE WORK AND PROPERTY

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section includes general requirements for safety and protection that augment the requirements of the General Conditions, as may be modified by the Supplementary Conditions. This Section also includes requirements for barricades and warning signals, and protection of trees and plants, existing structures, floors, roofs, installed items, and landscaping.

2. CONTRACTOR shall be responsible for taking all precautions, providing all programs, and taking all actions necessary to protect personnel health and safety, and to protect the Work and all public and private property and facilities from damage, as specified in the General Conditions, Supplementary Conditions, and the Specifications.

3. To prevent damage, injury, or loss, CONTRACTOR's actions shall include the following:

   a. Provide measures for safety of personnel at the Site, including workers engaged in the Work, delivery personnel, testing and inspection personnel, personnel of authorities having jurisdiction, other visitors to the Site, the public, OWNER's personnel, facility manager's personnel (if different from OWNER), ENGINEER, and Resident Project Representative (if any).

   b. Storing apparatus, materials, supplies, and equipment in an orderly, safe manner that does not unduly interfere with progress of the Work or work of other contractors, utility owners, and owners of transportation rights-of-way.

   c. Providing suitable storage facilities for materials and equipment subject to damage or degradation by exposure to climate, temperature, theft, breakage, or other cause.

   d. Placing upon the Work or any part thereof only loads consistent with the safety and integrity of that portion of the Work and existing construction.

e. Frequently removing and disposing of refuse, rubbish, scrap materials, and debris caused by CONTRACTOR's operations so that, at all times, the Site is safe, orderly, and workmanlike in appearance.

f. Providing temporary barricades, fencing, and guard rails around the following: openings, scaffolding, temporary stairs and ramps, around excavations, for elevated walkways, and other areas that may present a fall-hazard or hazard to vehicles.

4. Do not, except after written consent from proper parties, enter or occupy privately-owned property or premises with personnel, tools, materials or equipment, except on lands and easements provided by OWNER.

5. CONTRACTOR has full responsibility for preserving public and private property and facilities on and adjacent to the Site. Direct or indirect damage done by, or on account of, any act, omission, neglect, or misconduct by CONTRACTOR in executing the Work, shall be remedied by CONTRACTOR, at his expense, to condition equal to that existing before damage was done.

6. Owner May Remedy:

a. Should CONTRACTOR fail to protect and safeguard property and the Work after requests from ENGINEER or OWNER, OWNER may implement measures to protect property and the Work.

b. Cost of such OWNER-implemented measures shall be paid by CONTRACTOR. OWNER may deduct from payments due CONTRACTOR such amounts as set-offs in accordance with the Contract Documents.

c. Such right, however, shall not result in any obligation by OWNER or ENGINEER to continuously monitor or have responsibility for protection of property and the Work, which responsibility is exclusively CONTRACTOR's.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 BARRICADES AND WARNING SIGNALS

A. Barricades and Warning Signals – General:

1. Where the Work is performed on or adjacent to roadway, access road or driveway, right-of-way, or public place:
    a. Provide temporary barricades, fences, lights, warning signs, danger signals, watchmen, and take other precautionary measures for protecting persons, property, and the Work.
    b. Use appropriately colored and reflective barricades, or paint barricades accordingly, to be visible at night.
    c. From sunset to sunrise, provide and maintain not less than one temporary light at each barricade.
    d. Erect sufficient barricades to keep vehicles from being driven on or into Work under construction.
    e. Furnish watchmen in sufficient numbers to protect the Work.
2. Provide temporary barricades to protect personnel and property for Work not in or adjacent to transportation routes and vehicular travel areas, including indoor work, in accordance with Laws and Regulations.
3. CONTRACTOR's responsibility for maintaining temporary barricades, signs, lights, and for providing watchmen shall continue until the Work is substantially complete in accordance with the Contract Documents, unless other provision for security and protection is agreed to by the parties. After Substantial Completion, protect Work and property during periods when final Work or corrective Work is underway.

B. Temporary Fencing:

3.2 TREE AND PLANT PROTECTION

A. Tree and Plant Protection – General:

1. Protect existing trees, shrubs, and plants on or adjacent to the Site, shown or designated to remain in place, against unnecessary cutting, breaking, damage, or skinning of trunk, branches, bark, and roots.
2. Do not store materials or equipment or park construction equipment and vehicles within foliage drip lines.
3. In areas subject to traffic, provide temporary fencing or temporary barricades to protect trees and plants.
4. Open fires are not allowed onsite.
5. Within the limits of the Work, water trees and plants that are to remain to maintain their health during construction operations.
6. Cover exposed roots with burlap, and keep such burlap continuously wet. Cover exposed roots with earth as soon as possible. Protect root

systems from mechanical damage and damage by erosion, flooding, runoff, and noxious materials in solution.

7. If branches or trunks are damaged, prune branches immediately and protect cut or damaged areas with emulsified asphalt compounded specifically for horticultural use, in manner acceptable to ENGINEER.

8. When directed by ENGINEER, remove and dispose of at location away from the Site damaged trees and plants that die or suffer permanent injury, and replace each damaged tree or plant with specimen of equal or better species and quality.

3.3 PROTECTION OF EXISTING STRUCTURES

A. Underground Facilities:

1. Underground Facilities known to OWNER and ENGINEER, except water, gas, sewer, electric, and communications services to individual buildings and properties, are shown. Information shown for Underground Facilities is the best available to OWNER and ENGINEER but, in accordance with the General Conditions, as may be modified by the Supplementary Conditions, is not guaranteed to be correct or complete.

2. CONTRACTOR shall explore ahead of trenching and excavating Work and shall sufficiently uncover Underground Facilities that will or may interfere with the Work to determine their location, to prevent damage to Underground Facilities, and to prevent service interruption to structures and properties served by Underground Facilities. If CONTRACTOR damages an Underground Facility, CONTRACTOR shall restore it to its pre-construction condition, in accordance with requirements of the owner of the damaged facility and the Contract Documents.

3. Necessary changes in the location of the Work may be directed by ENGINEER to avoid Underground Facilities not shown or indicated on the Contract Documents.

4. If permanent relocation of an existing Underground Facilities is required and is not otherwise shown or indicated in the Contract Documents, CONTRACTOR may be directed in writing to perform the required work. When such relocation Work results in a change in the Contract Price, Contract Times, the associated Contract modification procedures and payment for such Work shall be in accordance with the Contract Documents.

B. Surface Structures:

1. Surface structures are existing buildings, structures, and other facilities at or above ground surface, including their foundations and any extension below ground surface. Surface structures include, but are not limited to, buildings, tanks, walls, bridges, roads, dams, channels, open drainage routes, exposed piping and utilities, poles, exposed wires, posts, signs, markers, curbs, walks, fencing, and other facilities visible at or above ground surface.

2. Existing surface facilities, including but not limited to guard rails, posts, guard cables, signs, poles, markers, curbs, and fencing, that are temporarily removed to facilitate the Work shall be replaced and restored to their pre-construction condition at CONTRACTOR's expense.

C. Protection of Underground Facilities and Surface Structures:

1. CONTRACTOR shall sustain in their places and protect from direct or indirect injury all Underground Facilities and surface structures located within or adjacent to the limits of the Work. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure or facility.

2. Before proceeding with the Work of sustaining and supporting such structure or facility, CONTRACTOR shall satisfy ENGINEER that methods and procedures to be used have been approved by party owning same.

3. CONTRACTOR shall bear all risks attending the presence or proximity of all Underground Facilities and surface structures within or adjacent to limits of the Work, in accordance with the Contract Documents.

4. CONTRACTOR shall be responsible for damage and expense for direct or indirect injury, caused by CONTRACTOR's activities, to structures and facilities. CONTRACTOR shall promptly repair damage caused by CONTRACTOR's activities, to the satisfaction of owner of damaged structure or facility.

5. Protection of Underground Facilities Under Roads and Parking Areas: Provide temporary, heavy-duty steel roadway plates to protect existing manholes, handholes, valve boxes, vaults, and other Underground Facilities near to or visible at the ground surface.

3.4 PROTECTION OF FLOORS AND ROOFS

A. Protection of Floors and Roofs – General:

1. Use proper protective covering when moving equipment, handling materials or other loads, when painting, handling mortar or grout, and when cleaning walls, ceilings, or structure contents.

2. Use metal pans to collect oil and cuttings from piping, conduits, and rod threading machines, and under metal cutting machines.

3. Do not load concrete floors less than 28 days old without written permission of ENGINEER. Do not load floors, roofs, or slabs in excess of design loading.

4. Do not load roofs without written permission of ENGINEER.

5. Restrict access to roofs, and keep CONTRACTOR personnel off existing roofs, except as required for the Work.

6. If access to roofs is required, roofing, parapets, openings, and all other construction on or adjacent to roof shall be protected with suitable plywood or other acceptable means.

3.5 PROTECTION OF INSTALLED MATERIALS, EQUIPMENT, AND LANDSCAPING

A. Protect installed Work to prevent damage from subsequent operations. Remove protective items when no longer needed, prior to Substantial Completion of the Work.

B. Control traffic to prevent damage to equipment, materials, and surfaces.

C. Coverings:

1. Provide temporary coverings to protect materials and equipment from damage.

2. Cover projections, wall corners and jambs, sills, and soffits of openings, in areas used for traffic and for passage of materials and equipment in subsequent work.

+ + END OF SECTION + +

SECTION 01 73 19

INSTALLATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. This Section describes general requirements for installing materials and equipment. Additional installation requirements are included in the various Specifications Sections in Divisions 02 through 49 and elsewhere in the Contract Documents.
   2. CONTRACTOR shall provide all labor, materials, equipment, services, tools, and incidentals required to install materials and equipment.

1.2 QUALITY ASSURANCE

A. General:
   1. Provide appropriate quality assurance for installing materials and equipment, and provide quality control over Suppliers, materials and equipment, services, Site conditions, and workmanship, to provide Work of the required quality.

B. Qualifications:
   1. Installer:
      a. Installers shall be experienced in the types of Work required, including, but not limited to, the requirements of Section 01 42 00, References, and the Division 02 through 49 Specifications where the particular element of the Work is specified.

C. Regulatory Requirements: Comply with the following:
   1. 29 CFR 1910, OSHA.

PART 2 – PRODUCTS

2.1 EQUIPMENT DRIVE GUARDS

A. Equipment Drive Guards – General:
   1. Unless otherwise shown or indicated, provide all-metal guards complying with 29 CFR 1910, Subpart O, with equipment driven by open shafts, belts, chains, pulleys, sheaves, or gears. Guards shall enclose drive and driven mechanism.

2. If material of guards are not otherwise specified, guards shall be galvanized sheet steel, galvanized woven wire, or expanded metal set in a frame of galvanized steel members, as appropriate.
3. Secure guards in position by steel braces or straps, securely fastened to frame of equipment, floor, or wall as required.
4. Fastenings shall allow removal of guards for servicing equipment.

2.2 MISCELLANEOUS MATERIALS

A. Shims shall be Type 304L stainless steel, clean and free of slag.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:
   1. Installation Instructions and Requirements:
      a. Install materials and equipment in accordance with approved Shop Drawings and CONTRACTOR's other submittals approved by ENGINEER, the Contract Documents, and manufacturer's installation instructions. When manufacturer's installation instructions conflict with the Contract Documents, obtain interpretation or clarification from ENGINEER before proceeding.
      b. Manufacturer's installation instructions include manufacturer's written instructions; drawings; illustrative, wiring and schematic diagrams; diagrams identifying external connections, terminal block numbers and internal wiring; and other such information pertaining to installation of materials and equipment. Included are all of manufacturer's printed installation instructions, including those that may be attached to equipment upon delivery.
   2. Prior to installing materials and equipment, complete preparation of surfaces on which materials and equipment are to be installed. Prior to installing materials and equipment on new concrete, concrete shall achieve sufficient compressive strength to support the materials and equipment.
   3. Maintain the work area in a broom-clean condition while installing materials and equipment.
   4. Use proper tools to assemble materials and equipment. Do not deform or mar surface of shafts, nuts, and other parts.
   5. Do not support rigging from building or structure without written permission of ENGINEER. CONTRACTOR is responsible for and shall repair damage to building or structure resulting from CONTRACTOR's operations, in accordance with Section 01 71 33, Protection of the Work and Property.
   6. During installation, maintain materials and equipment in neutral position and do not exert undue stress on materials and equipment.

7. Tighten connections requiring gaskets evenly all around to ensure uniform stress over entire gasket.
8. Use only an oil bath heater to expand couplings, gears, and other mechanical components to be expanded for installation. Do not force or drive couplings, gears, and other mechanical components onto equipment shafts, or subject such items to open flame or torch.
9. Do not alter or repair materials and equipment and do not burn or weld materials and equipment unless required in the Contract Documents or allowed by ENGINEER.
10. Provide plugs in lubrication holes to prevent entry of foreign matter.

B. Setting and Erection:
   1. Install materials and equipment plumb, level, true, and free of rack unless 1otherwise shown or indicated, and demonstrate plumbness and level to ENGINEER. Bring parts to proper bearing after installation and erection.
   2. Anchorages:
      a. Provide anchorage setting drawings in time to coordinate with fabrication of materials and equipment and the Work.
      b. Anchorages shall comply with Section 05 05 33, Anchor Systems. Requests for approval of substitute materials or methods of anchorage shall be in accordance with the General Conditions, Supplementary Conditions, and Section 01 25 00, Substitution Procedures.
   3. Shimming:
      a. Wedging is not allowed.
      b. During installation, use the minimum number of shims required for leveling the equipment.
      c. Provide shims, filling pieces, keys, packing, grouting of the type required by the Contract Documents, and other materials and equipment necessary to properly align, level, and secure apparatus in place.
   4. Installing Equipment onto Foundations:
      a. Using experienced millwrights, carefully set and align equipment on foundations, after equipment soleplates or baseplates (as applicable) have been shimmed to true alignment at anchorages.
      b. Set anchorages in place and tighten nuts against shims.
      c. Check bedplates or wing feet of equipment after securing to foundations and, after confirming alignments, grout soleplates or baseplates (as applicable) in place in accordance with the Contract Documents.
   5. Ream misaligned holes. Do not “force” bolts or keys.
   6. Where applicable, properly align equipment with associated piping and utility connections, without exerting undue stress on connecting piping and utilities.

C. Alignment and Leveling:
   1. Verify that all shafts, couplings, and sheaves are properly aligned and adjust to required tolerances.
   2. Align couplings while equipment is free of external loads.

3. Check angular and parallel alignment and record actual alignment and submit to ENGINEER. Alignment shall be within tolerances specified in Contract Documents and as recommended by Supplier of the material or equipment item.
4. Use laser indicators or dial indicators for checking angular and parallel alignment. Using dial indicators requires that, during rotation of half-couplings in performing testing, dial indicator shall be maintained in same relative position, and dial indicator readings taken at same place on circumference of coupling.

D. Threaded Connections:
1. Apply a molybdenum disulfide, anti-seize compound to threads in mechanical connections such as bolts, studs, cap screws, tubing, and other threads, unless otherwise shown or indicated.

3.2 FIELD QUALITY CONTROL

A. Supplier's Services:
1. When specified, provide competent, qualified representatives of material or equipment Supplier to perform services required, including: supervising installation, checking the completed installation, adjusting, testing of materials and equipment, and where required instructing operations and maintenance personnel in the use and care of materials and equipment.

+ + END OF SECTION + +

SECTION 01 73 24

CONNECTIONS TO EXISTING FACILITIES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. This Section includes requirements for connections to existing facilities. Requirements for tie-ins and shutdowns necessary to complete the Work are in Section 01 14 16, Coordination with Owner's Operations.
   2. CONTRACTOR shall provide labor, materials, tools, equipment, and incidentals shown, specified, and required for performing connections to existing facilities.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate Work that will be performed with or before the Work specified in this Section.

C. Related Sections:
   1. Section 01 14 16, Coordination with Owner's Operations.

   3. Section 01 73 29, Cutting and Patching.

D. General:
   1. Requirements for shutdowns, tie-ins, and other provisions on connections to existing facilities, are indicated in Section 01 14 16, Coordination with Owner's Operations.
   2. Requirements for temporary pumping for connections to existing facilities are in Section 01 14 16, Coordination with Owner's Operations
   3. Requirements for cutting and patching are in Section 01 73 29, Cutting and Patching.
   4. To extent possible, materials, equipment, systems, piping, and appurtenances that will be placed into service upon completion of connection to existing facilities shall be checked, successfully tested, and in condition for operation prior to making connections to existing facilities, if valves, gates, or similar watertight and gastight isolation devices are not provided at the connection point.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 – GENERAL

1.1 SCOPE:

A. The work under this Section includes, but is not necessarily limited to, cutting and patching work as indicated on the Drawings, herein specified and as necessary for proper and complete performance of the Work.

B. Requirements for cutting and patching may be described in various sections of these Specifications.

C. Execute cutting, including excavating and filling, or patching of work required to:

1. Make several parts fit properly.

2. Uncover work to provide for installation of ill-timed work.

3. Remove and replace defective work.

4. Remove and replace work not conforming to requirements of the Contract Documents.

5. Remove samples of the installed work as specified for testing.

6. Install specified work in existing construction.

D. In addition, upon written instruction of the Engineer:

1. Uncover work to provide for the Engineer's observation of covered work.

2. Remove samples of the installed materials for testing.

3. Remove work to provide for alteration of existing work.

E. Protection of Work:

1. Do not endanger any work by cutting or altering the Work or any part of it.

2. Do not cut or alter the work of another contractor without written consent of the Engineer.

1.2 SUBMITTALS:

A. Prior to cutting which affects the structural safety of the Project or the work of another contractor, submit a written notice to the Engineer requesting consent to proceed with cutting. The notice shall include:

1. Identification of Project.

2. Description of defective Work.

3. Necessity for cutting.

4. Affect on other work or on the structural integrity of the Project.
5. Description of the proposed work including:
    a. Scope of cutting and patching
    b. Subcontractor and trades to execute work
    c. Products proposed to be used
    d. Extent of refinishing
6. Alternatives to cutting and patching.
7. Designation of party responsible for the cost of cutting and patching.

B. Cost Estimate: Prior to cutting and patching performed on instruction of the Engineer, submit a cost estimate.

C. Should conditions of the Work or the schedule necessitate alternative materials or methods, submit a written recommendation to the Engineer that includes:
1. Compelling conditions for alternative materials or methods.
2. Recommended alternative materials or methods.
3. Submittals as required for substitutions.

D. Uncovered Work: Submit written notice to the Engineer designating the time the work will be uncovered for the Engineer's observation.

1.3 PAYMENT FOR COST:

A. Contractor's Costs: Costs caused by ill-timed or defective work or work not conforming to the Contract Documents, including costs for additional services of the Engineer, shall be paid by the Contractor.

B. Owner's Costs: Cost of work done as the result of the Engineer’s/Owner’s instructions, which is not shown on the Drawings or specified, other than defective or non-conforming work, will be paid for by the Owner.

PART 2 – PRODUCTS

2.1 MATERIALS:

A. All products and materials shall conform to the requirements of the Specifications for the type of work being performed, except where no products are specified in these Specifications for the item being replaced; then the products and materials shall be of an equivalent type, quality, thickness and width of the item removed.

PART 3 – EXECUTION

3.1 INSPECTION:

A. Inspect existing conditions of the Work including elements subject to movement or

damage during cutting and patching, or excavating and backfilling.

B. After uncovering work, inspect conditions affecting the installation of new products.

3.2 PREPARATION:

A. Provide shoring, bracing and support as required to maintain structural integrity of the Project.

B. Provide protection for other portions of the Project and provide protection from the elements.

3.3 PERFORMANCE:

A. Execute fitting and adjustments of products to provide finished installation that complies with specified tolerances and finishes.

B. Execute cutting and demolition by means that will prevent damage to other work and will provide proper surfaces to receive installation of repairs and new work.

C. Execute excavating and backfilling as specified in Division 31 Earthwork.

D. Restore work which has been cut or removed and install new products to provide completed work in accordance with the requirements of the Contract Documents.

E. Refinish entire surfaces as necessary to provide an even finish. Continuous surfaces shall be refinished to the nearest intersection and assemblies shall be entirely refinished.

+ + END OF SECTION + +

SECTION 01 74 05

CLEANING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. This Section includes requirements for keeping the Site free of accumulations of waste materials during construction ("progress cleaning") and cleaning for Substantial Completion and prior to final inspection (collectively, "closeout cleaning").
   2. CONTRACTOR shall perform cleaning during the Project, including progress cleaning, upon completion of the Work, and as required by the General Conditions, as may be modified by the Supplementary Conditions, and this Section.
   3. Maintain in a clean manner the Site, the Work, and areas adjacent to or affected by the Work.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. NFPA 241, Safeguarding Construction, Alteration, and Demolition Operations.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PROGRESS CLEANING

A. General:
   1. Clean the Site, work areas, and other areas occupied by CONTRACTOR not less than weekly. Dispose of materials in accordance with the General Conditions, as may be modified by the Supplementary Conditions, and the following:
      a. Comply with NFPA 241 for removing combustible waste materials and debris.
      b. Do not hold non-combustible materials at the Site more than three days if the temperature is expected to rise above 80 degrees F. When temperature is less than 80 degrees F, dispose of non-combustible materials within seven days of their generation.
      c. Provide suitable containers for storage of waste materials and debris.

d. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately.

B. Site:
   1. Keep outdoor, dust-generating areas wetted down or otherwise control dust emissions.
   2. Not less than weekly, brush-sweep roadways and paved areas at the Site that are used by construction vehicles or otherwise affected by construction activities.
   3. Comply with dust control requirements of Section 01 57 05, Temporary Controls, and Section 01 41 27, Earthmoving Permit and Dust Control.

C. Work Areas:
   1. Clean areas where the Work is in progress to maintain the extent of cleanliness necessary for proper execution of the Work.
   2. Remove liquid spills promptly. Immediately report spills to OWNER, ENGINEER, and authorities having jurisdiction, in accordance with the Contract Documents and Laws and Regulations.
   3. Where dust would impair proper execution of the Work, broom-clean or vacuum entire work area, as appropriate.
   4. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

D. Installed Work:
   1. Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of material or equipment installed, using only cleaning agents and methods specifically recommended by material or equipment manufacturer. If manufacturer does not recommend specific cleaning agents or methods, use cleaning agents and methods that are not hazardous to health and property and that will not damage exposed surfaces.

E. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration until Substantial Completion.

F. Cutting and Patching:
   1. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, trailings and cuttings, and similar materials.
   2. Thoroughly clean piping, conduits, and similar features before applying patching material, paint, or other finishing materials. Restore damaged coverings on piping, ducting, and similar items to its pre-construction condition.

G. Cleaning of Hydraulic Structures: Clean hydraulic structures that will contain fluid, such as tanks and channels, in accordance with this Section and Section 01 45 53, Cleaning, Testing, and Disinfecting Hydraulic Structures.

H. Waste Disposal:

1. Properly dispose of waste materials, surplus materials, debris, and rubbish off the Site.
2. Do not burn or bury rubbish and waste materials at the Site.
3. Do not discharge volatile or hazardous substances, such as mineral spirits, oil, or paint thinner, into storm sewers or sanitary sewers.
4. Do not discharge wastes into surface waters or drainage routes.
5. CONTRACTOR is solely responsible for complying with Laws and Regulations regarding storing, transporting, and disposing of waste generated by CONTRACTOR's operations or brought to the Site by CONTRACTOR.

I. During handling and installation of materials and equipment, clean and protect construction in progress and adjoining materials and equipment already in place. Apply protective covering where required for protection from damage or deterioration, until Substantial Completion.

J. Clean completed construction as frequently as necessary throughout the construction period.

3.2 CLOSEOUT CLEANING

A. Complete the following prior to requesting inspection for Substantial Completion:
1. Clean and remove from the Site rubbish, waste material, debris, and other foreign substances.
2. Sweep paved areas broom-clean. Remove petrochemical spills, stains, and other foreign deposits.
3. Hose-clean sidewalks and loading areas.
4. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
5. Leave surface waterways, drainage routes, storm sewers, and gutters open and clean.
6. Repair pavement, roads, sod, and other areas affected by construction operations and restore to specified condition; if condition is not specified, restore to pre-construction condition.
7. Clean exposed exterior and interior hard-surfaced finishes to dirt-free condition, free of spatter, grease, stains, fingerprints, films, and similar foreign substances.
8. Clean, wax, and polish wood, vinyl, and painted floors.
9. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, and similar spaces.
10. In unoccupied spaces, sweep concrete floors broom-clean.
11. Clean transparent materials, including mirrors and glazing in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
12. Remove non-permanent tags and labels.
13. Surface Finishes:

a. Touch-up and otherwise repair and restore chipped, scratched, dented or otherwise marred surfaces to specified finish and match adjacent surfaces.
b. Do not paint over "UL" or similar labels, including mechanical and electrical nameplates.

14. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint, and mortar droppings, and other foreign substances.
15. Clean plumbing fixtures to sanitary condition, free of stains, including stains resulting from water exposure.
16. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
17. Clean lighting fixtures, lamps, globes, and reflectors to function with full efficiency. Replace temporary lamps provided in permanent fixtures. Replace existing lighting fixture components that are burned out or noticeably dimmed from use during construction. Replace defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
18. Leave the Site clean, and in neat, orderly condition, satisfactory to OWNER and ENGINEER.

B. Complete the following prior to requesting final inspection:
1. Following completion of the Work on the "punch list" of Work uncompleted at Substantial Completion, clean in accordance with Paragraph 3.2.A of this Section.

+ + END OF SECTION + +

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall comply with the requirements and procedures for construction waste management and disposal, including:

a. Minimizing construction waste and debris and reusing, salvaging, and recycling to specified extent.

2. Extent of required construction waste management and disposal includes:

a. Construction waste management disposal within the Project limits, as shown or indicated.

B. Coordination:

1. Coordinate salvaging, recycling, and disposing of waste as specified under this and other Sections.

C. Related Sections:

1. Section 01 31 13, Project Coordination

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from the Site and properly dispose of waste in facility such as permitted landfill or incinerator or other method acceptable to authorities having jurisdiction.

1. Except as otherwise specified, remove from the Site all waste and debris from the Work as it accumulates. Upon completion of the Work, remove materials, equipment, waste, and debris and leave the Site clean, neat, and orderly. Comply with the Contract Documents regarding cleaning and removal of trash, debris, and waste.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Disposal: Transport waste materials to proper location at site other than OWNER's property for disposal in accordance with Laws and Regulations.

+ + END OF SECTION + +

SECTION 01 75 11

CHECKOUT AND STARTUP PROCEDURES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall initially start up and place equipment installed under the Contract into successful operation, in accordance with the equipment manufacturer's written instructions and as instructed by Supplier at the Site.

2. Provide all material, labor, tools, and equipment required to complete equipment checkout and start-up except as may be specifically noted otherwise.

3. Provide lubricants and other required operating fluids in sufficient quantity for equipment testing, start-up and initial operation until the CONTRACTOR has achieved Substantial Completion for the Project and the OWNER is able to begin full time continuous operation of the Project, unless otherwise shown or noted. OWNER will supply treatment chemicals for start-up.

4. Provide electricity, fuel, water, filters, and other expendables required for startup of equipment, unless otherwise specified. OWNER will pay for electricity.

5. General Activities Include:

a. Cleaning, as required under other provisions of the Contract Documents.

b. Removing temporary protective coatings.

c. Flushing and replacing lubricants, where required by manufacturer.

d. Lubrication.

e. Checking shaft and coupling alignments and resetting where required.

f. Checking and setting motor, pump, and other equipment rotation, safety interlocks, and belt tensions.

g. Checking and correcting (if necessary) leveling plates, grout, bearing plates, anchorage devices, fasteners, and alignment of piping, conduits, and ducts that may place stress on the connected equipment.

h. All adjustments required.

B. Coordination:

1. Coordinate checkout and start-up with other contractors, as necessary.

2. Do not start up system or subsystem for continuous operation until all components of that system or subsystem, including instrumentation and controls, have been tested to the extent practicable and proven to be operable as intended by the Contract Documents.

3. OWNER will provide sufficient personnel to assist CONTRACTOR in starting up equipment, but responsibility for proper operation is CONTRACTOR's.

4. Supplier shall be present during checkout, start-up, and when equipment is initially started up and placed into operation, unless otherwise acceptable to ENGINEER.

5. Start-up of heating and air conditioning equipment and systems is dependent upon the time of year. Return to the Site at beginning of next heating or air conditioning season (as applicable) to recheck and start the appropriate systems.

6. Do not start up system, unit process, or equipment without submitting acceptable preliminary operations and maintenance manuals by CONTRACTOR, in accordance with Section 01 78 23, Operations and Maintenance Data.

C. OWNER's Assumption of Responsibility for Equipment and Systems:

1. OWNER will assume responsibility for the equipment upon Substantial Completion.

2. Prior to turning over to OWNER responsibility for operating and maintaining system or equipment:

a. Complete system field quality control testing in accordance with the Contract Documents.

b. Submit acceptable final operations and maintenance manuals in accordance with Section 01 78 23, Operations and Maintenance Data.

c. Obtain from ENGINEER final certificate of Substantial Completion for either entire Work or the portion being turned over to OWNER.

1.2 SUBMITTALS

A. Closeout Submittals: Submit the following:

1. Certifications:

a. Supplier's certification of installation in accordance with Paragraph 3.1.B of this Section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 SERVICES OF SUPPLIER

A. When specified, furnish services of competent, qualified representatives of material and equipment manufacturers as specified, including supervising installation, adjusting, checkout, start-up, and testing of materials and equipment.

B. Certification:

1. When services by Supplier are required at the Site, within 14 days after first test operation of equipment, submit to ENGINEER a letter from Supplier, on Supplier's letterhead, stating that materials and equipment are installed in accordance with Supplier's requirements and installation instructions, and in accordance with the Contract Documents.

2. In lieu of Supplier letter, submit completed form attached to this Section.

3. Include in the final operations and maintenance manual for the associated equipment a copy of the letter or completed form, as applicable.

3.2 MINIMUM START-UP REQUIREMENTS

A. Bearings and Shafting:

1. Inspect for cleanliness, and clean and remove foreign matter.

2. Verify alignment.

3. Replace defective bearings and those that operate in a rough or noisy manner.

4. Grease as necessary, in accordance with manufacturer's recommendations.

B. Drives:

1. Adjust tension in V-belt drives and adjust vari-pitch sheaves and drives for proper equipment speed.

2. Adjust drives for alignment of sheaves and V-belts.

3. Clean and remove foreign matter before starting operation.

C. Motors:

1. Check each motor for comparison to amperage nameplate value.

2. Correct conditions that produce excessive current flow and conditions that exist due to equipment malfunction.

D. Pumps:

1. Check glands and seals for cleanliness and adjustment before running pump.
2. Inspect shaft sleeves for scoring.
3. Inspect mechanical faces, chambers, and seal rings, and replace if defective.
4. Verify that piping system is free of dirt and scale before circulating liquid through pump.

E. Valves:

1. Inspect manual and automatic control valves, and clean bonnets and stems.
2. Tighten packing glands to ensure no leakage, but allow valve stems to operate without galling.
3. Replace packing in valves to retain maximum adjustment after system is determined to be complete.
4. Replace packing on valves that continue to leak.
5. Remove and repair bonnets that leak.
6. After cleaning, coat packing gland threads and valve stems with surface preparation of “Molycote” or “Fel-Pro”.

F. Verify that control valve seats are free of foreign matter and are properly positioned for intended service.

G. Tighten flanges and other pipe joints after system has been placed in operation. Replace gaskets that show signs of leakage after tightening.

H. Inspect all joints for leakage:

1. Promptly remake each joint that appears to be faulty; do not wait for rust other corrosion to form.
2. Clean threads on both parts, and apply compound and remake joints.

I. After system has been placed in operation, clean strainers, drives, pockets, orifices, valve seats, and headers in fluid system to ensure freedom from foreign matter.

J. Open steam traps and air vents, where used, and remove operating elements. Clean thoroughly, replace internal parts, and place back into operation.

K. Remove rust, scale, and foreign matter from equipment and renew defaced surfaces.

L. Set and calibrate draft gauges of air filters and other equipment.

M. Inspect fan wheels for clearance and balance. Provide factory-authorized personnel for adjustment when needed.

N. Check each electrical control circuit to verify that operation complies with the Contract Documents.

O. Inspect each pressure gauge, thermometer, and other instruments for calibration. Replace items that are defaced, broken, or that read incorrectly.

P. Repair damaged insulation.

Q. Excess Gasses and Fluids:

1. Vent gasses trapped in systems.

2. Verify that liquids are drained from all parts of gas or air systems.

3.3 ATTACHMENTS

A. The attachment listed below, following the “End of Section” designation, is a part of this Specification Section.

1. Supplier’s Installation Certification Form (one page).

+ + END OF SECTION + +

SUPPLIER'S INSTALLATION CERTIFICATION

Contract No. and Name: _____

Equipment Specification Section: _____

Equipment Name: _____

Contractor: _____

Manufacturer of Equipment: _____

The undersigned Supplier of the equipment described above hereby certifies that Supplier has checked the equipment installation and that the equipment, as specified in the Contract Documents, has been provided in accordance with the manufacturer's recommendations and the Contract Documents, and that the trial operation of the equipment has been satisfactory.

Comments: _____

_____ _____

Date Supplier Name (print)

_____

Signature of Supplier

_____ _____

Date Contractor Name (print)

_____

Signature of Contractor

SECTION 01 77 19

CLOSEOUT REQUIREMENTS

PART 1 – GENERAL

1.1 GENERAL

A. Scope:

1. Section Includes.

a. Substantial Completion.

b. Final inspection.

c. Request for final payment.

1.2 SUBSTANTIAL COMPLETION

A. Procedures for requesting and documenting Substantial Completion are in the General Conditions, as may be modified by the Supplementary Conditions.

1.3 FINAL INSPECTION

A. Procedures for requesting and documenting the final inspection are in the General Conditions, as may be modified by the Supplementary Conditions.

1.4 REQUEST FOR FINAL PAYMENT

A. Procedure:

1. Submit request for final payment in accordance with the Agreement General Conditions, as may be modified by the Supplementary Conditions.

B. Request for final payment shall include:

1. Documents required for progress payments.

2. Documents required in the General Conditions, as may be modified by the Supplementary Conditions.

3. Releases or Waivers of Lien Rights:

a. When submitting releases or waivers of Lien rights, provide release or waiver by CONTRACTOR and each Subcontractor and Supplier that provided CONTRACTOR with labor, material, or equipment totaling $1,000 or more.

b. Provide list of Subcontractors and Suppliers for which release or waiver of Lien is required.

c. Each release or waiver of Lien shall be signed by an authorized representative of the entity submitting release or waiver to CONTRACTOR, and shall include Subcontractor's or Supplier's corporate seal, when applicable.

d. Release or waiver of Lien may be conditional upon receipt of final payment.

4. Refer to the General Conditions and Supplementary Conditions regarding final payment documentation requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 78 23

OPERATIONS AND MAINTENANCE DATA

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. Submit operation and maintenance data, in accordance with this Section and in accordance with requirements elsewhere in the Contract Documents, as instructional and reference manuals by operations and maintenance personnel at the Site.
2. Required operation and maintenance data are listed in the Contract Documents. If not otherwise listed, at minimum, submit operation and maintenance data for:
    a. All equipment and systems.
    b. Valves, gates, actuators, and related accessories.
    c. Instrumentation and control devices.
    d. Electrical gear.
3. For each operation and maintenance manual, submit the following:
    a. Preliminary Submittal: Printed and bound copy of and electronic copies of entire operation and maintenance manual, except for test data and service reports by Supplier.
    b. Final Submittal: Printed and bound copy and electronic copies of complete operations and maintenance manual, including test data and service reports by Supplier, with electronic copies.

1.2 SUBMITTALS

A. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data
    a. Submit the operations and maintenance data as required by the Contract Documents.

B. Quantity Required and Timing of Submittals:

1. Preliminary Submittal:
    a. Electronic Copies: one copy provided to the ENGINEER, and Owner, exclusive of copies required by CONTRACTOR.
    b. Submit to ENGINEER by the earlier of: ninety days following approval of Shop Drawings and product data

submittals, or thirty days prior to starting training of operations and maintenance personnel, or thirty days prior to field quality control testing at the Site.

2. Final Submittal: Provide final submittal prior to Substantial Completion, unless submittal is specified as required prior to an interim Milestone.
   a. Printed Copies: one copy to be provided to OWNER.
   b. Electronic Copies: one copy to be provided to the OWNER.

1.3 FORMAT OF PRINTED COPIES

A. Binding and Cover:

1. Bind each operation and maintenance manual in durable, permanent, stiff-cover binder(s), comprising one or more volumes per copy as required. Binders shall be minimum one-inch wide and maximum of three-inch wide. Binders for each copy of each volume shall be identical.
2. Binders shall be locking three-ring/"D"-ring type, or three-post type. Three-ring binders shall be riveted to back cover and include plastic sheet lifter (page guard) at front of each volume.
3. Do not overfill binders.
4. Covers shall be oil-, moisture-, and wear-resistant, including identifying information on cover and spine of each volume.
5. Provide the following information on cover of each volume:
   a. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS".
   b. Name or type of material or equipment covered in the manual.
   c. Volume number, if more than one volume is required, listed as "Volume __ of __", with appropriate volume-designating numbers filled in.
   d. Name of Project and, if applicable, Contract name and number.
   e. Name of building or structure, as applicable.
6. Provide the following information on spine of each volume:
   a. Title: "OPERATING AND MAINTENANCE INSTRUCTIONS".
   b. Name or type of material or equipment covered in the manual.

c. Volume number, if more than one volume is required, listed as “Volume __ of __”, with appropriate volume-designating numbers filled in.

d. Project name and building or structure name.

B. Pages:

1. Print pages in manual on 30-pound (minimum) paper, 8.5 inches by 11 inches in size.

2. Reinforce binding holes in each individual sheet with plastic, cloth, or metal. When published, separately-bound booklets or pamphlets are part of the manual, reinforcing of pages within booklet or pamphlet is not required.

3. Provide each page with binding margin at least one inch wide. Punch each page with holes suitable for the associated binding.

C. Drawings:

1. Bind into the manual drawings, diagrams, and illustrations up to and including 11 inches by 17 inches in size, with reinforcing specified for pages.

2. Documents larger than 11 inches by 17 inches shall be folded and inserted into clear plastic pockets bound into the manual. Mark pockets with printed text indicating content and drawing numbers. Include no more than three drawing sheets per pocket.

D. Copy Quality and Document Clarity:

1. Contents shall be original-quality copies. Documents in the manual shall be either original manufacturer-printed documents or first-generation photocopies indistinguishable from originals. If original is in color, copies shall be in color. Manuals that contain copies that are unclear, not completely legible, off-center, skewed, or where text or drawings are cut by binding holes, are unacceptable. Pages that contain approval or date stamps, comments, or other markings that cover text or drawing are unacceptable. Faxed copies are unacceptable.

2. Clearly mark in ink to indicate all components of materials and equipment on catalog pages for ease of identification. In standard or pre-printed documents, indicate options furnished or cross out inapplicable content. Using highlighters to so indicate options furnished is unacceptable.

E. Organization:

1. Coordinate with ENGINEER and OWNER to develop comprehensive, practical, and consistent indexing system for operations and maintenance data. ENGINEER will review indexing system before operations and maintenance data is submitted.

2. Table of Contents:

   a. Provide table of contents in each volume of each operations and maintenance manual.

   b. In table of contents and at least once in each chapter or section, identify materials and equipment by their functional names. Thereafter, abbreviations and acronyms may be used if their meaning is clearly indicated in a table bound at or near beginning of each volume. Using material or equipment model or catalog designations for identification is unacceptable.

3. Use dividers and indexed tabs between major categories of information, such as operating instructions, preventive maintenance instructions, and other major subdivisions of data in each manual.

1.4 FORMAT OF ELECTRONIC COPIES

A. Electronic Copies of Operation and Maintenance Manuals:

1. Each electronic copy shall include all information included in the corresponding printed copy. Cover page shall include the following:

   a. Title: “OPERATING AND MAINTENANCE INSTRUCTIONS”.

   b. Name or type of material or equipment covered in the manual.

   c. Project name and building or structure name.

2. Include drawings, diagrams, and illustrations up to and including 11 inches by 17 inches in size.

3. Clearly mark to indicate all components of materials and equipment on catalog pages for ease of identification. In standard documents, indicate options furnished or cross out inapplicable content.

4. Coordinate with ENGINEER and OWNER to develop comprehensive practical, and consistent indexing system for operations and maintenance data. ENGINEER will review indexing system before operations and maintenance data is submitted.

5. Table of Contents:

   a. Provide table of contents in each operations and maintenance manual.

   b. In table of contents and at least once in each chapter or section, identify materials and equipment by their functional names. Thereafter, abbreviations and acronyms may be used if their meaning is clearly indicated in a table included at or

near beginning of each manual. Using material or equipment model or catalog designations for identification is unacceptable.

6. Submit each electronic copy on a separate compact disc (CD), unless another electronic data transfer method or format is acceptable to ENGINEER.

7. File Format:

a. Files shall be in "portable document format" (PDF). Files shall be electronically searchable; the use of scanned pages is to be minimized and is subject to ENGINEER approval.

b. Submit separate file for each separate document in the printed copy.

c. Within each file, provide bookmarks for the following:

1) Each chapter and subsection listed in the corresponding printed copy document's table of contents.

2) Each figure.

3) Each table.

4) Each appendix.

B. Copies of Programming and Configuration Files:

1. Provide on CD copy of all software programming, such as programmable logic controller programs, prepared specifically for the Project. Third-party, licensed, commercially available software is excluded from requirements of this Article; submit copies of commercially-available, licensed, third-party software, where required, in accordance with the Contract Documents.

2. Submit on CD copies of system configuration prepared specifically for the Project, such as plant monitoring system and SCADA display configurations.

3. Submit programming and configuration files together with electronic copies of operation and maintenance data.

1.5 CONTENT

A. General:

1. Prepare each operations and maintenance manual specifically for the Project.
Include in each manual all pertinent instructions, as-built drawings as applicable, bills of materials, technical bulletins, installation and handling requirements, maintenance and repair instructions, and

other information required for complete, accurate, and comprehensive data for safe and proper operation, maintenance, and repair of materials and equipment furnished for the Project. Include in manuals specific information required in the Specification Section for the material or equipment, data required by Laws and Regulations, and data required by authorities having jurisdiction.

2. Completeness and Accuracy:

   a. Operation and maintenance manuals that include language stating or implying that the manual's content may be insufficient or stating that the manual's content is not guaranteed to be complete and accurate are unacceptable.

   b. Operations and maintenance manuals shall be complete and accurate.

   c. Operation and maintenance manuals shall indicate the specific alternatives and features furnished, and the specific operation and maintenance provisions for the material or equipment furnished.

3. Submit complete, detailed written operating instructions for each material or equipment item including: function; operating characteristics; limiting conditions; operating instructions for start-up, normal and emergency conditions; regulation and control; operational troubleshooting; and shutdown. Also include, as applicable, written descriptions of alarms generated by equipment and proper responses to such alarm conditions.

B. Submit written explanations of all safety considerations relating to operation and maintenance procedures.

C. Submit complete, detailed, written preventive maintenance instructions including all information and instructions to keep materials, equipment, and systems properly lubricated, adjusted, and maintained so that materials, equipment, and systems function economically throughout their expected service life. Instructions shall include:

1. Written explanations with illustrations for each preventive maintenance task such as inspection, adjustment, lubrication, calibration, and cleaning. Include pre-startup checklists for each equipment item and maintenance requirements for long-term shutdowns.

2. Recommended schedule for each preventive maintenance task.

3. Lubrication charts indicating recommended types of lubricants, frequency of application or change, and where each lubricant is to be used or applied.

4. Table of alternative lubricants.

5. Troubleshooting instructions.

6. List of required maintenance tools and equipment.

D. Submit complete bills of material or parts lists for materials and equipment furnished. Lists or bills of material may be furnished on a per-drawing or per-equipment assembly basis. Bills of material shall indicate:

1. Manufacturer's name, address, telephone number, fax number, and Internet website address.

2. Manufacturer's local service representative's or local parts supplier's name, address, telephone number, fax number, Internet website address, and e-mail addresses, when applicable.

3. Manufacturer's shop order and serial number(s) for materials, equipment or assembly furnished.

4. For each part or piece include the following information:

a. Parts cross-reference number. Cross-reference number shall be used to identify the part on assembly drawings, Shop Drawings, or other type of graphic illustration where the part is clearly shown or indicated.

b. Part name or description.

c. Manufacturer's part number.

d. Quantity of each part used in each assembly.

e. Current unit price of the part at the time the operations and maintenance manual is submitted. Price list shall be dated.

E. Submit complete instructions for ordering replaceable parts, including reference numbers (such as shop order number or serial number) that will expedite the ordering process.

F. Submit manufacturer's recommended inventory levels for spare parts, extra stock materials, and consumable supplies for the initial two years of operation. Consumable supplies are items consumed or worn by operation of materials or equipment, and items used in maintaining the operation of material or equipment, including items such as lubricants, seals, reagents, and testing chemicals used for calibrating or operating the equipment. Include estimated delivery times, shelf life limitations, and special storage requirements.

G. Submit manufacturer's installation and operation bulletins, diagrams, schematics, and equipment cutaways. Avoid submitting catalog excerpts unless they are the only document available showing identification or description of particular component of the equipment. Where materials pertain to multiple models or types, mark the literature to indicate specific material or equipment supplied. Marking may be in the form of checking, arrows, or underlining to indicate pertinent information, or by crossing out or

other means of obliterating information that does not apply to the materials and equipment furnished.

H. Submit original-quality copies of each approved and accepted Shop Drawing, product data, and other submittal, updated to indicate as-installed condition. Reduced drawings are acceptable only if reduction is to not less than one-half original size and all lines, dimensions, lettering, and text are completely legible on the reduction.

I. Submit complete electrical schematics and wiring diagrams, including complete point-to-point wiring and wiring numbers or colors between all terminal points.

J. Programmable Logic Controllers: If programmable logic controllers are furnished under the Contract:

1. Submit complete logic listings in ladder logic format.

2. Format Requirements:

a. For ladder diagram logic, include complete cross-referencing of all logic elements. Annotate all elements with clearly understandable tags or descriptive labels.

3. Submit complete programmable logic controller listing of all input/output address assignments, tag assignments, and pre-set constant values, with functional point descriptions.

4. Submit complete manufacturer's programming manuals.

K. Submit copy of warranty bond and service contract as applicable.

L. When copyrighted material is used in operations and maintenance manuals, obtain copyright holder's written permission to use such material in the operation and maintenance manual.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 78 36

WARRANTIES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. This section describes general requirements for warranties required in the various Specifications.
2. Provisions on the Contract's correction period, CONTRACTOR'S general warranty and guarantee, and CONTRACTOR's warranty of title are in the General Conditions, as may be modified by the Supplementary Conditions.
3. This section includes general requirements for:
   a. Suppliers' standard warranties.
   b. Suppliers' special warranties.
   c. Implied warranties.
   d. Commencement and duration of warranties.

1.2 SUBMITTALS

A. General:

1. For each item of equipment furnished under the Contract, submit Supplier's standard warranty, regardless of whether such warranty or submittal thereof is required by the associated Specifications for that item. Submit such warranties for materials where such submittal is required in the Specifications for the material.
2. For each item of material or equipment where Supplier's special (or extended) warranty is required by the Contract Documents, submit appropriate special warranty that complies with the Contract Documents.
3. Supplier's warranties shall be specifically endorsed solely to OWNER by the entity issuing such warranty.
4. Submit Suppliers' standard warranties and special warranties as submittals in accordance with Schedule of Submittals accepted by ENGINEER.

1.3 SUPPLIERS' WARRANTIES FOR MATERIALS AND EQUIPMENT

A. Warranty Types:

1. Required by the General Conditions:
    a. Warranties specified for materials and equipment shall be in addition to, and run concurrent with, CONTRACTOR's general warranty and guarantee and requirements for the Contract's correction period.
    b. Disclaimers and limitations in specific materials and equipment warranties do not limit CONTRACTOR's general warranty and guarantee, nor does such affect or limit CONTRACTOR's performance obligations under the correction period.
2. Material or equipment manufacturer's standard warranty is pre-printed, written warranty published by item's manufacturer and specifically endorsed by manufacturer to OWNER.
3. Special warranty is written warranty that either extends the duration of material or equipment manufacturer's standard warranty or provides other, increased rights to OWNER. Where the Contract Documents indicate specific requirements for warranties that differ from the manufacturer's standard warranty for that item, special warranty is implied.

B. Requirements for Special Warranties:
1. Submit written special warranty document that contains appropriate provisions and identification, ready for execution by material or equipment manufacturer and OWNER. Submit draft warranty with submittals required prior to fabrication and shipment of the item from the Supplier's facility.
2. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed by product manufacturer and other entities as appropriate.
3. Specified Form: When specified forms for special warranties are included in the Contract Documents, prepare written document, properly executed by item manufacturer and OWNER, using the required form.
4. Refer to the Specifications for content and requirements for submitting special warranties.

1.4 IMPLIED WARRANTIES

A. Warranty of Title and Intellectual Property Rights:
1. Except as may be otherwise indicated in the Contract Documents, implied warranty of title required by Laws and Regulations is

applicable to the Work and to materials and equipment incorporated therein.

2. Provisions on intellectual property rights, including patent fees and royalties, are in the General Conditions, as may be modified by the Supplementary Conditions.

B. Warranty of Merchantability:

1. Notwithstanding any other provision of the Contract to the contrary, implied warranties of merchantability required by Laws and Regulations apply to the the materials and equipment incorporated into the Work.

C. Warranty of Fitness-for-Purpose:

1. When Supplier is aware of, or has reason to be aware of, specified materials or features of the Work that are contrary to the intended use, purpose, service, application, or environment in which the material or equipment item will be used, submit request for interpretation in accordance with Section 01 26 00, Contract Modification Procedures. Where appropriate, such request for interpretation shall indicate the apparent discrepancy and propose appropriate, alternative materials or equipment.

1.5 COMMENCEMENT AND DURATION OF WARRANTIES

A. Commencement of Warranties:

1. Contract correction period and CONTRACTOR's general warranty commence as indicated in the General Conditions, as may be modified by the Supplementary Conditions.

2. Suppliers' general warranties and special warranties commence running on the date that the associated item is certified by ENGINEER as substantially complete. In no event shall special warranties commence running prior to ENGINEER's review and acceptance of special warranty submittal for the item.

3. Implied warranties commence in accordance with Laws and Regulations.

B. Duration of Warranties:

1. Duration of correction period is in accordance with the General Conditions, as may be modified by the Supplementary Conditions.

2. Duration of CONTRACTOR's general warranty and guarantee is in accordance with Laws and Regulations.

3. Duration of Suppliers' general warranties is in accordance with the applicable general warranty document accepted by ENGINEER.

4. Duration of required Suppliers' special warranties shall be in accordance with the requirements of the Contract Documents for the subject item.
5. Duration of implied warranties shall be in accordance with Laws and Regulations.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall maintain and submit to ENGINEER with record documents in accordance with the Specifications, General Conditions, and Supplementary Conditions.

B. Maintenance of Record Documents:

1. Maintain in CONTRACTOR's field office, in clean, dry, legible condition, complete sets of the following record documents: Drawings, Specifications, and Addenda; Shop Drawings, Samples, and other CONTRACTOR submittals, including records of test results, approved or accepted as applicable, by ENGINEER; Change Orders, Work Change Directives, Field Orders, photographic documentation, survey data, and all other documents pertinent to the Work.

2. Provide files and racks for proper storage and easy access to record documents. File record documents in accordance with the edition of the Construction Specification Institute's "Master Format" used for organizing the Project Manual, unless otherwise accepted by ENGINEER.

3. Make record documents available for inspection upon request of ENGINEER or OWNER.

4. Do not use record documents for purpose other than serving as Project record. Do not remove record documents from CONTRACTOR's field office without ENGINEER's approval.

C. Submittal of Record Documents:

1. Submit to ENGINEER the following record documents:

a. Drawings.

b. Project Manual including Specifications and Addenda (bound).

2. Prior to readiness for final payment, submit to ENGINEER one copy of final record documents. Submit complete record documents; do not make partial submittals.

3. Submit record documents with transmittal letter on CONTRACTOR letterhead complying with letter of transmittal requirements in Section 01 33 00, Submittal Procedures.

4. Record documents submittal shall include notarized certification, with original signature of official authorized to execute legal agreements on behalf of CONTRACTOR, reading as follows:

   "[*Insert Contractor's corporate name*] has maintained and submitted record documentation in accordance with the General Conditions and Supplementary Conditions, Section 01 78 39, Project Record Documents, and other elements of Contract Documents, for the Trilith Elevated Water Storage Tank project . We certify that each record document submitted is complete, accurate, and legible relative to the Work performed under our Contract, and that the record documents comply with the requirements of the Contract Documents.

   [*Provide signature, print name, print signing party's corporate title, and date*]"

1.2 RECORDING CHANGES

A. General:

1. At the start of the Project, label each record document to be submitted as, "PROJECT RECORD" using legible, printed letters. Letters on record copy of the Drawings shall be two inches high.
2. Keep record documents current. Make entries on record documents within two working days of receipt of information required to record the change.
3. Do not permanently conceal the Work until required information has been recorded.
4. Accuracy of record documents shall be such that future searches for items shown on the record documents may rely reasonably on information obtained from ENGINEER-accepted record documents.
5. Marking of Entries:
   a. Use erasable, colored pencils (not ink or indelible pencil) for marking changes, revisions, additions, and deletions to record documents.
   b. Clearly describe the change by graphic line and make notations as required. Use straight-edge to mark straight lines. Writing shall be legible and sufficiently dark to allow scanning of record documents into legible electronic files.
   c. Date all entries on record documents.

d. Call attention to changes by drawing a “cloud” around the change(s) indicated.

e. Mark initial revisions in red. In the event of overlapping changes, use different colors for subsequent changes.

B. Drawings:

1. Record changes on copy of the Drawings. Submittal of CONTRACTOR-originated or -produced drawings as a substitute for recording changes on the Drawings is unacceptable.

2. Record changes on plans, sections, schematics, and details as required for clarity, making reference dimensions and elevations (to Project datum) for complete record documentation.

3. Record actual construction including:

a. Depths of various elements of foundation relative to Project datum.

b. Horizontal and vertical location of Underground Facilities referenced to permanent surface improvements. For each Underground Facility, including pipe fittings, provide dimensions to at least two permanent, visible surface improvements.

c. Location of exposed utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.

d. Changes in structural and architectural elements of the Work, including changes in reinforcing.

e. Field changes of dimensions, arrangements, and details.

f. Changes made in accordance with Change Orders, Work Change Directives, and Field Orders.

g. Changes in details on the Drawings. Submit additional details prepared by CONTRACTOR when required to document changes.

4. Recording Changes for Schematic Layouts:

a. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items are shown schematically and are not intended to portray physical layout. For such cases, the final physical arrangement shall be determined by CONTRACTOR subject to acceptance by ENGINEER.

b. Record on record documents all revisions to schematics on Drawings, including: piping schematics, ducting schematics, process and instrumentation diagrams, control and circuitry diagrams, electrical one-line diagrams, motor control center layouts, and other schematics when included in the Contract. Record actual locations of equipment, lighting fixtures, in-place grounding system, and other pertinent data.

c. When dimensioned plans and dimensioned sections on the Drawings
show the Work schematically, indicate on the record documents, by dimensions accurate to within one inch in the field, centerline location of items of Work such as conduit, piping, ducts, and similar items

1) Clearly identify the Work item by accurate notations such as “cast iron drain”, “rigid electrical conduit”, “copper waterline”, and similar descriptions.

2) Show by symbol or note the vertical location of Work item; for example, “embedded in slab”, “under slab”, “in ceiling plenum”, “exposed”, and similar designations. For piping not embedded, also provide elevation dimension relative to Project datum.

3) Descriptions shall be sufficiently detailed to be related to Specifications.

d. ENGINEER may furnish written waiver of requirements relative to
schematic layouts shown on plans and sections when, in ENGINEER’s judgment, dimensioned layouts of Work shown schematically will serve no useful purpose. Do not rely on waiver(s) being issued.

5. Supplemental Drawings:

a. In some cases, drawings produced during construction by ENGINEER or CONTRACTOR supplement the Drawings and shall be included with record documents submitted by CONTRACTOR. Supplemental record drawings shall include drawings provided with Change Orders, Work Change Directives, and Field Orders and that cannot be incorporated into the Drawings due to space limitations.

b. Supplemental drawings provided with record drawings shall be integrated with the Drawings and include necessary

cross-references between drawings. Supplemental record drawings shall be on sheets the same size as the Drawings.

c. When supplemental drawings developed by CONTRACTOR using computer-aided drafting/design (CADD) software are to be included in record drawings, submit electronic files for such drawings in AutoCAD 2014 format as part of record drawing submittal. Submit electronic files on compact disc labeled, "Supplemental Record Drawings", together with CONTRACTOR name, Project name, and Contract name and number.

C. Specifications and Addenda:

1. Mark each Section to record:

a. Manufacturer, trade name, catalog number, and Supplier of each product and item of equipment actually provided.

b. Changes made by Addendum, Change Orders, Work Change Directives, and Field Orders.

1.3 ELECTRONIC FILES FURNISHED BY ENGINEER

A. CADD files will be furnished by ENGINEER upon the following conditions:

1. CONTRACTOR shall submit to ENGINEER a letter on CONTRACTOR letterhead requesting CADD files and providing specific definition(s) or description(s) of how files will be used, and specific description of benefits to OWNER (including credit proposal, if applicable) if the request is granted.

2. CONTRACTOR shall execute ENGINEER's standard agreement for release of electronic files and shall abide by all provisions of the agreement for release of electronic files.

3. Layering system incorporated in CADD files shall be maintained as transmitted by ENGINEER. CADD files transmitted by ENGINEER containing cross-referenced files shall not be bound by CONTRACTOR. Drawing cross-references and paths shall be maintained. If CONTRACTOR alters layers or cross-reference files, CONTRACTOR shall restore all layers and cross-references prior to submitting record documents to ENGINEER.

4. CONTRACTOR shall submit record drawings to ENGINEER in same CADD format that files were furnished to CONTRACTOR.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 78 43

SPARE PARTS AND EXTRA MATERIALS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. This Section includes administrative and procedural requirements for furnishing spare parts, extra materials, maintenance supplies, and special tools required for maintenance (collectively, "spare parts and extra materials") required by the Contract Documents.
   2. CONTRACTOR shall furnish spare parts, extra materials, and associated information, for materials and equipment furnished in accordance with the Contract Documents. Furnish such items in accordance with the requirements of this Section and the Specifications sections in which such items are indicated.
   3. CONTRACTOR shall be fully responsible for loss and damage to spare parts and extra materials until such items are received by OWNER's facility manager.
   4. Promptly replace spare parts and extra materials furnished by OWNER to CONTRACTOR for use in remedying defective Work.

B. List of Spare Parts and Extra Materials:
   1. With the Shop Drawings and product data submittals for each Specifications section, submit a complete listing of spare parts and extra materials required for maintenance for two years of operation, together with unit prices in current United States funds, and source(s) of supply for each.
   2. Also include listing of spare parts and extra materials, with pricing and sources, in the operations and maintenance data submitted in accordance with Section 01 78 23, Operations and Maintenance Data.

1.2 SUBMITTALS

A. Maintenance Material Submittals: Submit the following:
   1. Spare Parts and Extra Materials:
      a. Furnish to OWNER in accordance with requirements of this Section, and the Specifications section in which the spare parts and extra materials are specified.
   2. Transfer Documentation: For each delivery of spare parts and extra materials, submit to ENGINEER the following:

a. Submit, on CONTRACTOR's letterhead, a letter of transmittal for spare parts and extra materials furnished under each Specifications section. Letter of transmittal shall accompany spare parts and extra materials. Do not furnish letter of transmittal separate from associated spare parts and extra materials.
b. Furnish three original, identical, signed letters of transmittal for each delivery of spare parts and extra materials furnished under each Specifications section. Upon delivery of specified quantities and types of spare parts and extra materials to OWNER, designated person from OWNER will countersign each original letter of transmittal indicating OWNER's receipt of spare parts and extra materials in the quantity, type, and quality required by the Contract Documents. OWNER will retain one fully-signed original, CONTRACTOR shall submit one fully-signed original to ENGINEER. CONTRACTOR shall retain one fully-signed original for CONTRACTOR's records.
c. Letter of transmittal shall include the following:
    1) Information required for letters of transmittal in Section 01 33 00, Submittal Procedures.
    2) Transmittal shall list spare parts and extra materials furnished under each Specifications Section. List each individual part, material, equipment item, tool, and product and the associated quantity furnished.
    3) Include space for countersignature by OWNER as follows: space for signature, space for printed name, and date.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Packaging and Labeling of Spare Pars and Extra Materials:
    1. Furnish spare parts and extra materials in manufacturer's unopened cartons, boxes, crates, or other original, protective covering suitable for preventing corrosion and deterioration for maximum length of storage normally anticipated by manufacturer.
    2. Packaging of spare parts and extra materials shall be clearly marked and identified with name of manufacturer, applicable material or equipment, part number, part description, and part location in the equipment or system.
    3. Protect and package spare parts and extra materials for maximum shelf life normally anticipated by manufacturer.

B. Storage Prior to Delivery to Owner:
    1. Prior to furnishing spare parts and extra materials to OWNER, store spare parts and extra materials in accordance with the Contract Documents and manufacturers' recommendations.

C. Procedure for Delivery to Owner:

1. Deliver spare parts and extra materials to OWNER's permanent storage rooms at the Site or area(s) at the Site designated by OWNER.
2. When spare parts and extra materials are delivered, CONTRACTOR and OWNER will mutually inventory the spare parts and extra materials delivered to verify compliance with the Contract Documents regarding quantity, part numbers, and quality.
3. Additional procedures for delivering spare parts and extra materials to OWNER, if required, will be developed by ENGINEER and complied with by CONTRACTOR.
4. CONTRACTOR shall reimburse OWNER for all costs and expenses incurred by OWNER, including professional services, for delivery of inadequate, incorrect, or defective spare parts and extra materials. OWNER may withhold such amounts from payments due CONTRACTOR via set-offs in accordance with the Contract Documents.

D. Delivery Time and Eligibility for Payment:
   1. Deliver to OWNER spare parts and extra materials prior to date of Substantial Completion for materials and equipment associated therewith.
   2. Do not deliver spare parts and extra materials before commencing startup for associated material or equipment.
   2. Spare parts and extra materials are not eligible for payment until delivered to OWNER and CONTRACTOR's receipt of OWNER's countersignature on letter of transmittal.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01 79 23

INSTRUCTION OF OPERATIONS AND MAINTENANCE PERSONNEL

PART 1 – GENERAL (NOT USED)

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +

DIVISION 2 - SITE WORK

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SECTION 02 41 00

DEMOLITION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified and required for demolition, removal, and disposal Work.
   2. The Work under this Section includes, but is not necessarily limited to:
      a. Demolition and removal of existing materials and equipment as shown or indicated in the Contract Documents. The Work includes demolition of structural concrete, foundations, walls, doors, windows, structural steel, metals, roofs, masonry, attachments, appurtenances, piping, electrical and mechanical systems and equipment, paving, curbs, sidewalks, gutters, fencing and similar existing facilities.
      b. Demolition and removal of all Underground Facilities underneath, and above-grade piping and utilities in, the building(s) and structures shown or indicated for demolition, unless the Underground Facilities or above-grade facilities are shown or indicated as to remain.
      c. Remove from slabs, foundations, walls, and footings that are to be demolished all utilities and appurtenances embedded in such construction.
   3. Demolitions and removals specified under other Sections shall comply with requirements of this Section.
   4. Perform demolition Work within areas shown or indicated.
   5. Pay all costs associated with transporting and, as applicable, disposing of materials and equipment resulting from demolition.

B. Coordination:
   1. Comply with Section 01 14 16, Coordination with Owner's Operations.
   2. Review procedures under this and other Sections and coordinate the Work that will be performed with or before demolition and removals.
   3. Notify other contractors in advance of demolition and removals Work to provide other contractors with sufficient time for performing work and coordinating items included in their contracts that will be performed before or in conjunction with demolition and removals Work.

C. Related Sections:
   1. Section 31 23 16.26, Rock Removal.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Electrical Removals: Entity and personnel performing electrical removals shall be electrician legally qualified to perform electrical construction and electrical work in the jurisdiction where the Site is located.
2. Plumbing Removals: Entity and personnel performing plumbing removals shall be plumber legally qualified to perform plumbing construction and plumbing work in the jurisdiction where the Site is located.

B. Regulatory Requirements:
1. Demolition, removal, and disposal Work shall be in accordance with 29 CFR 1926.850 through 29 CFR 1926.860 (Subpart T - Demolition), and all other Laws and Regulations.
2. Comply with requirements of authorities having jurisdiction.

1.3 SUBMITTALS

A. Informational Submittals: Submit the following:
1. Procedure Submittals:
a. Demolition and Removal Plan: Not less than ten days prior to starting demolition Work, submit acceptable plan for demolition and removal Work, including:
1) Plan for coordinating shut-offs, capping, temporary services, and continuing utility services.
2) Other proposed procedures as applicable.
3) Equipment proposed for use in demolition operations.
4) Recycling/disposal facility(ies) proposed, including facility owner, facility name, location, and processes. Include copy of appropriate permits and licenses, and compliance status.
5) Planned demolition operating sequences.
6) Detailed schedule of demolition Work in accordance with the accepted Process Schedule.
2. Qualifications Statements:
a. Name and qualifications of entity performing electrical removals, including copy of licenses required by authorities having jurisdiction.
b. Name and qualifications of entity performing plumbing removals, including copy of licenses required by authorities having jurisdiction.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PREPARATION

A. Protection of Surrounding Areas and Facilities:
1. Perform demolition and removal Work in manner that prevents damage and injury to property, structures, occupants, the public, and facilities. Do not

interfere with use of, and free and safe access to and from, structures and properties.

2. Closing or obstructing of roads, drives, sidewalks, and passageways adjacent to the Work is not allowed unless indicated otherwise in the Contract Documents. Conduct the Work with minimum interference to vehicular and pedestrian traffic.
3. Provide temporary barriers, lighting, sidewalk sheds, and other necessary protection.
4. Repair damage to facilities that are to remain.

B. Existing Utilities: In addition to requirements of the General Conditions, Supplementary Conditions, and Division 01 Specifications, do the following:
1. Should uncharted or incorrectly charted Underground Facilities be encountered, Contractor responsibilities shall be in accordance with the General Conditions as may be modified by the Supplementary Conditions. Cooperate with utility owners in keeping adjacent services and facilities in operation.
2. Sanitary Sewer: Before proceeding with demolition, locate and cap all sewer lines and service laterals discharging from the building or structure being demolished.
3. Storm Water: Existing storm water system shall remain in place until demolitions of existing building or structure is completed. Upon completing demolition, cut and cap storm sewer laterals at locations shown on the Drawings. Remove existing storm water piping and related structures between points of cutting, and backfill, restore to grade, and stabilize the area over the removed facilities.
4. Water Piping: Before proceeding with demolition, locate and cap all potable and non-potable waterlines and service laterals serving the building or structure being demolished.
5. Other Utilities: Before proceeding with demolition, locate and cap as required all other utilities, such as fuel and gas; heating, ventilating, and air conditioning; electric; and communications; and service laterals serving the building or structure being demolished.
6. Shutdown of utility services shall be coordinated by Contractor, assisted by Owner as required relative to contacting utility owners.

3.2 DEMOLITION – GENERAL

A. Locate construction equipment used for demolition Work and remove demolished materials and equipment to avoid imposing excessive loading on supporting and adjacent walls, floors, framing, facilities, and Underground Facilities.

B. Pollution Controls:
1. Use water sprinkling, temporary enclosures, and other suitable methods to limit emissions of dust and dirt to lowest practical level. Comply with Section 01 57 05, Temporary Controls, and Laws and Regulations.

2. Do not use water when water may create hazardous or objectionable conditions such as icing, flooding, or pollution.
3. Clean adjacent structures, facilities, properties, and improvements of dust, dirt, and debris caused by demolition Work, in accordance with the General Conditions and Section 01 74 05, Cleaning.

C. Comply with Section 01 73 29, Cutting and Patching.

D. Demolition of Site Improvements:
1. Pavement, Sidewalks, Curbs, and Gutters: Demolition of asphalt or concrete pavement, sidewalks, curbs, and gutters, as applicable, shall terminate at cut edges. Edges shall be linear and have a vertical cut face.
2. Fencing, Guardrails, and Bollards: Remove to the limits shown or indicated on the Drawings. Completely remove below-grade posts and concrete.
3. Manholes, Vaults, Chambers, and Handholes: Remove to the limits shown or indicated on the Drawings.

E. Finishing of Surfaces Exposed by Removals: Unless otherwise shown or indicated in the Contract Documents, surfaces of walls, floors, ceilings, and other areas exposed by removals, and that will remain as finished surfaces, shall be repaired and re-finished with materials that match existing adjacent surface, or as otherwise approved by Engineer.

3.3 DISPOSAL OF DEMOLITION DEBRIS

A. Remove from the Site all debris, waste, rubbish, and material resulting from demolition operations and equipment used in demolition Work. Comply with the General Conditions, Supplementary Conditions, and Section 01 74 05, Cleaning. Comply with Section 01 74 19, Construction Waste Management and Disposal.

B. Transportation and Disposal:
1. Non-hazardous Material: Properly transport and dispose of non-hazardous demolition debris at appropriate landfill or other suitable location, in accordance with Laws and Regulations. Non-hazardous material does not contain Asbestos, PCBs, Petroleum, Hazardous Waste, Radioactive Material, or other material designated as hazardous in Laws and Regulations.
2. Hazardous Material: When handling and disposal of hazardous materials is included in the Work, properly transport and dispose of hazardous materials in accordance with the Contract Documents and Laws and Regulations.

C. Submit to Engineer information required in this Section on proposed facility(ies) where demolition material will be recycled. Upon request, Engineer or Owner, shall be allowed to visit recycling facility(ies) to verify adequacy and compliance status. During such visits, recycling facility operator shall cooperate and assist Engineer and Owner.

+ + END OF SECTION + +

SECTION 02 41 13.13

PAVING REMOVAL

PART 1 - GENERAL

1.1 SUMMARY

A. SECTION INCLUDES:

Section	Title
1.2	References
1.3	Work Included
1.4	Submittals
2.1	Equipment
3.1	Trench Paving Removal
3.2	Milling Operation

1.2 REFERENCES

A. Drawings and general provisions of the Contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this section.

B. Georgia Department of Transportation Standard Specifications.

1.3 WORK INCLUDED

A. The Contractor shall furnish all materials, tools, labor, and equipment, necessary to remove asphalt and/or concrete paving as required for the installation of proposed water mains or sewer mains and related appurtenances under the Contract and as directed by FCWS.

1.4 SUBMITTALS

A. Submit for approval, in accordance with Section 01 33 00 SUBMITTAL PROCEDURES all working drawings and schedules of materials and methods proposed to be followed in the execution of the Work under this item.

B. The Contractor shall submit photographs and/or videotape, sufficiently detailed, of existing conditions of project site. These shall be used to evaluate project areas that might be misconstrued as damage caused by debris, or construction material removal.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. MILLING EQUIPMENT:

1. Use power-driven, self-propelled milling equipment that is the size and shape that allows traffic to pass safely through areas adjacent to the work. Also use equipment that is:
    a. Designed to mill and remove specified depth of existing asphalt and/or concrete paving.
    b. Equipped with grade slope controls operating from a string line or ski, and based on mechanical or sonic operation.
    c. Capable of removing pavement to an accuracy of 1/8 in. (3 mm).
    d. Furnished with lighting system for night work, as necessary.
    e. Provided with conveyors capable of side, rear, or front loading to transfer the milled material from the roadway to a truck.

B. DUST CONTROL

1. Provide power brooms, vacuum sweepers, power blowers, or other means to remove loose debris or dust. Do not allow dust control to restrict visibility of passing traffic or to disrupt adjacent property owners.

PART 3 - EXECUTION

3.1 TRENCH PAVING REMOVAL

A. Where trench excavation within a paved surface is required, the Contractor shall saw cut in a straight line, vertical joints for the entire depth of pavement. The saw cut joints shall extend for the entire length of trench on both sides of the trench. Ragged edges shall be trimmed so as to provide a substantially straight line juncture between the old and new surfaces.

B. The saw cut joints shall be a minimum of twelve inches (12”) outside of the maximum width of excavated trench.

C. Pavement shall be removed and hauled off site and disposed of in a proper legal manner. Contractor shall be careful not to disturb or damage any pavement that is to remain.

3.2 MILLING OPERATION

A. Follow the Plans to mill the designated areas and depths, as required. Ensure the following requirements are met:

1. Schedule the construction operation. Use milling methods that will produce a uniform finished surface and maintain a constant cross slope between extremities in each lane.

2. Provide positive drainage to prevent water accumulation on the milled pavement, as shown on the Plans or directed by the Engineer.

3. Bevel back the longitudinal vertical edges greater than 2 in (50 mm) that are produced by the removal process and left exposed to traffic. Bevel

them back at least 3 in for each 2 in (75 mm for each 50 mm) of material removed. Use an attached mold board or other approved method.

4. When removing material at ramp areas and ends of milled sections, taper the transverse edges 10 ft (3 m) to avoid creating a traffic hazard and to produce a smooth surface.

5. Protect with a temporary asphaltic concrete tie-in (paper joint) vertical edges at other areas such as bridge approach slabs, drainage structures, and utility appurtenances greater than ½-inch that are left open to transversing vehicles. Place the temporary tie-in at taper rate of at least 6 to 1 horizontal to vertical distance.

6. Remove dust, residue, and loose milled material from the milled surface. Do not allow traffic on the milled surface and do not place asphaltic concrete on the milled surface until removal is complete.

B. The reclaimed asphaltic and/or concrete pavement becomes the Contractor's property unless otherwise specified.

+ + END OF SECTION + +

DIVISION 3 - CONCRETE

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SECTION 03 00 05

CONCRETE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete, reinforcing, and related materials.
   2. The Work includes:
      a. Providing concrete consisting of portland cement, fine and coarse aggregates, water, and approved admixtures; combined, mixed, transported, placed, finished, and cured.
      b. Fabricating and placing reinforcing, including ties and supports.
      c. Design, erection, and removal of formwork.
      d. Building into the concrete all sleeves, frames, anchorage devices, inserts, and other items required to be embedded in concrete.
      e. Providing openings in concrete as required to accommodate Work under this and other Sections.

B. Coordination:

   1. Review installation procedures under other Sections and coordinate installation of items to be installed in the concrete Work.

C. Classifications of Concrete:
   1. Class “A” concrete shall be steel-reinforced and includes all concrete unless otherwise shown or indicated.
   2. Class “B” concrete shall be placed without forms or with simple forms, with little or no reinforcing and includes the following:
      a. Concrete fill.
      b. Duct banks.
      c. Unreinforced encasements.
      d. Curbs and gutters.
      e. Sidewalks.
      f. Thrust blocks.

B. Related Sections:
   1. Section 05 05 33, Anchor Systems.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ACI 224R, Control of Cracking in Concrete Structures.
   2. ACI 301, Specifications for Structural Concrete for Buildings.
   3. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
   4. ACI 305R, Specification for Hot Weather Concreting.
   5. ACI 306R, Cold Weather Concreting.
   6. ACI 309R, Guide for Consolidation of Concrete.
   7. ACI 318, Building Code Requirements for Structural Concrete and Commentary.
   8. ACI 347, Guide to Formwork for Concrete.
   9. ACI SP-66, ACI Detailing Manual.
   10. ASTM A1064/ASTM 1064M, Standard Specification for Steel Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   11. ASTM A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   12. ASTM C31/C31M, Practice for Making and Curing Concrete Test Specimens in the Field.
   13. ASTM C33/C33M, Specification for Concrete Aggregates.
   14. ASTM C39/C39M, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   15. ASTM C42/C42M, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   16. ASTM C94/C94M, Specification for Ready-Mixed Concrete.
   17. ASTM C138/C138M, Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
   18. ASTM C143/C143M, Test Method for Slump of Hydraulic-Cement Concrete.
   19. ASTM C150/C150M, Specification for Portland Cement.
   20. ASTM C595/C595M, Standard Specification for Blended Hydraulic Cements
   21. ASTM C172, Practice for Sampling Freshly Mixed Concrete.
   22. ASTM C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   23. ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
   24. ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   25. ASTM C494/C494M, Specification for Chemical Admixtures for Concrete.
   26. ASTM C579, Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   27. ASTM C1064/C1064M, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
   28. ASTM D1752, Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
   29. ASTM E96/E96M, Test Methods for Water Vapor Transmission of Materials
   30. ASTM E154, Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
   31. CRD-C 572, U. S. Army Corps of Engineers Specification for Polyvinylchloride Waterstops.

32. CRSI 1MSP, Manual of Standard Practice.

1.3 QUALITY ASSURANCE

A. Laboratory Trial Batch:
   1. Employ independent testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
   2. Each concrete mix design specified shall be verified by laboratory trial batch, unless indicated otherwise.
   3. Perform the following testing on each trial batch:
      a. Aggregate gradation for fine and coarse aggregates.
      b. Slump.
      c. Air content.
      d. Compressive strength based on three cylinders each tested at seven days and at 28 days.
   4. Submit for each trial batch the following information:
      a. Project identification name and number (if applicable).
      b. Date of test report.
      c. Complete identification of aggregate source of supply.
      d. Tests of aggregates for compliance with the Contract Documents.
      e. Scale weight of each aggregate.
      f. Absorbed water in each aggregate.
      g. Brand, type, and composition of cementitious materials.
      h. Brand, type, and amount of each admixture.
      i. Amounts of water used in trial mixes.
      j. Proportions of each material per cubic yard.
      k. Gross weight and yield per cubic yard of trial mixtures.
      l. Measured slump.
      m. Measured air content.
      n. Compressive strength developed at seven days and 28 days, from not less than three test cylinders cast for each seven day and 28-day test, and for each design mix.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. List of concrete materials and concrete mix designs proposed for use. Include results of tests performed to qualify the materials and to establish the mix designs. Do not start laboratory trial batch testing until this submittal is approved by ENGINEER.
      b. Laboratory Trial Batch Reports: Submit laboratory test reports for concrete cylinders, materials, and mix design tests.
      c. Concrete placement drawings showing the location and type of all joints.
      d. Drawings for fabricating, bending, and placing concrete reinforcing. Comply with ACI SP-66. For walls and masonry construction, provide

elevations to a minimum scale of 1/4-inch to one foot. Show bar schedules, stirrup spacing, adhesive dowels, splice lengths, diagrams of bent bars, arrangements, and assemblies, as required for fabricating and placing concrete reinforcing.

2. Product Data:
   a. Manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
3. Samples:
   a. Samples: Submit samples of materials as specified and as otherwise requested by ENGINEER, including names, sources, and descriptions.

B. Informational Submittals: Submit the following:
1. Site Quality Control Submittals:
   a. Report of testing results for testing of field concrete cylinders for each required time period. Submit within 24 hours after completion of associated test. Test report shall include results of all testing required at time of sampling.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Transportation, Delivery, and Handling:
1. Deliver concrete reinforcing products to Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings on approved Shop Drawings.
2. Materials used for concrete shall be clean and free from foreign matter during transportation and handling, and kept separate until measured and placed into concrete mixer.
3. Implement suitable measures during hauling, piling, and handling to ensure that segregation of coarse and fine aggregate particles does not occur and grading is not affected.
4. Deliver grout materials from manufacturers in unopened containers that bear intact manufacturer labeling.

B. Storage:
1. Store formwork materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective, waterproof covering. Provide for adequate air circulation or ventilation under cover.
2. Store concrete reinforcing materials to prevent damage and accumulation of dirt and excessive rust. Store on heavy wood blocking so that reinforcing does not come into contact with the ground. Space framework or blocking supports to prevent excessive deformation of stored materials.
3. Store concrete joint materials on platforms or in enclosures or covered to prevent contact with ground and exposure to weather and direct sunlight.
4. For storage of concrete materials, provide bins or platforms with hard, clean surfaces.

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I/II, or ASTM C595, Type IL. Type IL cement shall meet the following requirements:
   a) Type IL cement shall have moderate sulfate resistance (MS) per ASTM C595.
   b) Type IL cement shall have a maximum heat of hydration no more than 80 (cal/g) or 335 (KJ/kg) per ASTM 595.
   c) Type IL cement Tricalcium Aluminate content shall not exceed 8%.

B. Aggregates: ASTM C33/C33M.
   1. Fine Aggregate: Clean, sharp, natural silica sand free of loam, clay, lumps, and other deleterious substances. Dune sand, bank run sand, and manufactured sand are unacceptable.
   2. Coarse Aggregate:
      a. Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter.
      b. Coarse aggregate shall comply with the following:
         1) Crushed stone, processed from natural rock or stone.
         2) Washed gravel, either natural or crushed. Slag, pit gravel, and bank-run gravel are not allowed.
      c. Coarse Aggregate Size: ASTM C33/C33M, Nos. 57 or 67, unless otherwise approved by ENGINEER.

C. Water: Clean, potable.

D. Admixtures:
   1. Air-Entraining Admixture: ASTM C260.
   2. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   3. Water Reducing and Set-Adjusting Admixtures: ASTM C494/C494M, Types D and E.
   4. High Range Water-Reducing Admixture: ASTM C494/C494M, Type F/G.
   5. Use only admixtures that have been tested and approved in the mix designs.
   6. Do not use calcium chloride or admixtures containing chloride ions.

E. Cementitious Materials:
   a. Fly Ash ASTM C618, Class F, content in cementitious material up to 20% by weight.
   b. Slag ASTM C989, Grade 120, content in cementitious material up to 20% by weight.

2.2 CONCRETE MIX

A. General:
   1. Normal weight: 150 pounds per cubic foot.

2. Use air-entraining admixture in all concrete. Provide not less than four percent, nor more than eight percent, entrained air for concrete exposed to freezing and thawing, and provide from three to five percent entrained air for other concrete.

B. Proportioning and Design of Class "A" Concrete Mix:
   1. Minimum compressive strength at 28 days: 4,500 psi.
   2. Maximum water-cement ratio by weight: 0.42.
   3. Minimum cement content: 564 pounds per cubic yard.

C. Proportioning and Design of Class "B" Concrete Mix:
   1. Minimum compressive strength at 28 days: 3,000 psi.
   2. Maximum water-cement ratio by weight: 0.50.
   3. Minimum cement content: 517 pounds per cubic yard.

D. Slump Limits:
   1. Proportion and design mixes to result in concrete slump at point of placement of not less than one inch and not more than four inches.
   2. When using high-range water reducers, slump prior to addition of admixture shall not exceed three inches. Slump after adding admixture shall not exceed eight inches at point of placement.

E. Adjustment of Concrete Mixes:
   1. Concrete mix design adjustments may be requested by CONTRACTOR when warranted by characteristics of materials, Site conditions, weather, test results, or other, similar circumstances.
   2. Submit for ENGINEER's approval laboratory test data for adjusted concrete mix designs, including compressive strength test results.
   3. Implement adjusted mix designs only after ENGINEER's approval.
   4. Adjustments to concrete mix designs shall not result in additional costs to OWNER.

2.3 FORM MATERIALS

A. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection. CONTRACTOR shall be responsible for designing the formwork system to resist all applied loads including pressures from fluid concrete and construction loads.

B. Smooth Form Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces in accordance with ACI 301.

C. Unexposed Concrete Surfaces: Material to suit project conditions.

D. Provide 3/4-inch chamfer at all external corners. Chamfer is not required at re-entrant corners unless otherwise shown or indicated.

E. Form Ties:
   1. Provide factory-fabricated, removable, or snap-off metal form ties, that prevent form deflection and prevent spalling of concrete surfaces upon removal. Materials used for tying forms are subject to approval of ENGINEER.
   2. Unless otherwise shown or indicated, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1.5 inches from outer surface of concrete. Unless otherwise shown or indicated, provide form ties that, upon removal, will leave a uniform, circular hole not larger than one-inch diameter in the concrete surface.
   3. Ties for exterior walls, below-grade walls, and walls subject to hydrostatic pressure shall be provided with waterstops.
   4. Wire ties are unacceptable.

2.4 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars.

B. Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete: ASTM A1064/ASTM A1064M.

C. Provide supports for reinforcing including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing in place.
   1. Use wire bar-type supports complying with CRSI MSP1 recommendations, except as specified in this Section. Do not use wood, brick, or other unacceptable materials.
   2. For slabs on grade, use precast concrete blocks, four inches square minimum with compressive strength equal to or greater than the surrounding concrete, or supports with sand plates or horizontal runners where base materials will not support chair legs.
   3. For all concrete surfaces where legs of supports are in contact with forms, provide supports having either hot-dip galvanized, plastic-protected, or stainless steel legs in accordance with CRSI MSP1.
   4. Provide precast concrete supports over waterproof membranes.

D. Adhesive Dowels:
   1. Dowels:
      a. Dowel reinforcing bars shall comply with ASTM A615, Grade 60.
   2. Adhesive:
      a. For requirements for adhesive, refer to Section 05 05 33, Anchor Systems.

2.5 RELATED MATERIALS

A. Waterstops:
   1. PVC Waterstops:
      a. Manufacturers: Provide products of one of the following:
         1) W.R. Meadows, Inc.

2) Greenstreak Plastic Products Company.
3) Or approved equal.

b. Waterstops shall comply with CRD-C 572. Do not use reclaimed or scrap material.
c. Minimum Thickness: 3/8-inch.
d. Provide waterstops with minimum of seven ribs equally spaced at each end on each side with the first rib located at the edge. Each rib shall be minimum 1/8-inch in height.
e. Construction Joints: Waterstops shall be six-inch wide flat-strip type.
f. Expansion Joints: Waterstops shall be nine-inch wide centerbulb type.

2. Hydrophilic Waterstops:
   a. Products and Manufacturers: Provide one of the following:
      1) Duroseal Gasket, by BBZ USA, Inc.
      2) Adeka Ultraseal MC-2010M, by Asahi Denka Kogyo K.K.
      3) Hydrotite, by Greenstreak Plastic Products Company.
      4) Or approved equal.
   b. Hydrophilic waterstop materials shall be bentonite-free and shall expand by minimum of 80 percent of dry volume in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.
   c. Waterstop material shall be composed of resins and polymers that absorb water and cause a completely reversible and repeatable increase in volume.
   d. Waterstop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
   e. Select material in accordance with manufacturer's recommendations for type of liquid to be contained.
   f. Minimum cross-sectional dimensions: 3/16-inch by 3/4-inch.
   g. Location of hydrophilic waterstops shall be as shown or indicated on the Drawings, or where approved by ENGINEER.
   h. Hydrophilic Sealant: Shall adhere firmly to concrete, metal, and PVC in dry or damp condition and be indefinitely elastic when cured.
      1) Products and Manufacturers: Provide one of the following:
         a) Duroseal Paste, by BBZ USA, Inc.
         b) Adeka Ultraseal P-201, by Asahi Denka Kogyo K.K.
         c) Hydrotite, by Greenstreak Plastic Products Company.
         d) Or approved equal.

B. Vapor Retarder:
   1. Products and Manufacturers: Provide one of the following:
      a. Stego Wrap 10-mil Vapor Retarder, by Stego Industries LLC.
      b. Griffolyn 10-mil, by Reef Industries.
      c. Moistop Ultra, by Fortifiber Industries.
      d. Or approved equal.
   2. Vapor retarder membrane shall comply with the following.
      a. Water Vapor Transmission Rate, ASTM E96/E96M: 0.04 perms or lower.
      b. Water Vapor Retarder, ASTM E1745: Meets or exceeds Class C.

c. Thickness of Retarder (plastic), ACI 302 1R: Not less than 10 mils.
d. Provide accessories by same manufacturer as vapor retarder.

C. Membrane-Forming Curing Compound: ASTM C309, Type I.

D. Epoxy Bonding Agent:
1. Two-component epoxy resin bonding agent.
2. Products and Manufacturers: Provide one of the following:
a. Sikadur 32, Hi-Mod LPL, by Sika Corporation.
b. Eucopoxy LPL, by the Euclid Chemical Company.
c. Or approved equal.

E. Epoxy-Cement Bonding Agent:
1. Three-component blended epoxy resin-cement bonding agent.
2. Products and Manufacturers: Provide one of the following:
a. Sika Armatec 110 EpoCem, by Sika Corporation.
b. Duralprep A.C., by Euclid Chemical Company.
c. Or approved equal.

F. Preformed Expansion Joint Filler:
1. Provide preformed expansion joint filler complying with ASTM D1752, Type I (sponge rubber) or Type II (cork).

G. Joint Sealant and Accessories:
1. For joint sealants and accessories used on isolation joints, control joints, and expansion joints, refer to Section 07 92 00, Joint Sealants.

2.6 GROUT

A. Non-shrink Grout:
1. Pre-packaged, non-metallic, cementitious grout requiring only the addition of water at the Site.
2. Minimum 28-day Compressive Strength: 7,000 psi.
3. Products and Manufacturers: Provide one of the following:
a. NS Grout by Euclid Chemical Company.
b. Set Grout by Master Builders, Inc.
c. NBEC Grout by Five Star Products, Inc.
d. Or approved equal.

B. Epoxy Grout:
1. Pre-packaged, non-shrink, non-metallic, 100 percent solids, solvent-free, moisture-insensitive, three-component epoxy grouting system.
2. Minimum Seven-day Compressive Strength: 14,000 psi, when tested in accordance with ASTM C579.
3. Products and Manufacturers: Provide one of the following:
a. Euco High Strength Grout, by Euclid Chemical Company.
b. Sikadur 42, Grout Pak, by Sika Corporation.

c. Five Star Epoxy Grout, by Five Star Products, Inc.
d. Or approved equal.

C. Grout Fill:
1. Grout mix shall consist of cement, fine and coarse aggregates, water, and admixtures complying with requirements specified in this Section for similar materials in concrete.
2. Proportion and mix grout fill as follows:
a. Minimum Cement Content: 564 pounds per cubic yard.
b. Maximum Water-Cement Ratio: 0.45.
c. Maximum Coarse Aggregate size: 1/2-inch, unless otherwise indicated.
d. Minimum 28-day Compressive Strength: 4,000 psi.

PART 3 – EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the substrate and the conditions under which the Work will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 FORMWORK

A. Construct formwork in accordance with ACI 347 such that concrete members and structures are of correct size, shape, alignment, elevation, and position.

B. Provide openings in formwork to accommodate the Work of other trades. Accurately place and securely support items required to be built into formwork.

C. Clean and adjust forms prior to placing concrete. Apply form release agents or wet forms as required. Re-tighten forms during and after concrete placing, when required, to eliminate cement paste leaks.

D. Removing Formwork:
1. Comply with ACI 301 and ACI 347, except as otherwise indicated in the Contract Documents.
2. Do not remove formwork and shoring until supported concrete members have acquired minimum of 90 percent of specified compressive strength. Results of suitable quality control tests of field-cured specimens may be submitted to ENGINEER for review as evidence that concrete has attained sufficient strength for removal of supporting formwork and shoring prior to removal times indicated in the Contract Documents.
3. Removal time for formwork is subject to ENGINEER's acceptance.
4. Repair form tie-holes following in accordance with ACI 301.

3.3 REINFORCING, JOINTS, AND EMBEDDED ITEMS

A. Comply with the applicable recommendations of Laws and Regulations and standards referenced in this Section, including CRSI MSP1, for details and methods of placing and supporting reinforcing.

B. Clean reinforcing to remove loose rust and mill scale, earth, ice, and other materials which act to reduce or destroy bond between reinforcing material and concrete.

C. Position, support, and secure reinforcing against displacement during formwork construction and concrete placing. Locate and support reinforcing by means of metal chairs, runners, bolsters, spacers, and hangers, as required.
   1. Place reinforcing to obtain minimum concrete coverages as shown on the Drawings and as required in ACI 318. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcing accurately in position during concrete placing. Set with ties so that twisted ends are directed away from exposed concrete surfaces.
   2. Do not secure reinforcing to formwork using wire, nails or other ferrous metal. Metal supports subject to corrosion shall not be in contact with formed or exposed concrete surfaces.

D. Provide sufficient strength on supports required to carry reinforcing. Do not place reinforcing more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

E. Splices: Provide standard reinforcing splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown or indicated for minimum lap of spliced bars, as shown on Drawings.

F. Install welded wire reinforcement in lengths as long as practical, lapping adjoining sections a minimum of one full mesh.

G. Do not place concrete until reinforcing is inspected and ENGINEER indicates that conditions are acceptable for placing concrete. Concrete placed in violation of this paragraph will be rejected. Notify ENGINEER in writing at least two working days prior to proposed concrete placement.

H. Joints:
   1. Provide construction, isolation, expansion, and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs-on-grade to stabilize differential settlement and random cracking.
   2. In walls, locate joints at a maximum spacing of 40 feet and approximately 12 feet from corners.
   3. In foundation slabs and slabs-on-grade, locate joints at intervals of approximately 40 feet.

4. In mats and structural slabs and beams, locate joints in compliance with ACI 224R.
5. Locations of joints shall be in accordance with the Contract Documents and as approved by ENGINEER in the Shop Drawings.
6. Where construction joints are indicated to be roughened, intentionally roughen surfaces of previously-placed concrete to amplitude of 1/4-inch.

I. Installation of Embedded Items: Set and build into the Work anchorage devices and embedded items required for other Work that is attached to, or supported by, cast-in-place concrete. Use setting diagrams, templates, and instructions provided under other Sections and, when applicable, other contracts for locating and setting. Refer to Paragraph 1.1.B of this Section. Do not embed in concrete uncoated aluminum items. Where aluminum items are in contact with concrete surfaces, coat aluminum to prevent direct contact with concrete.

J. Adhesive Dowels:
1. Adhesive dowels shall be reinforcing bar dowels set in an adhesive in hole drilled into hardened concrete. Comply with adhesive system manufacturer's installation instructions regarding hole diameter, drilling method, embedment depth required to fully develop required tensile strength, and hole cleaning and preparation instructions. Unless more-stringent standards are required by adhesive system manufacturer, comply with the following.
2. Drill holes to adhesive system manufacturer's recommended diameter and depth to develop required tensile strength. Holes shall not be more than 1/4-inch greater than nominal bar diameter, and hole depth shall not be less than twelve times nominal bar diameter. Hammer-drill holes. Cored holes are not allowed.
3. Embedment depths shall be based on concrete compressive strength of 4,000 psi when embedded in existing concrete, and 4,000 psi when embedded in new concrete.
4. Determine location of existing reinforcing steel in vicinity of proposed holes prior to drilling. Adjust location of holes to be drilled to avoid drilling through or damaging existing reinforcing bars only when approved by ENGINEER.
5. Before setting adhesive dowel, hole shall be free of dust and debris using method recommended by adhesive system manufacturer. Hole shall be brushed, with manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.
6. Inject adhesive into hole through injection system mixing nozzle and necessary extension tubes, placed to bottom of hole. Withdraw discharge end as adhesive is placed, but keep end of tube immersed to prevent forming air pockets. Fill hole to depth that ensures that excess material is expelled from hole during dowel placement.
7. Twist dowels during insertion into partially-filled hole to guarantee full wetting of bar surface with adhesive. Insert bar slowly to avoid developing air pockets.

3.4 CONCRETE PLACING

A. Site Mixing: Use drum-type batch machine mixer, mixing not less than 1.5 minutes for one cubic yard or smaller capacity. Increase required mixing time by minimum of 15 seconds for each additional cubic yard or fraction thereof.

B. Ready-Mixed Concrete: Comply with ASTM C94/C94M.

C. Concrete Placing:
   1. Place concrete in a continuous operation within planned joints or sections in accordance with ACI 304R.
   2. Do not begin placing concrete until work of other trades affecting concrete is completed.
   3. Wet concrete and subgrade surfaces to saturated surface dry condition immediately prior to placing concrete.
   4. Deposit concrete as near its final location as practical to avoid segregation due to re-handling or flowing.
   5. Avoid separation of the concrete mixture during transportation and placing. Concrete shall not free-fall for distance greater than four feet during placing.
   6. Complete concrete placing within 90 minutes of addition of water to the dry ingredients.

D. Consolidate placed concrete in accordance with ACI 309R using mechanical vibrating equipment supplemented with hand rodding and tamping, such that concrete is worked around placing and other embedded items and into all parts of formwork. Insert and withdraw vibrators vertically at uniformly-spaced locations. Do not use vibrators to transport concrete within the formwork. Vibration of formwork or placing is not allowed.

E. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.
   1. In hot weather comply with ACI 305R.
   2. In cold weather comply with ACI 306R.

3.5 QUALITY OF CONCRETE WORK

A. Make concrete solid, compact, smooth, and free of laitance, cracks, and cold joints.

B. Concrete for liquid-retaining structures and concrete in contact with earth, water, or exposed directly to the elements shall be watertight.

C. Cut out and properly replace to extent directed by ENGINEER, or repair to satisfaction of ENGINEER, surfaces that contain cracks or voids, are unduly rough, or are in defective in any way. Patches or plastering are unacceptable.

D. Repair, removal and replacement of defective concrete directed by ENGINEER shall be at no additional cost to OWNER.

3.6 CURING

A. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by using moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until formwork is removed. Provide protection, as required, to prevent damage to exposed concrete surfaces. Total curing period shall not be less than seven days. Curing methods and materials shall be compatible with scheduled finishes.

3.7 FINISHING

A. Slab Finish:
   1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently. Use a wood float only. Check and level surface plane to a tolerance not exceeding 1/4-inch in ten feet when tested with a ten foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float the surface to a uniform, smooth, granular texture. Slab surfaces shall receive a float finish. Provide additional trowel finishing as required in this Section.
   2. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over the surface.
   3. Consolidate concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in ten feet when tested with a ten-foot straightedge. Grind smooth surface defects that would telegraph through applied floor covering system.
   4. Use trowel finish for the following:
      a. Interior exposed slabs, unless otherwise shown or indicated.
      b. Apply non-slip broom finish, after troweling, to exterior concrete slab and elsewhere as shown.

B. Apply chemical floor hardener to exposed interior concrete floor areas when cured and dry, in accordance with hardener manufacturer’s instructions.

C. Formed Finish:
   1. Provide smooth form concrete finish at exposed surfaces. Use largest practical form panel sizes to minimize form joints. Exposed surfaces include interior water-contacting surfaces of tanks, whether or not directly visible. All surfaces shall be considered as exposed, unless buried or covered with permanent structural or architectural material. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/8-inch in height. Where surface will be coated or will receive further treatment, remove all fins flush with concrete surface.

2. Provide rough form finish at all unexposed surfaces. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/2-inch in height.

3.8 GROUT PLACING

A. Place grout as shown and indicated, and in accordance with grout manufacturer's instructions and recommendations. If grout manufacturer's instructions conflict with the Contract Documents, notify ENGINEER and not proceed until obtaining ENGINEER's clarification.

B. Dry-packing is not allowed, unless otherwise indicated.

C. Manufacturers of proprietary grout materials shall make available upon 72 hours notice the services of qualified, full-time, factory-trained employee to aid in ensuring proper use of grout materials at the Site.

D. Placing grout shall comply with temperature and weather limitations described in Article 3.4 of this Section.

3.9 FIELD QUALITY CONTROL

A. Site Testing Services:
   1. CONTRACTOR shall employ independent testing laboratory to perform field quality control testing for concrete. ENGINEER will direct where samples are obtained.
   2. Testing laboratory will provide all labor, material, and equipment required for sampling and testing concrete, including: scale, glass tray, cones, rods, molds, air tester, thermometer, and other incidentals required.
   3. CONTRACTOR shall provide curing and necessary cylinder storage .

B. Quality Control Testing During Construction:
   1. Perform sampling and testing for field quality control during concrete placing, as follows:
      a. Sampling Fresh Concrete: ASTM C172.
      b. Slump: ASTM C143/C143M; one test for each concrete load at point of discharge.
      c. Concrete Temperature: ASTM C1064/C1064M; one for every two concrete loads at point of discharge, and when a change in the concrete is observed. Test each load when time from batching to placement exceeds 75 minutes.
      d. Air Content: ASTM C231; one for every two concrete load at point of discharge, and when a change in the concrete is observed.
      e. Unit Weight: ASTM C138/C138M; one for every two concrete loads at point of discharge, and when a change in the concrete is observed.
      f. Compression Test Specimens:

1) In accordance with ASTM C31/C31M, make one set of compression cylinders for each 50 cubic yards of concrete, or fraction thereof, of each mix design placed each day. Each set shall be four standard cylinders, unless otherwise directed by ENGINEER.
2) Cast, store, and cure specimens in accordance with ASTM C31/C31M.

g. Compressive Strength Tests:
1) In accordance with ASTM C39/C39M; one specimen tested at seven days, and three specimens tested at 28 days.
2) Concrete that does not comply with strength requirements will be considered as defective Work.

h. Submit test results from certified by testing laboratory to ENGINEER within 24 hours of completion of test.

i. When there is evidence that strength of in-place concrete does not comply with the Contract Documents, CONTRACTOR shall employ the services of concrete testing laboratory to obtain cores from hardened concrete for compressive strength determination. Cores and tests shall comply with ASTM C42/C42M and the following:
1) Testing of Adhesive Dowels: OWNER will employ testing agency to perform field quality control testing of drilled dowel installations. After adhesive system manufacturer's recommended curing period and prior to placing connecting reinforcing, proof-test for pullout ten percent of adhesive dowels installed. Adhesive dowels shall be tensioned to 60 percent of specified yield strength. Where dowels are located less than six bar diameters from edge of concrete, ENGINEER will determine tensile load required for test. If one or more dowels fail, retest all dowels installed for the Work. Dowels that fail shall be reinstalled and retested at CONTRACTOR's expense.

+ + END OF SECTION + +

SECTION 03 41 10

DESIGNED PRECAST CONCRETE VAULTS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all professional services, labor, materials, equipment and incidentals as shown, specified and required to design, furnish, and install all precast concrete structures.
   2. The Work includes:
      a. Water Vault.

B. General:
   1. Structures shall conform in shape, size, dimensions, material, and other respects to the details shown or as ordered by ENGINEER.
   2. Concrete for inverts in precast concrete structures shall be Class A and shall conform to the requirements specified under Section 03 00 05, Concrete.

C. Related Sections:
   1. Section 03 00 05, Concrete.
   2. Section 05 54 63, Floor Access Hatch Covers
   3. Division 40, Process Interconnections.
   4. Section 31 23 05, Excavation and Fill.

1.2 QUALITY ASSURANCE

A. Standards referenced in this Section are:
   1. American Association of State Highway and Transportation Officials (AASHTO).
   2. ASTM C 478, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
   3. PCI MNL-116, Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.

B. Fabrication Tolerances:
   1. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, unless otherwise indicated. Keep bar sizes small, even where this will reduce the spacing of the bars.
   2. Units shall be true to dimensions. Unit bow, as fabricated and installed, shall not exceed 1/8 inch per unit in the short dimension and 1/4-inch per unit in the long dimension. Step in alignment face and jog in alignment shall not

exceed 1/4-inch. Provide a 3/4-inch chamfer or 1 x 2-inch radius on all exposed edges and corners.

3. Imperfections such as air bubbles, ripples, joint lines, warpage, stains, projections, honeycombs, uneven matrix plate, and other defects will not be acceptable.

C. Qualifications and Responsibilities of Contractor's Design Professional:
   1. Professional Engineer for delegated design:
      a. Engage a registered professional engineer qualified to practice in the State of Georgia and experienced in providing engineering services of the kind indicated.
      b. Responsibilities include but are not necessarily limited to:
         1) Carefully reviewing precast concrete structure performance and design criteria stated in the Contract Documents.
         2) Preparing written requests for clarifications or interpretations of performance or design criteria for submittal to ENGINEER by CONTRACTOR.
         3) Preparing or supervising the preparation of design calculations and related drawings, Shop Drawings, testing plan development, test-result interpretation and a comprehensive engineering analysis verifying compliance of the precast concrete structure with the requirements of the Contract Documents.
         4) Signing and sealing all calculations and design drawings, and Shop Drawings.
         5) Certifying that:
            i. It has performed the design of the precast concrete structure in accordance with the performance and design criteria stated in the Contract Documents, and
            ii. The said design conforms to all applicable local, state and federal codes, rules and regulations, and to the prevailing standards of practice.

D. Qualifications of Fabricator: A firm that complies with the following requirements and is experienced in producing structural precast concrete units similar to those indicated for this Project and with a record of successful in-service performance.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Qualifications:
      a. Submit qualifications data for the Contractor's Design Professional.
   2. Precast Structures:
      a. Drawing showing design and construction of all precast concrete, as well as the location and details of all items that are to be embedded in the precast units.

b. Design calculations and shop drawings, signed and stamped with a seal of a Registered Professional Engineer licensed to practice in the State of Georgia.
c. Test result from concrete cylinder strength tests.

3. Certificate of Performance: Submit certification of performance of the delegated design by the Contractor's design professional (Attachment A, located at the end of this Section).

B. Shop Tests:
1. Submit description of proposed testing methods, procedures and apparatus. Prepare and submit report for each test.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:
1. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation.

B. Storage of Materials:
1. Store units at project site in a manner that will prevent cracking, distortion, warping, staining, or other physical damage and so that precast copings are without damage at time of installation.

C. Handling of Materials:
1. Lift and support units only at designated lifting or supporting points as shown on final Shop Drawings.

PART 2 – PRODUCTS

2.1 PRECAST CONCRETE STRUCTURES

A. Layout and details shall be as shown and specified. Design shall be adequate to withstand live loads, lateral earth pressure loading, and uplift case.
1. Design Criteria:
a. Top slab live load: 300 psf.
b. Lateral soil pressure: 55 pcf equivalent fluid pressure.
c. Maximum allowable soil bearing pressure: 2000 psf. Geotechnical Engineer to verify, refer to Contract Geotechnical Engineering Evaluation Report.
d. Moist unit weight of soil = 120 pcf.
e. Safety factor for uplift normal ground water > 1.5.
f. Design shall meet the requirements of ACI 350 and the Building Code.
g. Minimum slab and wall thickness shall be 8” with minimum #4 reinforcement.

B. Concrete Mix: Standard-weight concrete consisting of specified portland cement, pigments, aggregates, admixtures, and water to produce the following properties:

1. Compressive Strength: 5,000 psi minimum at 28 days.
2. Total Air Content: Not less than 4 percent nor more than 6 percent.

C. Where precast structures are made up of various precast components such as base sections, riser sections and top sections, the joint between sections shall be watertight and be the tongue and groove type complying with AWWA C302.

D. Top slabs shall be designed to be removable, unless otherwise noted.

E. Walls shall be precast with wall pipes or with pipe sleeves with water stop suitable for use with mechanical link seal as shown on the Drawings. Contractor to grout fill around pipes as shown on the Drawings.

F. Precast structure shall be designed and constructed to accept access hatches or castings as shown and specified.

G. Precast structures shall be designed to support the weight of equipment lifted from the station to the top slab.

H. Underground precast units shall have a shop-applied coal tar epoxy applied to the exterior surface.

I. Lifting holes, if used, shall be tapered. Tapered, solid rubber plugs shall be furnished to seal the lifting holes. The lifting holes shall be made to be sealed by plugs driven from the outside face only.

J. Mark date of manufacture and name of trademark of manufacturer on inside of barrel.

2.2 ACCESS HATCHES AND CASTINGS

A. All necessary access hatches and castings as shown and specified shall be cast into concrete as necessary.

2.3 SHOP TESTING

A. Shop Tests:
1. At a minimum, conduct the following shop tests:
a. Conduct concrete cylinder strength tests. Cylinders shall be cured in the same manner as the precast structures. Collect a minimum of two test cylinders from every 10 cubic yards of concrete poured at a minimum.

PART 3 – EXECUTION

3.1 INSPECTION

A. CONTRACTOR and his installer shall examine the substrate and the conditions under which Work is to be performed and notify OWNER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to OWNER.

3.2 INSTALLATION

A. Set units in true alignment. All joints shall be sealed with cement mortar inside and out and troweled smooth to the contour of the wall surface. Raised or rough joint finishes will not be accepted.

B. Precast vault structure walls shall be set on a crushed stone, crushed gravel, or concrete foundation as shown on drawings and in accordance with geotechnical recommendations. Refer to Contract Geotechnical Engineering Evaluation report. Precast units shall be set at the proper grade and carefully leveled and aligned. Prepare subgrade under the supervision of the Geotechnical Engineer to withstand vault loads.

C. Install units in accordance with manufacturer's recommendations.

D. Replace precast concrete units damaged for any reason or which fail to perform as specified.

3.3 ATTACHMENTS

A. Attachments listed below, following the "End of Section" designation, are part of this Specification section.
   1. Attachment A, Professional Design Services Performance Certification.

+ + END OF SECTION + +

ATTACHMENT A

Professional Design Services Performance Certification

I hereby certify that, to the best of my knowledge, information and belief, I have performed or supervised the performance of the professional design services hereunder, and that said services have been performed in accordance with all applicable local, state and federal codes, rules and regulations and in accordance with the standard of care currently expected of professional engineers/architects performing similar services for projects of similar size and complexity in the State of Georgia.

_____
Signature

_____
Typed or Printed Name

_____
Name of Firm

_____
Street Address

[SEAL] _____
City/State/Zip Code

Telephone: _____

Fax: _____

DIVISION 5 – METALS

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SECTION 05 05 33

ANCHOR SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all professional services, labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install anchor systems.
   2. This Section includes all anchor systems required for the Work, but not specified under other Sections.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before anchor systems Work.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ACI 318, Building Code Requirements for Structural Concrete.
   2. ACI 350, Code Requirements for Environmental Engineering Concrete Structures.
   3. ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete.
   4. ANSI/MSS SP-58, Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.
   5. ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
   6. ASTM A276, Specification for Stainless Steel Bars and Shapes.
   7. ASTM A493, Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging.
   8. ASTM A563, Specification for Carbon and Alloy Steel Nuts.
   9. ASTM A1011/A1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   10. ASTM B633, Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   11. ASTM C307, Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
   12. ASTM C881/C881M, Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
   13. ASTM D695, Test Method for Compressive Properties of Rigid Plastics.
   14. ASTM D790, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

15. ASTM E329, Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
16. ASTM E488, Test Methods for Strength of Anchors in Concrete.
17. ASTM F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
18. ASTM F594, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
19. ASTM F1554, Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.
20. FS A-A-1922A, Shield, Expansion (Caulking Anchors, Single Lead).
21. FS A-A-1923A, Concrete Expansion Anchors.
22. FS A-A-1925A, Shield, Expansion (Nail Anchors).
23. FS A-A-55614, Shield, Expansion (non-drilling expansion anchors).
24. ICC-ES AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
25. ICC-ES AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
26. ISO 3506-1, Mechanical Properties of Corrosion-Resistant Stainless Steel Fasteners – Part 1: Bolts, Screws and Studs.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Testing Laboratory: Shall comply with ASTM E329 and shall be experienced in tension testing of post-installed anchoring systems.
   2. Professional Engineer:
      a. CONTRACTOR or delegated system manufacturer shall retain a registered professional engineer legally qualified to practice in the same state as the Site.
      b. Responsibilities include:
         1) Reviewing anchor system performance and design criteria stated in the Contract Documents.
         2) Preparing written requests for clarifications or interpretations of performance or design criteria for submittal to ENGINEER by CONTRACTOR.
         3) Preparing or supervising preparation of design calculations and related Shop Drawings.
         4) Signing and sealing all design calculations and Shop Drawings.
         5) Certifying that:
            a) Design of anchor systems has been performed in accordance with performance and design criteria stated in the Contract Documents, and
            b) Design conforms to all applicable local, state, and federal Laws and Regulations, and to prevailing standards of practice.

   3. Post-installed Anchor Installer:

a. Mechanical and Adhesive anchors, except as noted in 1.3.A.4.b: Installer shall be experienced and trained by post-installed anchor system manufacturer in proper installation of manufacturer's products. Product installation training by distributors or manufacturer's representatives is unacceptable unless the person furnishing the training is qualified as a trainer by the anchor manufacturer.

b. Adhesive Anchors: Installation of horizontal or upwardly inclined adhesive anchors shall be performed by personnel certified under an applicable certification program. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Anchors Installer Certification Program, or equivalent. Description of equivalent programs shall be submitted for ENGINEER's approval and shall be accepted by the building official having jurisdiction.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Listing of all anchor systems products intended for use in the Work including product type, intended location in the Project, and embedded lengths.
   2. Product Data:
      a. Manufacturer's specifications, load tables, dimension diagrams, acceptable base material conditions, acceptable drilling methods, and acceptable bored hole conditions.
      b. Copies of valid ICC ES reports that presents load-carrying capacities and installation requirements for anchor systems.

B. Delegated Design Submittals:
   1. Design Data: Submit the following:
      a. Design Calculations for delegated anchor systems. Structural calculations shall include all specified performance criteria. The magnitude of delegated system/anchorage reactions to supporting structure shall be clearly noted. Design calculations shall be signed, sealed, and dated by CONTRACTOR's professional engineer.

C. Informational Submittals: Submit the following:
   1. Certificates:
      a. For each type of anchor bolt or threaded rod, submit copies of laboratory test reports and other data required to demonstrate compliance with the Contract Documents.
         1) Reports shall demonstrate compliance with ductile steel element definition of ACI 350, Appendix D or ACI 318
      b. Post-installed anchor system manufacturer's certification that installer received training in the proper installation of manufacturer's products required for the Work.

c. For each required adhesive anchor installer, submit ACI/CRSI Adhesive Anchor Installer Certification.

2. Manufacturer's Instructions:
   a. Installation instructions for each anchor system product proposed for use, including bore hole cleaning procedures and adhesive injection, cure, and gel timetables, and temperature ranges (storage, installation and in-service).
3. Field Quality Control Submittals:
   a. Submit results of field quality control testing and inspections performed by testing laboratory.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage and Protection:
   1. Keep materials dry during delivery and storage.
   2. Store adhesive materials within manufacturer's recommended storage temperature range.
   3. Protect anchor systems from damage at the Site. Protect products from corrosion and deterioration.

PART 2 – PRODUCTS

2.1 SYSTEM PERFORMANCE

A. General:
   1. At locations where conditions dictate that Work specified in other Sections is to be of corrosion resistant materials, provide associated anchor systems of stainless steel materials, unless other corrosion-resistant anchor system material is specified. Provide anchor systems of stainless steel materials where stainless steel materials are required in the Contract Documents.
   2. Stainless Steel Nuts:
      a. For anchor bolts and adhesive anchors, provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts for stainless steel anchors used for anchoring equipment, gates, and weirs, and other locations, if any, where the attachment will require future removal for operation or maintenance. Provide lock washer or double nuts on each anchorage device provided for equipment, as required by equipment manufacturer.
      b. For other locations, provide for each anchorage device a nut as specified or as required by anchor manufacturer. When ASTM A194/A194M, Grade 8S (Nitronic 60) nuts are not required for anchor bolts and adhesive anchors as specified in this Section, provide anti-seizing compound where stainless steel rods are used with stainless steel nuts of the same type.

B. Design Criteria

1. Size, Length, and Load-carrying Capacity: Comply with the Contract Documents. When size, length or load-carrying capacity of anchor system is not otherwise shown or indicated, provide the following:
   a. Anchor Bolts: Provide size, length, and capacity required to carry design load based on values and requirements of Paragraph 3.2.A of this Section. For conditions outside limits of critical edge distance and spacing in Paragraph 3.2.A of this Section, minimum anchor bolt embedment as shown or indicated in Paragraph 3.2.A of this Section apply and capacity shall be based on requirements of Laws and Regulations, including applicable building codes.
   b. Adhesive Anchors, Expansion Anchors, or Concrete Inserts: Provide size, length, type, and capacity required to carry design load. Anchor capacity shall be based on the procedures required by the building code in effect at the Site. Where Evaluation Service Reports issued by the ICC Evaluation Service are required in this Section, anchor capacities shall be based on design procedure required in the applicable ICC Evaluation Service Report.
      1) General: Determine capacity considering reductions due to installation and inspection procedures, embedment length, strength of base fastening materials, spacing, and edge distance, as indicated in the manufacturer's design guidelines. For capacity determination, concrete shall be assumed to be in the cracked condition, unless calculations demonstrate that the anchor system will be installed in an area that is not expected to crack under any and all conditions of design loading.
      2) Concrete Adhesive Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum embedment depth of the greater of the following: required to develop tensile strength of anchor, or a minimum embedment of 10 anchor diameters; and minimum anchor spacing and edge distance of 12 anchor diameters.
      3) Concrete Expansion Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum embedment depth of six anchor diameters, and minimum anchor spacing and edge distance of seven anchor diameters.
2. Delegated Design: When anchor systems are used for supporting materials, equipment, or systems delegated to CONTRACTOR, Subcontractor, or Supplier, provide anchor system suitable for loads indicated in delegated design documents and consistent with the design intent expressed in the Contract Documents. Anchor system shall be designed by a professional engineer, retained by CONTRACTOR, Subcontractor, or Supplier, registered in the same state as the Site, with proper consideration of concrete strength, spacing and edge distance

   Design Loads. Comply with the Contract Documents. When design load of supported material, equipment, or system is not otherwise shown or indicated, provide the following:

a. Equipment Anchors: Use design load recommended by equipment manufacturer. When equipment can be filled with fluid, use loads that incorporate equipment load and load imposed by fluid.
b. Pipe Hangers and Supports: Use full weight of pipe, and fluid contained in pipe that are tributary to the support plus the full weight of valves and accessories located between the hanger or support being anchored and the next hanger or support.
c. Hangers and Supports for Electrical Systems, and HVAC, Plumbing, and Fire Suppression Systems and Piping: Use the full weight of supported system that is tributary to the support plus the full weight of accessories located between the hanger or support being anchored and the next hanger or support. When piping or equipment is to be filled with fluid, anchor systems shall be sized to support such loads in addition to the weight of the equipment, piping, or system, as applicable.

C. Application:
1. Anchor Bolts:
a. Where anchor bolt is shown or indicated, use cast-in-place anchor bolt unless another anchor type is approved by ENGINEER.
b. Provide anchor bolts as shown or indicated, or as required to secure structural element to appropriate anchor surface.
2. Concrete Adhesive Anchors:
a. Use where adhesive anchors are shown or indicated for installation in concrete.
b. Suitable for use where subject to vibration.
c. Suitable for use in exterior locations or locations subject to freezing.
d. Suitable for use in submerged, intermittently submerged, or buried locations.
e. Do not use in overhead applications, unless otherwise shown or approved by ENGINEER.
f. Do not use for pipe hangers, unless otherwise shown or approved by ENGINEER.
3. Concrete Wedge Expansion Anchors:
a. Use where expansion anchors are shown or indicated for installation in concrete.
b. Do not use where subject to vibration.
c. Do not use in exterior locations or locations subject to freezing.
d. Do not use in submerged, intermittently submerged, or buried locations.
e. Suitable for use in overhead applications.
4. Drop-in Expansion Anchors:
a. Use drop-in expansion anchors installed in concrete where light-duty anchors are required to support piping or conduit two-inch diameter or smaller.

b. Do not use for attaching safety-related systems, such as piping conveying hazardous or potentially hazardous materials, or fire suppression systems.
c. Do not use where subject to vibration.
d. Do not use at submerged, intermittently submerged, or buried locations.
e. Do not use in exterior locations or locations subject to freezing.
f. Suitable for use in overhead applications.

5. Concrete Undercut Anchors:
   a. Use where undercut anchors are shown or indicated for installation in concrete.
   b. Suitable for use where subject to vibration.
   c. Do not use in submerged, intermittently submerged, or buried locations.
   d. Do not use in exterior locations or locations subject to freezing.
   e. Suitable for use in overhead applications.
6. Concrete Inserts:
   a. Use only where shown or indicated in the Contract Documents.
   b. Allowed for use to support pipe hangers and pipe supports for pipe size and loading recommended by the concrete insert manufacturer.
7. Drive-In Expansion Anchors:
   a. Use drive-in expansion anchors installed in concrete, precast concrete, grouted masonry units, or brick, where light-duty anchors are required to support piping or conduit one-inch diameter and smaller.
   b. Do not use for attaching safety-related systems, such as piping conveying hazardous or potentially hazardous materials, or fire suppression systems.
   c. Do not use in overhead applications.
8. For Use in Precast Concrete Planks:
   a. To support piping or conduit six-inch diameter and smaller, use low-profile drop-in anchors, hollow concrete masonry adhesive anchors, or through-bolts.
   b. For piping greater than six-inch diameter, or to support safety-related systems, use through-bolts. Each through-bolt shall consist of threaded rod, nuts, washers, and bearing plate.

2.2 MATERIALS

A. Anchor Bolts:
   1. Interior Dry Non-Corrosive Locations: Provide straight threaded carbon steel rods complying with ASTM F1554, Grade 36, with heavy hex nuts complying with ASTM A563 Grade A, unless otherwise shown or indicated on the Drawings. Hooked anchor bolts are unacceptable.
   2. Exterior, Buried, Submerged Locations, or When Exposed to Wastewater: Provide stainless steel straight threaded rods complying with ASTM F593, AISI Type 316, Condition A, with ASTM F594, AISI Type 316, stainless steel nuts. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless

steel nuts where required. Other AISI types may be used when approved by ENGINEER. Hooked bolts are unacceptable.

a. Stainless steel straight threaded rod shall comply with ductility requirements of ACI 350 Appendix D or ACI 318, chapter 17.

3. Equipment: Provide anchor bolts complying with material requirements of this Section and equipment manufacturer's requirements relative to size, embedment length, and anchor bolt projection. Anchor bolts shall be straight threaded rods with washers and nuts as specified in this Section. Hooked bolts are unacceptable.
4. Anchoring of Structural Elements: Provide anchor bolts of size, material, and strength shown or indicated in the Contract Documents.

B. Concrete Adhesive Anchors:
1. General:
   a. Adhesive anchors shall consist of threaded rods anchored into hardened concrete using an adhesive system.
2. Products and Manufacturers: Provide one of the following unless otherwise noted in the Drawings:
   a. HIT-RE 500-V3 Injection Epoxy Adhesive Anchoring System, by Hilti Fastening Systems, Inc.
   b. HIT-HY 200-A and HIT-HY 200-R Adhesive Anchoring System, by Hilti Fastening Systems, Inc
   c. SET-XP Epoxy-Tie Adhesive, by Simpson Strong-Tie Company, Inc.
   d. Or approved equal.
3. Adhesive:
   a. Adhesive system shall use two-component adhesive mix.
   b. Epoxy adhesives shall comply with physical requirements of ASTM C881/C881M, Type IV, Grade 2 and 3, Class A, B, and C, except gel times.
   c. Adhesives shall have a current evaluation report by ICC Evaluation Service for use in both cracked and uncracked concrete with seismic recognition for SDC A through F as tested and assessed in accordance with ICC-ES AC308.
4. Anchor:
   a. Provide continuously threaded, AISI Type 316 stainless steel adhesive anchor rod. Threaded rods shall comply with the concrete adhesive anchor manufacturer's specifications as included in the ICC Service Evaluation Report for the anchor submitted. Nuts shall have specified proof load stresses equal to or greater than the minimum tensile strength of the stainless steel threaded rod used. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts where required.
   b. Stainless steel threaded rod shall comply with ductility requirements of ACI 350 or ACI 318

C. Concrete Wedge Expansion Anchors:
1. General:

a. Concrete wedge expansion anchors shall consist of stud, wedge, nut, and washer.

2. Products and Manufacturers: Provide one of the following:
   a. Kwik Bolt TZ Wedge Anchor, by Hilti Fastening Systems, Inc.
   b. Strong Bolt 2 Wedge Anchor, by Simpson Strong-Tie Company, Inc.
   c. Or approved equal.
3. Anchors shall comply with physical requirements of FS A-A-1923A, Type 4. Provide concrete wedge expansion anchors suitable for use in cracked and uncracked concrete in accordance with ACI 318 and ACI 350, Appendix D. Demonstrate suitability of cracked concrete wedge anchors in accordance with ACI 355.2 prequalification tests.
4. Interior Dry Non-Corrosive Locations: Provide carbon steel anchors complete with nuts and washers, zinc plated, in accordance with ASTM B633.
5. Other Locations: Provide expansion anchors complete with nuts and washers, AISI Type 304 stainless steel anchor body, in accordance with ASTM A276 or ASTM A493.
6. Anchor shall comply with ductility requirements of ACI 350 or ACI 318.
7. Concrete wedge expansion anchors shall have a current ICC Evaluation Service Report for use in both cracked and uncracked concrete with seismic recognition in seismic design Categories A through F when tested and assessed in accordance with ICC-ES AC193.

D. Drop-in Expansion Anchors:
1. General:
   a. Drop-in expansion anchors shall each consist of an internally threaded, deformation-controlled expansion anchor with pre-assembled expander plug.
2. Products and Manufacturers: Provide one of the following:
   a. HDI Drop-In Anchors, by Hilti Fastening Systems, Inc.
   b. Drop-In Anchor, by Simpson Strong-Tie Company, Inc.
   c. Or approved equal.
3. Provide carbon steel anchors complete with nuts and washers, zinc plated, in accordance with ASTM B633, complying with physical requirements of FS A-A-55614, Type I. Anchors shall be flush or shell type. Provide low-profile anchors for use in precast concrete planks.

E. Concrete Undercut Anchors:
1. General:
   a. Each concrete undercut anchor shall consist of threaded stud, thick-walled expansion sleeve, expander coupler, and nut and washer. Anchors shall be pre-set type or through-set type, as shown on the Drawings.
2. Products and Manufacturers: Provide one of the following:
   a. HDA Undercut Anchor, by Hilti Fastening Systems, Inc.
   b. DUC Ductile Undercut Anchor, by USP Structural Connectors.
   c. Or approved equal

3. Provide concrete undercut expansion anchors in accordance with ACI 318 and ACI 350. Demonstrate suitability of cracked concrete undercut anchors in accordance with ACI 355.2 prequalification tests.
    a. Anchor shall comply with ductility requirements of ACI 350 or ACI 318.
4. Installed anchor shall exhibit form fit between bearing elements and the undercut in the concrete.
5. Interior Dry Non-Corrosive Locations: Provide carbon steel anchors, complete with nuts and washers, zinc plated, in accordance with ASTM B633.
6. Other Locations: Provide stainless steel anchors, complete with nuts and washers, manufactured of AISI Type 316 stainless steel or materials complying with ISO 3506-1 and having corrosion resistance equivalent to AISI Type 316 stainless steel.
7. Concrete undercut anchors shall have a current ICC Evaluation Service Report for use in both cracked and uncracked concrete for seismic recognition for seismic design Categories A through F when tested and assessed in accordance with ICC-ES AC193.

F. Concrete Inserts:
1. Manufacturers: Provide products of one of the following:
    a. Unistrut Corporation.
    b. Cooper B-Line, Inc.
    c. Anvil International, Inc.
    d. Or approved equal.
2. Spot Concrete Inserts:
    a. Provide inserts recommended by insert manufacturer for required loading. Inserts shall comply with ANSI/MSS SP-58, malleable iron, Type 18. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Provide nuts compatible with insert and to suit threaded hanger rod sizes.
3. Continuous Concrete Inserts:
    a. Provide inserts recommended by insert manufacturer for required loading. Inserts shall be continuous type and shall be manufactured from minimum 12-gage cold-formed channel sections, complying with ASTM A1011/A1011M, stainless steel, Grade 33, complete with styrofoam inserts, end caps, and means for attaching to forms. Provide channel nuts compatible with insert suitable for threaded hanger rod sizes.
4. Provide inserts with plain finish.

G. Drive-In Expansion Anchors:
1. General:
    a. Drive-In expansion anchors shall each consist of stainless steel drive pin and expanding alloy body.
2. Products and Manufacturers: Provide one of the following:
    a. Metal HIT Anchor, by Hilti Fastening Systems, Inc.

b. Zinc Nailon Anchor, by Simpson Strong-Tie Company, Inc.
c. Or approved equal.

3. Provide Type 304 stainless steel drive pin with zinc alloy body. Anchor shall comply with physical requirements of FS A-A-1925A, Type 1.

H. Unless approved by ENGINEER, do not use power-actuated fasteners or other types of bolts and fasteners not specified in this Section.

I. Anti-Seizing Compound:
1. Products and Manufacturers: Provide one of the following:
a. Pure Nickel Never-Seez, by Bostik.
b. Nickel-Graf, by Anti-Seize Technology.
c. Or approved equal.
2. Provide pure nickel anti-seizing compound.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials will be installed and advise ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Anchor Bolts:
1. Provide anchor bolts as shown or indicated in the Contract Documents, or as required to secure structural element to the appropriate anchor surface.
2. Locate and accurately set anchor bolts using templates or other devices as required, prior to placing concrete. Wet setting of anchor bolts is unacceptable.
3. Protect threads and shank from damage during installation and subsequent construction operations.
4. Minimum embedment and spacing of anchor bolts shall be as indicated on Contract Documents.

B. Adhesive Anchors, Undercut Anchors, and Expansion Anchors – General:
1. Prior to drilling, locate existing reinforcing steel in vicinity of proposed holes. If reinforcing conflicts with proposed hole location, obtain ENGINEER's approval of alternate hole locations to avoid drilling through or damaging existing reinforcing bars.

C. Adhesive Anchors:
1. Installation conditions shall comply with all requirements of the approved product Evaluation Service Report (ESR), including "Conditions of Use."

Comply with manufacturer's written installation instructions and the following.

2. Drill holes to adhesive system manufacturer's recommended drill bit diameter to the specified depth. Drill holes in hammering and rotation mode with carbide-tipped drill bits that comply with the tolerances of ANSI B212.15. Core-drilled holes are unacceptable.
3. Before setting adhesive anchor, hole shall be made free of dust and debris by method recommended by adhesive anchor system manufacturer. Hole shall be brushed with adhesive system manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.
4. Before injecting adhesive, obtain ENGINEER's concurrence that hole is dry and free of oil and other contaminants.
5. Prior to injecting adhesive into the drilled hole, dispense, to a location appropriate for such waste, an initial amount of adhesive from the mixing nozzle, until adhesive is uniform color.
6. Inject adhesive into hole through injection system-mixing nozzle and necessary extension tubes, placed to bottom of hole. Discharge end shall be withdrawn as adhesive is placed but kept immersed to prevent formation of air pockets. Fill hole to depth that ensures that excess material is expelled from hole during anchor placement.
7. Twist anchors during insertion into partially-filled hole to guarantee full wetting of rod surface with adhesive. Insert rod slowly to avoid developing air pockets.
8. Provide adequate curing in accordance to adhesive system manufacturer's requirements prior to continuing with adjoining Work that could place load on installed adhesive anchors. Do not begin adjoining Work until adhesive anchors are successfully tested or when allowed by ENGINEER.
9. Limitations:
    a. Core drilled holes shall not be allowed.
    b. At time of anchor installation, concrete shall have compressive strength (f'c) of not less than 3000 psi.
    c. At time of anchor installation, concrete shall have age of not less than 21 days.
    d. Installation Temperature: Comply with manufacturer's instructions for installation temperature requirements. Provide temporary protection and other measures, such as heated enclosures, necessary to ensure that base material temperature complies with anchor systems manufacturer's requirements during installation and curing of adhesive anchor system.
    e. Oversized Holes: Advise ENGINEER immediately if size of drilled hole is larger than recommended by anchor system manufacturer. Cost of corrective measures, including but not limited to redesign of anchors due to decreased anchor capacities, shall be paid by CONTRACTOR.

f. Embedment depths shall be based on installation in normal-weight concrete with compressive strength of 3000 psi when embedded in existing concrete, and 4,000 psi when embedded in new concrete.
g. Obstructions in drill path: When existing reinforcing steel is encountered during drilling, stop and do not damage existing reinforcing. Obtain ENGINEER approval for any required modifications.

D. Expansion Anchors:
1. Comply with expansion anchor manufacturer's written installation instructions and the following:
2. Drill holes using anchor system manufacturer's recommended drill bit diameter and to the specified depth. Drill holes in hammering and rotation mode with carbide-tipped drill bits complying with tolerances of ANSI B212.15. Core drilled holes are unacceptable.
3. Before installing anchor, hole shall be made free of dust and debris by method recommended by anchor system manufacturer. Hole shall be brushed with anchor system manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles.
4. Before installing anchor, obtain ENGINEER's concurrence that hole is dry and free of oil and other contaminants.
5. Protect threads from damage during anchor installation. Drive anchors not less than four threads below surface of the attachment. Set anchors to anchor manufacturer's recommended torque using a torque wrench.
6. Limitations:
a. At time of anchor installation, concrete shall have age of not less than 7 days.
b. At time of anchor loading, concrete shall have attained full specified compressive strength (f'c).

E. Concrete Undercut Anchors:
1. Comply with undercut anchor manufacturer's written installation instructions and the following.
2. Protect threads from damage during anchor installation.
3. Drill hole to anchor manufacturer's specified depth and diameter using a drill bit matched to the specific anchor.
4. Before setting the undercut anchor, hole shall be free of dust and debris using method recommended by undercut anchor system manufacturer. Hole shall be blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles.
5. Insert the anchor by hand until anchor reaches bottom of hole.
6. Set anchor in accordance with manufacturer's instructions using anchor manufacturer's specified setting tool.
7. Verify that the setting mark is visible on the threaded rod above the sleeve.
8. Anchor shall be set to manufacturer's recommended torque, using a torque

wrench.

9. Limitations:
    a. At time of anchor installation, concrete shall have age of not less than 7 days.
    b. At time of anchor loading, concrete shall have attained full specified compressive strength (f'c).

F. Concrete Inserts:
    1. Comply with concrete insert manufacturer's installation instructions.
    2. Inserts shall be flush with slab bottom surface.
    3. Protect embedded items from damage during concrete placing. Ensure that embedded items are securely fastened to prevent movement during concrete placing and ensure that embedded items do fill with concrete during concrete placing.
    4. Inserts intended for piping greater than four-inch diameter shall be provided with hooked rods attached to concrete reinforcing.

G. Anti-Seizing Compound:
    1. Provide anti-seizing compound in accordance with anti-seizing compound manufacturer's installation instructions, at locations indicated in Paragraph 2.1.B of this Section.
    2. Do not use anti-seizing compound at locations where anchor bolt or adhesive anchor will contact potable water or water that will be treated to become potable.

3.3 CLEANING

A. After embedding concrete is placed, remove protection and clean bolts and inserts.

3.4 FIELD QUALITY CONTROL

A. Site Tests:
    1. Furnish services of independent testing laboratory to perform field quality tensile testing of production adhesive anchors at the Site, unless otherwise specified.
        a. Testing shall comply with ASTM E488.
        b. Test at least ten percent of all types of adhesive anchors. If one or more adhesive anchors fail the test, CONTRACTOR shall pay cost of testing all anchors of the same type installed in the Work. CONTRACTOR shall be responsible for retesting costs
        c. ENGINEER will direct which adhesive anchors are to be tested and indicate test load to be used.
        d. Apply test loads with hydraulic ram.
        e. Displacement of post-installed anchors shall not exceed D/10, where D is nominal diameter of anchor being tested.

2. Mechanical Anchors:
   a. Responsibility:
      1) Furnish services of independent testing laboratory to perform field quality control tensile testing of mechanical anchors at the Site.
      2) CONTRACTOR shall demonstrate competence in installing mechanical anchors by performing field quality control tests.
   b. Perform field quality control tests on test anchors at location directed by ENGINEER. Test anchors shall not be part of the finished Work.
   c. Test not less than one installation of each type of mechanical anchor used in the Work.
      1) ENGINEER will indicate test loads to be used..
      2) Testing shall comply with ASTM E488.
      3) Apply test loads with hydraulic ram.
   d. Anchors that fail to reach the specified test load shall be considered as not passing the test and shall be re-tested at no additional cost to OWNER.
   e. Testing agency shall submit test results to CONTRACTOR and ENGINEER within 24 hours of completion of test.
3. Correct defective Work by removing and replacing or correcting, as directed by ENGINEER.
4. CONTRACTOR shall pay for all corrections and subsequent testing required to confirm competence in the installation of post-installed mechanical anchors.
5. Testing agency shall submit test results to CONTRACTOR and ENGINEER within 24 hours of completion of test.

B. Manufacturer's Services:
   1. Provide at the Site services of qualified adhesive manufacturer's representative during initial installation of adhesive anchor systems to train CONTRACTOR's personnel in proper installation procedures. Manufacturer's representative shall observe to confirm that installer demonstrates proper installation procedures for adhesive anchors and adhesive material.

+ + END OF SECTION + +

SECTION 05 53 11

STEEL GRATING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified and required to furnish and install steel grating and frames.
   2. The Work includes:
      a. Providing grating, frames, and appurtenances.
      b. Providing openings in grating to accommodate the Work under this and other Sections and attaching to steel grating all items such as sleeves, bands, studs, fasteners, and items required for which provision is not specifically included under other Sections.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before steel grating Work.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASTM A36/A36M, Specification for Carbon Structural Steel.
   2. ASTM A510, Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
   3. ASTM A1011/A1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   4. MS MIL-P-21035, Paint, High Zinc Dust Content Galvanizing Repair.
   5. NAAMM MBG 531, Metal Bar Grating Manual.
   6. NAAMM MBG 533, Welding Specifications for Fabrication of Steel, Aluminum and Stainless Bar Grating.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Shall have at least five years experience manufacturing products substantially similar to those required and shall be able to submit documentation of at least five installations in satisfactory operation for at least five years each.

B. Component Supply and Compatibility:
   1. Obtain all products included in this Section regardless of component manufacturer from a single steel grating manufacturer.
   2. Steel grating manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. Components shall be suitable for the specified service conditions and shall be integrated into overall assembly by steel grating manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Fabrication and erection of all steel gratings Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
      b. Setting drawings and templates for location and installation of anchorage devices.
   2. Product Data:
      a. Manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Deliver products to the Site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in concrete in ample time to prevent delaying the Work.
   2. Comply with Section 01 65 00, Product Delivery Requirements.

B. Storage and Protection:
   1. Protect materials from corrosion and deterioration.
   2. Comply with Section 01 66 00, Product Storage and Handling Requirements.

PART 2 – PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Steel Grating: Provide steel grating complying with the following:
   1. Grating Design Loads: Uniform live load shall be as shown or indicated in the Contract Documents.
   2. Maximum Clear Span Deflection for Uniform Live Loads: 1/120 of span, but not more than 1/4-inch.
   3. Maximum Fiber Stress: 18,000 psi.
   4. Minimum Size of Members:

a. Minimum size of bearing bars shall be within standard mill tolerance of that indicated in load tables in NAAMM MBG 531 for applicable loading and deflection requirements.
b. Minimum dimensions of cross bars shall be as indicated in the tables of Minimum Standard Cross Bars and Connecting Bars in NAAMM MBG 531.

5. Banding bar shall be 1/4-inch thick minimum. Top of banding bar shall be flush with top of grating unless otherwise shown or indicated. Banding bar shall be 1/4-inch shorter than bearing bar height.

2.2 MANUFACTURERS

A. Grating, Products and Manufacturers: Provide grating of one of the following:
1. Weldforged, manufactured by IKG Industries.
2. Light Duty Welded grating, manufactured by Ohio Gratings, Inc.
3. Or approved equal.

2.3 MATERIALS

A. Hot rolled carbon steel sheet and strip bearing bars and cross bars shall comply with ASTM A1011/A1011M, Commercial Steel (CS Type 2).

B. Structural steel bearing bars and cross bars shall comply with ASTM A36/A36M.

C. Wire rod Cross Bars: ASTM A510, except that permissible tolerance on diameter of coarse round wire shall be plus-0.005-inch

D. Frames: Steel complying with ASTM A36/A36M.

E. Galvanizing Repair Paint: High zinc-dust content paint for repairing damaged galvanized surfaces complying with MS MIL-P-21035.

2.4 FABRICATION

A. Use materials of minimum depth and thickness specified and as required to comply with performance criteria shown or indicated in the Contract Documents.

B. Provide grating as follows:
1. Grating Type: Welded rectangular bearing bars with cross bars resistance-welded at right angles to bearing bars.
2. Depth: One inch, minimum.
3. Bearing Bars: Minimum one-inch by 3/16-inch spaced at 1-3/16-inch on centers.
4. Cross Bars: Welded to bearing bars at maximum spacing of four inches on centers.
5. Surface: Plain.

6. Finish: Hot-dip galvanized.

D. Provide cutouts in grating for passage of piping, electrical conduit, valve stems, columns, ducts, and similar work. Where more than two bearings bars are included in a cut out, provide banding bars of same dimensions as bearing bars around opening welded to grating component parts.

E. Gratings shall be accurately fabricated, free from warps, twists, and other defects that would affect grating appearance or grating serviceability.

F. Tops of grating bearing bars and cross bars shall be in the same plane.

G. Welding shall comply with NAAMM MBG 533. Welds shall be ground smooth at top and bearing surfaces.

H. Openings in and edges of grating sections shall be banded with flat banding bars as specified in this Section, welded along the line of cutout or to end of grating panel.

I. Size each section of grating to weigh not more than 150 pounds, unless otherwise indicated in the Contract Documents.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine conditions under which Work is to be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Check all dimensions at the Site after piping and equipment are in place and determine exact locations of openings and cutouts.

3.2 INSTALLATION

A. Fastening to In-Place Construction:
   1. Use anchorage devices and fasteners to secure steel grating to supporting members or prepared openings, as recommended by manufacturer.
   2. For steel grating having bearing bars at 1-3/16-inch on centers or greater, provide four saddle clip anchors designed to fit over two bearing bars, and four stud bolts with washers and nuts for each grating panel, unless otherwise shown or indicated in the Contract Documents. For bearing bars spacing less than 1-3/16-inch on centers, provide anchors in accordance with manufacturer's recommendations.

B. Cutting, Fitting, and Placing:
   1. Perform cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true, and free of rack. Do not use wedges or shimming devices.
   2. Where grating is penetrated by piping, electrical conduit, ducts, structural members, or similar protrusions, cut openings neatly and accurately to size and attach banding bar as specified.
   3. Divide panels into sections only to extent required for installation where steel grating is to be installed around previously installed piping, electrical conduit, ducts, structural members, or similar protrusions.

C. Steel gratings in concrete floors shall be removable and shall be arranged in sizes to be readily lifted. Provide steel gratings in concrete with steel angle frames having mitered corners and welded joints. Grind exposed joints smooth. Frames shall have welded anchors set into concrete. Angle size shall match grating depth selected for flush fit.

D. Clearance at ends or between sections of steel grating shall be not more than 1/4-inch.

E. Tops of steel gratings shall be set flush with surrounding construction.

F. Steel gratings shall be set with full and uniform end bearing on frames to preclude rocking movement; do not use wedges or similar shimming devices.

G. Remove stains, cement droppings, oils, dirt, grease, paint, and other foreign matter.

H. Repair galvanized coating, damaged in the shop or during field erection, with galvanizing repair paint applied in accordance with the repair paint manufacturer’s instructions and recommendations.

+ + END OF SECTION + +

SECTION 05 54 63

FLOOR ACCESS HATCH COVERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install floor access hatch covers.
   2. The Work also includes:
      a. Providing openings in and attachments to floor access hatch covers to accommodate the Work under this and other Sections, and providing for floor access hatch covers items such as anchorage devices, and all items required for which provision is not specifically included under other Sections.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items to be installed with or before floor access hatch covers Work.

C. Related Sections:
   1. Section 09 91 00, Painting.

1.2 REFERENCES

A. Standards referenced in this Section:
   1. AASHTO Standard Specifications for Highway Bridges.
   2. MIL-P-21035B, Military Specification, Paint, High Zinc Dust Content Galvanizing Repair.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Manufacturer shall have not less than five years experience producing products substantially similar to those specified and, upon ENGINEER’s request, shall submit documentation of not less than five satisfactory installations in place for not less than five years each.

B. Component Supply and Compatibility:

1. Obtain all products included in this Section regardless of the component manufacturer from a single floor access hatch covers manufacturer. Furnishing covers from more than one manufacturer is unacceptable.
2. Floor access hatch covers manufacturer shall prepare, or shall review and approve, all Shop Drawings and other submittals for all components furnished under this Section.
3. Components shall be suitable for specified service conditions and shall be integrated into the overall assembly by the floor access hatch covers manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Detailed plans and other drawings showing location of products and direction of door swing; floor access hatch cover schedules indicating cover location, material, type, loading capacity, and other information; and fabrication details for the access hatch covers Work, including materials, thickness of metals, finishes, latching or locking provisions, type of anchorages, and accessory items.
   2. Product Data:
      a. Copies of manufacturer's literature and specifications for each type of floor access hatch incorporated in the Work.

B. Informational Submittals: Submit the following:
   1. Supplier Instructions:
      a. Installation data, including setting drawings and templates.
   2. Qualifications Statements:
      a. Manufacturer, when requested by ENGINEER.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping:
   1. Protect mill finish and other finish during shipping and installation by an attached, adhesive-backed vinyl material that is removable during and after installation of the access hatch cover.

B. Storage and Protection:
   1. Protect steel members and packaged materials from corrosion and deterioration.

1.6 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive OWNER of other rights or remedies OWNER may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by CONTRACTOR under the Contract Documents. The

obligations of CONTRACTOR under the Contract Documents shall not be limited in any way by the provisions of the specified special warranty.

B. Special Warranty:
   1. Provide manufacturer's written warranty, running to the benefit of OWNER, agreeing to correct, or at option of OWNER, remove or replace structural components of the products specified in this Section found to have defect in material and workmanship during a period of five years after the date of Substantial Completion.

PART 2 – PRODUCTS

2.1 GENERAL

A. General:
   1. Provide manufacturer's standard fabricated access hatch cover units, modified when necessary to comply with the Contract Documents. Where standard units are not available for the sizes and types required, provide custom-fabricated units of the same quality as manufacturer's similar standard-sized units.
   2. Fabricate each access hatch cover unit in the shop, complete with anchors, gaskets, hardware, and accessory items, as required.
   3. Galvanizing Repair Paint: For repairing damaged galvanized surfaces, provide high zinc-dust content paint complying with MIL-P-21035B.

2.2 CHANNEL-FRAME TYPE ACCESS HATCH COVERS

A. Aluminum Floor Access Hatch Covers – Channel Frame Type:
   1. Design Live Load: 300 pounds per square foot.
   2. Products and Manufacturers: Provide one of the following:
   a. Double-Leaf Door Aluminum Access Hatch Cover:
      1) Model TPD, by U.S.F. Fabrication, Inc.
      2) Type JD-AL, by The Bilco Company.
      3) Or approved equal.
   3. Cover: Not less than 1/4-inch thick, aluminum diamond-pattern plate cover. Provide flush drop-handle for lifting the cover.
   4. Frame: Extruded aluminum channel frame with manufacturer's standard anchor tabs or continuous anchor flange around perimeter for anchorage to concrete.
   5. Drain Coupling: 1.5-inch diameter NPT threaded drain coupling welded under the channel frame for connection of a drain pipe.
   6. Gasket: EPDM gasket mechanically attached to the channel frame.

7. Hinges: Type 316 stainless steel, heavy-duty butt hinges with Type 316 stainless steel pin fastened to door with Type 316 stainless steel tamper-resistant bolts.
8. Latch: Type 316 stainless steel, watertight, slam-type latch with inside lever handle and outside removable exterior turn/lift handle fastened to leaf (door) with tamper-resistant Type 316 stainless steel bolts. Latch release shall be protected by a flush, gasketed, removable screw plug.
9. Lift Assistance: Open-style stainless steel compression springs with Type 316 stainless steel guide tubes. Automatic Type 316 stainless steel hold-open arm with grip handle release.10. Fall-Through Prevention System: Provide access hatch cover manufacturer's standard safety grating of FRP or aluminum, constructed for live load capacity of not less than 300 psf. Provide hinges and lift-assist to allow grating sections to automatically lock in place in full-open 90-degree position. Provide hold-open arm and release assembly of aluminum or Type 316 stainless steel. Grating shall be colored OSHA "Safety Yellow" or "Safety Orange".
11. Safety Post: Any hatch with a ladder below shall have a safety post.
12. Finish: Mill finish.

2.3 ANGLE-FRAME TYPE ACCESS HATCH COVERS

A. Aluminum Floor Access Hatch Covers – Angle Frame Type:
   1. Design Live Load: 300 pounds per square foot.
   2. Products and Manufacturers: Provide one of the following:
      a. Double-Leaf Door Aluminum Access Hatch Cover:
         1) Model APD300, by U.S.F. Fabrication, Inc.
         2) Type KD, by The Bilco Company.
         3) Or approved equal.
   3. Cover: Not less than 1/4-inch thick aluminum diamond-pattern plate cover. Provide flush drop handle for lifting the cover.
   4. Frame: Extruded aluminum angle frame with manufacturer's standard anchor tabs or continuous anchor flange around the perimeter for anchorage to concrete.
   5. Hinges: Tamper-resistant, heavy-duty hinges with Type 316 stainless steel pin fastened to leaf (door) with Type 316 stainless steel tamper-resistant bolts.
   6. Latch: Type 316 stainless steel, watertight, slam-type latch with inside lever handle and outside, removable exterior turn/lift handle fastened to leaf (door) with tamper-resistant Type 316 stainless steel bolts. Latch release shall be protected by a flush, gasketed, removable screw plug.

7. Lift Assistance: Open-style stainless steel compression springs with Type 316 stainless steel guide tubes. Automatic Type 316 stainless steel hold-open arm with grip handle release.
8. Fall-Through Prevention System: Provide access hatch cover manufacturer's standard safety grating of FRP or aluminum, constructed for live load capacity of not less than 300 psf. Provide hinges and lift-assist to allow grating sections to automatically lock in place in full-open 90-degree position. Provide hold-open arm and release assembly of aluminum or Type 316 stainless steel. Grating shall be colored OSHA "Safety Yellow" or "Safety Orange".
9. Safety Post: Any hatch with a ladder below shall have a safety post.
10. Finish: Mill finish.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which floor access hatch cover Work will be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install floor access hatch covers in accordance with approved Shop Drawings and other approved submittals, the Contract Documents, and manufacturer's instructions.

B. Set floor access hatch covers level and true to line or grade, without warp or rack.

C. Drain Piping for Channel Frames:
   1. Provide drain piping from the floor access match cover channel frame routed as shown or indicated on the Drawings.
   2. Provide drain piping from the floor access hatch cover channel frame and route to the nearest floor drain or sump pit in a manner that does not obstruct access for facility operations and maintenance.
   3. After installation, fill drain piping with water. Drain piping shall be free of visible leaks.

D. Protection of Aluminum from Dissimilar Materials: Coat surfaces of aluminum in contact with dissimilar materials such as concrete, masonry, steel, and other metals in accordance with Section 09 91 00, Painting.

E. Galvanized Covers: Where zinc coating is damaged, touch-up abraded surfaces with galvanizing repair paint applied in accordance with the paint manufacturer's instructions and recommendations.

3.3 ADJUSTING AND CLEANING

A. Adjust leafs of floor access hatch covers as necessary to provide proper operations.

B. Remove stains, concrete splatter, oils, grease, and other foreign materials necessary and provide clean, finished surfaces.

+ + END OF SECTION + +

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

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SECTION 07 41 13

METAL ROOF PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals required to furnish and install preformed, metal roof panels as shown and specified. The Work also includes:
      a. Providing openings in metal roof panels to accommodate the Work under this and other Sections and building into the preformed metal roof panels all items such as sleeves, inserts and all other items to be embedded in preformed metal roof panels for which placement is not specifically provided under other Sections.
   2. The extent of preformed, metal roof panel Work is shown and is defined to include exterior preformed, prefinished metal roofing, cap and drip flashings, metal closures and all other associated trim and accessories.
   3. The types of preformed, metal roof panel Work required include the following:
      a. Preformed, insulated, metal roof panels.
      b. Miscellaneous fasteners, trim, flashings, closures, and accessories.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or embedded in, the preformed prefinished roof panels.

C. Related Sections:
   1. Section 05 05 33, Anchor Systems.
   2. Section 07 71 00, Roof Specialties.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   2. AAMA 621, Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
   3. ASTM A 167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
   4. ASTM A 653, Specification for Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

5. ASTM C 645, Specification for Nonstructural Steel Framing Members
6. ASTM D 2244, Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
7. ASTM E 1980, Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
8. FM Global Loss Prevention Data Sheets, 1-29, Above Deck Roof Components.
9. UL, Building Materials Directory.
10. UL 580, Tests for Uplift Resistance of Roof Assemblies.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide company specializing in architectural sheet metal products with a minimum of ten years of experience.

B. Installer Qualifications:
1. Engage a single installer regularly engaged in preformed metal roof panel installation and with experience in the erection of the types of materials required; and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications to ENGINEER.

C. Component Supply and Compatibility: Obtain all preformed, metal roof panels and accessories from the same manufacturer.

D. Requirements of Regulatory Agencies:
1. International Building Code, 2018 edition with Georgia Amendments.
2. Underwriters Laboratories requirements for roof deck constructions which are rated "UL Class A".
3. Factory Mutual requirements for "Class 1-90" rated construction, for wind resistance.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
1. Shop Drawings:
a. Copies of manufacturer's specifications, standard and custom detail drawings, and installation instructions for preformed metal roof panels, supports and trim. Submit manufacturer's standard warranty on factory-applied finish of preformed metal roofing panels.
b. Profiles of preformed prefinished roofing panel units, and the details of forming, jointing, gaskets (if any), supports, anchorages, trim, flashing, and accessories. Show details of weatherproofing at edges, terminations, and penetrations of the preformed prefinished roof panel Work. Show 1/4-inch to the foot scale layout and elevations of entire Work. Show all details at 3-inch to the foot scale, indicating all internal components and intersection members, details, and special fabrication techniques.

2. Samples:
    a. Samples of each type of preformed metal roof panel and trim complete with factory-applied finish, two foot long by full-width. Samples will be reviewed by ENGINEER for pattern, texture, and color only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
    b. One of each type fastener employed, with statement of intended use. Samples will be reviewed by ENGINEER for material and color only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
    c. Complete selection of manufacturer's standard and custom colors.

B. Informational Submittals: Submit the following:
1. Certificates:
    a. Provide written certification to the ENGINEER from the coil manufacturer verifying that the coil to be used for on-site roll forming is compatible with the roll forming machinery that will be used.
2. Test Reports: Submit for approval certified laboratory tests reports for required products:
    a. High-Performance Organic Finish.
3. Source Quality Control Submittals:
    a. Submit results of testing.
4. Site Quality Control Submittals:
    a. Submit results of testing and inspection performed in the field by Manufacturer's technical representative.
5. Qualification Statements
    a. Installer's qualifications.

C. Closeout Submittals: Submit the following:
1. Warranty Documentation:
    a. Submit manufacturers and CONTRACTOR'S written warranties as specified, herein.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:
1. Deliver preformed metal roof panels and all accessories dry and undamaged, with manufacturer's protective coating intact.
2. Deliver preformed metal roof panels in bundles with banded wood surrounds and end caps intact.

B. Storage of materials:
1. Store preformed prefinished roof paneling and accessory materials in a manner that will protect the panels from exposure to sun and condensation, with good air circulation around each piece.
2. Store preformed prefinished roof paneling and accessory materials in an area protected from dirt, damage, and weather.

3. Do not store in contact with concrete or other materials that might cause corrosion.

C. Handling of Materials:
   1. Do not subject preformed prefinished roof paneling and accessory materials to bending or stress.
   2. Do not damage edges or handle material in a manner that will cause scratches, warps, or dents.

1.6 JOB CONDITIONS

A. Scheduling:
   1. Coordinate metal roof panel Work with flashing, trim, and the construction of decks, parapets, and other adjoining work, to provide a permanently watertight, leak-proof, secure and non-corrosive installation.
   2. Deliver materials to the Site in sufficient quantities to ensure uninterrupted progress of the Work.
   3. Schedule the installation of metal roof panels to coincide with the installation of waterproofing, drains, piping, blocking, nailers, reglets, framing at openings, curbs, parapets and other adjoining and substrate Work.
   4. Proceed with and complete the Work only when materials, equipment and knowledgeable tradesmen, required for the installation of roof specialties, are at the Site and are ready to follow, and integrate metal roof panel Work with flashing Work, in order to maintain watertight conditions.

1.7 WARRANTIES

A. Provide manufacturer's standard warranty on the coil coated polyvinylidene fluoride based coating specified, herein.

B. Guarantee that the polyvinylidene fluoride based coating meets all criteria specified and will not spall, check, craze, peel or otherwise lose adhesion for a period of twenty years from the date of Final Acceptance, to the extent that such shall create unsightly conditions or otherwise impair the intended architectural qualities of the building.

C. In the event that the coil coated polyvinylidene fluoride based coating fails to meet the specified standards the manufacturer shall, at their own expense, replace or field paint, at the direction of the ENGINEER, all areas affected by the failure. In the event that repainting is selected, it shall be done at mutually agreeable intervals throughout the term of the warranty.

D. The warranty does not apply where failure is caused by accidents, or external conditions or forces beyond the control of the manufacturer.

E. Provide a written guarantee agreeing to replace preformed metal roof panel Work which fails in material or workmanship within one year of the date of Final

Acceptance. Failure of materials or workmanship shall include, but is not limited to, deterioration in excess of normal weathering and lack of water or weather tightness. Imperfections, by reason of defective materials, workmanship or arrangement of the various parts shall be made good to the satisfaction of the OWNER, at the CONTRACTOR'S expense.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design Criteria:
   1. Provide mechanically sealed, preformed, prefinished, insulating roofing panels, framing and accessories that comply with the following minimum performance characteristics:
      a. Wind loading: 90 miles per hour, unless heavier loading is required by the International Building Code, 2018 edition with Georgia Amendments.
   2. Anchorage system shall be designed so that panels are free to move for expansion and contraction.
   3. Panel width: 40-inches.
   4. Form panels in lengths, as required.
   5. Solar Reflectance Index: Not less than 78 for a low slope roof of 2:12 or less and 29 for a steep slope roof of over 2:12 pitch when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

2.2 MATERIALS

A. Preformed, Prefinished, Insulated Metal Roof Panels:
   1. Custom-fabricated, roll-formed, 22 gauge minimum, but in no case lighter than required to meet deflection requirements. Panels shall be hot dipped galvanized ASTM A 653 Grade C steel panels.

B. Flashing and Trim:
   1. Provide flashings and sheet metal contour closure trim components, indicated or required for a complete installation, as part of the preformed metal roofing panels Work, including cap flashings, base and drip flashings, closure and batten cleats, panel stops and closures, surrounds at openings, soffits, and similar components of the Work.
   2. Provide factory fabricated trim components.
   3. Except as otherwise shown or specified, match the material, gage, and finish of the preformed metal roof panels.
   4. Provide all concealed fasteners for flashing and trim Work.

C. Insulating Core:
   1. Minimum 90 percent closed cell structure (per ASTM D6226) urethane modified isocyanurate core with the following minimum physical properties:

a. Thermal Properties: The panel shall provide a nominal R-value of 7.1 [hr·ft2·°F/Btu] per inch thickness when tested in accordance with ASTM C518 at 75°F mean temperature and 8.1 [hr·ft2·°F/Btu] per inch thickness when tested in accordance with ASTM C518 at 35°F mean temperature.
b. Density Nominal: 2.1-2.5 pcf per ASTM D1622.
c. Shear Strength: 14 psi per ASTM C273.
d. Tensile Strength: 8.25 psi per ASTM D1623.
e. Compressive Strength: 14 psi per ASTM D1621.
f. Dimensional Stability: 14 day aged per ASTM D2126: -20 degree F < 1% chg, dry heat 158 degree F < 1.5% chg, Humid Heat 158 degree F/95% RH < 4.5% chg.

D. Miscellaneous Materials:
1. Furring: Light-gage steel, ASTM C 645; 26 gage, hot-dipped galvanized, ASTM A653, G60.
2. Provide manufacturer's custom, stainless steel, self-tapping concealed fasteners, and hold-down cap assemblies, and other components needed for a complete, permanently weatherproof installation. Provide stainless steel complying with ASTM A 167.
3. All fasteners used at all locations shall be stainless steel.
4. Sealant: Provide manufacturer's standard factory applied elastomeric sealant for use within this Section of the Work, where applicable.

E. Provide strippable film of liquid applied to the top side of the painted coil to protect the finish during fabrication, shipping, and field handling. This strippable film must be removed before installation.

F. Products and Manufacturers: Provide products of one of the following:
1. KingRib 3 Insulated Trapezoidal Roof Panel System by Kingspan.
2. CFR Insulated Metal Roof Panel, by Metl Span.
3. Or equal.

2.3 PREFORMED PREFINISHED ROOFING PANEL FABRICATION

A. General:
1. Comply with the dimensions, profile limitations, gages and fabrication details as shown or specified.
a. Width: 18-inches, on centers.
2. Prefabricate all components of the system at the factory, ready for field assembly of preformed prefinished roofing panels, joint cleat, anchor clips, trim and accessories.
3. Fabricate components and assemble units to comply with the performance requirements specified for the completed installation of the Work.

2.4 PREFORMED ROOF PANEL COATINGS

A. High-Performance Organic Finish (Three-Coat Fluoropolymer): AAMA 2605: manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 621 and the coating and resin manufacturers' written instructions.
   1. Colors: Provide the following:
      a. Full selection of manufacturer's standard colors for final selection by ENGINEER.
   2. Products and Manufacturers: Provide one of the following:
      a. Kynar 500 Fluropon by the Valspar Corporation.
      b. Kynar 500 Duranar XL by PPG Industries.
      c. Or equal.

2.5 GUTTERS AND DOWNSPOUTS

A. Refer to Section 07 71 00, Roof Specialties.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR and installer must examine the alignment of the substrate framing before erection of the preformed metal roof panels Work begins and notify the ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the preformed metal roof panels panel Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.

3.2 PREPARATION

A. Wherever possible, take field measurements, prior to completion of shop fabrication and finishing of preformed metal roof panels. Do not delay job progress. Allow for trimming where final dimensions cannot be established before fabrication.

3.3 INSTALLATION

A. Comply with preformed metal roof panel manufacturer's instructions for assembly, installation, erection and seaming of preformed metal roofing panel Work.

B. Install light gauge metal framing in accordance with the manufacturer's instructions. Refer to Sections 05 05 33, Anchor Systems.

C. Anchor component parts of preformed metal roof panels and light gauge metal framing securely in place providing for necessary thermal and structural movement.

D. Do not exceed fastener spacing recommended by the preformed metal roof panel manufacturer.

E. All fasteners must be long enough to penetrate through the entire roof panel assembly and extend through the structural support a minimum of 1/2-inch.

F. Fasten flashings and accessories 12-inches on center.

G. Do not use exposed fasteners on the exterior panel faces.

H. Drive all fasteners normal to the surface and to a uniform depth.

I. Install sealants for the preformed metal roof panels panel Work as specified, and as required for watertight performance. Comply with sealant manufacturer's instructions for installation and curing.

J. Do not fabricate flashings, closures and associated trim at the Site.

K. Install all special flashing and trim shapes, and calking compounds required to maintain complete weathertightness.

L. Comply with roofing panel manufacturer's instructions and recommendations.

M. Install snow guards in accordance with manufacturer's instructions and recommendations for type of metal roof installation.

3.4 FIELD QUALITY CONTROL

A. Determine conformity of preformed prefinished metal finish to this Section as follows:
   1. The manufacturer of the preformed, metal roof panels shall set aside a labeled sample of the preformed, metal roof panels from each production lot of panels at the Site. Protect sample preformed metal roof panels from weather.
   2. Make sample preformed metal roof panels available at all times, for comparison with installed preformed metal roof panels, as requested by the OWNER, for the full time period of the warranty.
   3. Make color comparison measurements with a Hunter Tristimulus Color Difference Meter employing methods of computation in use at the National Bureau of Standards conforming to ASTM D 2244.
   4. Manufacturer's technical representative shall visit the Site to perform field inspection of the roof panels, flashing and other system components at the start and at Substantial Completion of Work prior to issuance of warranty, as a minimum, and as otherwise requested by the ENGINEER. Each inspection visit shall include a written review of the entire installation to date, signed by the manufacturer's technical representative and submitted to the ENGINEER. CONTRACTOR shall notify the ENGINEER a minimum of two working days prior to the Site visit by the manufacturer's technical representative.

3.5 ADJUSTMENT AND CLEANING

A. Set preformed, metal roof panels plumb, level, and true to line, without warp or rack.

B. Clean exposed surfaces of preformed metal roof panel Work promptly after completion of installation. Comply with recommendations of the preformed, metal roof panel manufacturer.

C. Leave preformed metal roof panels and flashing perfectly flat, free from dents, burrs, scratches, holes or other blemishes.

D. Do not erect components which have become scarred, chipped or otherwise damaged or defaced.

E. Remove and replace with new material preformed, metal roof panels and component parts of the Work, including finish, which have been damaged beyond successful repair, as directed by the ENGINEER, in writing. Repair minor damage.

F. Do not use roofing panel sheets, trim members, and flashing sheets, in which holes have been made in locations where fasteners are not required.

G. At the completion of the Work, clean or replace adjacent work, marred by the Work of this Section.

H. Remove all materials and debris and leave the Site of the Work in clean condition.

+ + END OF SECTION + +

SECTION 07 42 13

METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install metal wall panels. The Work also includes:
a. Provide structural metal framing supporting metal wall panels, windows, and accessories. Provide structural metal framing design by a licensed Structural Engineer in the State of Georgia.
b. Providing openings in preformed metal panels to accommodate the Work under this and other Sections and building into the preformed metal panels all items such as sleeves, inserts and all other items to be embedded in metal wall panels for which placement is not specifically provided under other Sections.
2. Extent of each type of metal wall panels is shown.
3. Types of products required include the following:
a. Insulated sandwich panel construction with structural framing.

B. Coordination:
1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or embedded in, the metal wall panels.

C. Related Sections:
1. Section 07 62 00, Sheet Metal Flashing and Trim.

1.2 REFERENCES

A. American society of Civil Engineers, (ASCE).
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. American Society for Testing and Materials, (ASTM).
1. ASTM A 653, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 666, Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.
3. ASTM B 117, Practice for Operating Salt Spray (FOG) Apparatus.
4. ASTM C 36, Specification for Gypsum Wallboard.

5. ASTM C 423, Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
6. ASTM C 442, Specification for Gypsum Backing Board and Coreboard.
7. ASTM C 518, Test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus.
8. ASTM C 991, Specification for Flexible Fibrous Glass Insulation for Metal Buildings.
9. ASTM D 522, Test Methods for Mandrel Bend Test of Attached Organic Coatings.
10. ASTM D 523, Test Method for Specular Gloss.
11. ASTM D 968, Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
12. ASTM D 1308, Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
13. ASTM D 2244, Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
14. ASTM D 2247, Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
15. ASTM D 3363, Test Method for Film Hardness by Pencil Test.
16. ASTM D 4213, Test Method for Scrub Resistance of Paints by Abrasion Weight Loss.
17. ASTM E 72, Test Methods of Conducting Strength Tests of Panels for Building Construction.
18. ASTM E 84, Method for Surface Burning Characteristics of Building Materials.
19. ASTM E 96, Test Methods for Water Vapor Transmission of Materials.
20. ASTM E 119, Test Methods for Fire Tests of Building Construction and Materials.
21. ASTM E 283, Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
22. ASTM E 330, Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Pressure Difference.
23. ASTM E 331, Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference.

C. Underwriters Laboratories, Incorporated, (UL).
   1. UL, Fire Resistance Index.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Samples: Submit the following:
   1. Samples of each type of metal wall panels and trim complete with factory-applied finish, two foot long by full-width. Samples will be reviewed by Engineer for pattern, texture, and color only. Compliance with other requirements is the exclusive responsibility of Contractor.
   2. One of each type fastener employed, with statement of intended use. Samples will be reviewed by Engineer for material and color only. Compliance with other requirements is the exclusive responsibility of Contractor.
   3. Complete selection of manufacturer's standard and custom colors matching Owner’s sample.

D. Shop Drawings: Submit the following:
   1. Copies of manufacturer's specifications, standard and custom detail drawings, and installation instructions for preformed prefinished metal panels, supports and trim. Submit manufacturer's standard fifteen warranty on factory-applied finish of preformed metal roofing panel.
   2. Profiles of preformed prefinished roofing panel units, and the details of forming, jointing, gaskets (if any), supports, anchorages, trim, flashing, and accessories. Show details of weatherproofing at edges, terminations, and penetrations of the preformed prefinished roof panel Work. Show 1/4-inch to the foot scale layout and elevations of entire Work. Show all details at 3-inch to the foot scale, indicating all internal components and intersection members, details, and special fabrication techniques.
   3. Complete selection of manufacturer's standard and custom colors.
   4. Installer's qualifications.

E. Submit design computations signed and sealed by a Registered Professional Structural Engineer licensed in the State of Georgia to verify structural adequacy of members, support framing and connections, for review with Shop Drawings.

F. Test Reports: Submit for approval certified laboratory tests reports for required performance tests:
   1. Air Infiltration: ASTM E 283.

2. Water Infiltration: ASTM E 331.
3. Wind Uplift: UL-90 rated wind up-lift resistance requirement specified in UL 580 test.
4. Formability: ASTM D 522.
5. Weathering: ASTM G 152, ASTM G 153, and ASTM G 155.
6. Chalking Resistance: ASTM D 4214.
7. Color Change: ASTM D 2244.
8. Salt Spray: ASTM B 117.
9. Abrasion: ASTM D 968.
10. Humidity: ASTM D 2247.

G. Certification: Submit for approval written certification prepared, signed and sealed by a Registered Professional Structural Engineer, licensed in the State of Georgia, verifying that the design meets indicated loading requirements and codes of authorities having jurisdiction.
1. Provide written certification to the Engineer from the coil manufacturer verifying that the coil to be used for on-site roll forming is compatible with the roll forming machinery that will be used.

H. Informational Submittals:
1. Qualification Data: For Installer.
2. Product Test Reports: For each product, tests performed by a qualified testing agency.
3. Field quality-control reports.
4. Sample Warranties: For special warranties.

I. Closeout Submittals:
1. Maintenance Data: For metal panels to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide coil finish applicator experienced in the handling and application of polyvinylidene coatings acceptable to the manufacturer of the coating.

B. Installer Qualifications: Engage a single installer regularly engaged in metal wall panel installation and with successful and documented experience in the erection of metal wall panels of the scope and type of Work required; and who agrees to employ only tradesmen with specific skill and successful experience in this type of Work. Submit name and qualifications to Engineer along with the following information on a minimum of three successful projects:
1. Names and telephone numbers of owners, architects, or engineers responsible for projects.
2. Approximate contract cost of the metal wall panels.

3. Amount of area installed.

C. Preinstallation Conference: Conduct conference at Project site.
   1. Meeting attendees:
      a. OWNER.
      b. ENGINEER.
      c. Owner’s insurer if applicable.
      d. Metal panel Installer.
      e. Metal panel manufacturer’s representative.
      f. Structural-supports Installer.
      g. Installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   7. Review temporary protection requirements for metal panel assembly during and after installation.
   8. Review procedures for repair of metal panels damaged after installation.
   9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

D. Testing Agency Qualifications: To qualify for approval, an independent testing agency shall demonstrate to Engineer’s satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

E. Mock-ups:
   1. Prior to the installation of metal wall panels and accessories, but after Engineer's approval of samples, install sample of each type of metal wall panels in areas selected by Engineer to show a representative installation of the metal wall panels. Obtain Engineer's acceptance of visual qualities of the mock-up before start of metal wall panels Work. Retain and protect mock-up during construction as a standard for judging completed metal wall panels Work. Do not alter mock-ups.
   2. Metal wall panels Work that does not meet the standard approved on the mock-up areas shall be removed and replaced with new material.

F. Source Quality Control: Obtain all metal wall panels and accessories from the same manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Section 01 65 00 – Product Delivery, Storage and Handling Requirements: Requirements for transporting, handling, storing and protection products.

B. Delivery of Materials:
1. Deliver metal wall panels and all accessories dry and undamaged, with manufacturer's protective coating intact.
2. Deliver gypsum drywall laid flat and properly protected.
3. Deliver metal wall panels in bundles with banded wood surrounds and end caps intact.

C. Storage of Materials:
1. Store metal wall panels and accessory materials in a manner that will protect strippable coating from exposure to sun and condensation; with good air circulation around each piece.
2. Store metal wall panels and accessory materials in an area protected from dirt, damage and weather.
3. Do not store in contact with concrete or other materials that might cause corrosion.

D. Handling of Materials:
1. Do not subject metal wall panels and accessory materials to bending or stress.
2. Do not damage edges or handle material in a manner that will cause scratches, warps, or dents.

E. Retain strippable protective covering on metal panels during installation.

1.6 FIELD CONDITIONS

A. Conform to applicable OSHA and the Georgia State Building Codes.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

C. Coordinate metal wall panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.7 WARRANTY

A. Section 01 78 36 – Warranties: Requirements for warranties.

B. The manufacturer shall warranty for a period of one year that the wall and window system materials will be free from defects.

C. Provide manufacturer's twenty-year warranty on the coil coated polyvinylidene fluoride-based coating specified.

D. Guarantee that the polyvinylidene fluoride based coating meets all criteria specified and will not spall, check, craze, peel or otherwise lose adhesion for a period of twenty years from the date of installation, to the extent that such shall create unsightly conditions or otherwise impair the intended architectural qualities of the building.

E. In the event that the coil coated polyvinylidene fluoride based coating fails to meet the specified requirements the manufacturer shall, at their own expense, replace or field paint, at the direction of Engineer, all areas affected by the failure. In the event that repainting is selected, it shall be done at mutually agreeable intervals throughout the term of the warranty.

F. The warranty specified shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

G. The warranty does not apply where failure is caused by accidents, or external conditions or forces beyond the control of the manufacturer.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. System Description:

1. Metal wall panels shall include a complete system of field-assembled components including exterior and interior wall panels, structural framing, and subgirts finished as specified and capable of structurally spanning between support framing or girts shown. The complete system shall also include all fascias, spandrel panels, soffits, cap flashings, custom transition flashings and similar custom flashings, fasteners, extensions of the Work for interior uses, and all associated trim, closures, and accessories.

2. The complete system shall provide all system performance criteria specified.

B. Performance Criteria:
   1. Panels, windows, and secondary support systems shall be designed for component and cladding wind loads determined in accordance with the more stringent of the 2018 IBC, local building code or ASCE 7-16 for the parameters specified.
      a. Risk Category, III.
      b. Wind Exposure Category, C.
      c. Basic Wind Speed, V=114 MPH.
      d. Internal Pressure Coefficient, $GC_{pi} = \pm 0.55$.
   2. Secondary supports for the louver and wall system shall be designed in accordance with AISC or Aluminum Association design procedures. Through-tube support systems shall be designed and installed only by the manufacturer and certified wall systems contractor.
      a. Secondary supports shall not vary from the theoretical plane by more than the specified tolerances. (Note: These are more stringent than AISC or ACI tolerances to ensure optimal appearance and performance of the wall system.)
         1) 1/4 inch in any 20-foot length vertically or horizontally.
         2) 1/2 inch in any building elevation.
         3) 1/8 inch within 5 feet of any change in plane such as corners and soffits.
      b. In lieu of tube supports, masonry walls shall be used where shown on Drawings. Support members and connections shall be designed and installed as per the manufacturer's details and signed and sealed calculations.
   3. The wall system or secondary supports shall be designed to allow differential movement of the building's roof and floor structures. (Note: Movement of roof and/or floor systems exceeding ¼" shall require the use of thru tube supports with sliding connections.)
   4. Performance of the wall and window system shall be verifiable with tests witnessed or conducted by independent agencies.
      a. Structural performance of the wall panels shall be derived from ASTM E72 Chamber Method with a deflection limit of l/180 applied to positive load. Ultimate structural values shall be achieved without the use of backside mechanical attachments to the structure.
      b. There shall be no evidence of delamination of the wall panels after two million cycles of positive and negative L/180 deflection.
      c. Thermal performance of the wall panels shall be based on tests in accordance with ASTM C236 corrected to 15 mph outside and still air inside. Tests shall include 3 side-joints, in a mock-up assembly

approx. 5’-0” X 5’-0” in size, standard fastening and integral reveals or profiling. Where reveals exceed the standards, the manufacturer shall provide similar testing to document any adjustments required to the standard conditions.

1) R value for 2" panel shall be 14.4.

d. Air infiltration of the wall panels and windows shall not exceed .06 CFM/Ft² at a static pressure of 6.24 PSF (equivalent to 49 mph wind) when tested in accordance with ASTM E283. Mock-up test size should be approx. 10’-0” X 10’-0” in size to simulate actual field conditions. Or as required by local codes.

e. There shall be no uncontrolled water penetration through the panel joints and louver components at 12 PSF (equivalent to 68.5 mph wind) when tested in accordance with ASTM E331. Mock-up test size should be approx. 10’-0 X 10’-0 in size to simulate actual field conditions.

f. The standard horizontal panel joint shall demonstrate effective rain screen and pressure equalization principles with interior seal broken and any exterior seal removed when tested at a static pressure of 12 PSF (equivalent to 68.5 mph wind) in accordance with ASTM E331. Effective performance shall mean no water rising within the equalization chamber, no leakage to the interior and the ability of any dynamically driven water to drain to the exterior.

g. Fire Rating, ASTM E 119: Non-combustible.

h. Thermal Conductance (k), ASTM C 518: The thicknesses of insulation shown are for the thermal conductivity, k-value at 75°F.

2.2 MATERIALS

A. Exterior and Liner Panels: Smooth, roll-formed, galvanized steel, conforming to ASTM A 653, CS Type A, Coating Designation G90, minimum spangle, with 0.90 ounces of zinc per square foot.

B. Support Steel: Provide panel supporting tube sections designed to the above wind criteria. Members shall be placed vertically and shall support horizontal panels at ends and intermediate point as recommended by panel manufacturer.

1. Material: Galvanized steel, ASTM A500/A500M, Grade B members, designed for required anchorage and loading capacity, and selected for compatibility with panel faces.

C. Insulating Core: Polyisocyanurate (ISO) core, ASTM C591 Type IV, CFC and HCFC free, compliant with Montreal Protocol and Clean Air Act, with the following minimum physical properties:

1. Core is 90 percent closed cell when tested in accordance with ASTM D6226.
2. Panel shall provide a minimum R-value of 7.5 per inch thickness when tested in accordance with ASTM C518 at a mean temperature of 75 deg. F (24 deg. C).
3. Foam has a density of 2.2 to 2.8 pounds per cubic foot when tested in accordance with ASTM D1622.
4. Compressive Stress:
    a. Parallel to Rise: 42 psi
    b. Perpendicular to Rise: 24 psi.
    c. Tested in accordance with ASTM D1621.
5. Shear Stress: 17.5 psi when tested in accordance with ASTM C273.
6. Tensile Stress: 25 psi when tested in accordance with ASTM D1623.
7. Oven Aging at 200 deg. F:
    a. 1 day: plus 1 percent volume change.
    b. 7 days: plus 3 percent volume change.
    c. Tested in accordance with ASTM D2126.
8. Low Temperature Aging at -20 degrees F:
    a. 1 day: 0 percent volume change.
    b. 7 days: 0 percent volume change.
    c. Tested in accordance with ASTM D2126.

D. Flashing and Trim: Provide flashings and sheet metal contour closure trim components, indicated as part of the metal wall panels Work, including cap flashings, fascias, sills, corner units, surrounds at openings, soffits, jamb trim, seam covers, battens, gutters, accent/shadow/graphic bars, and similar components of the Work. Except as otherwise shown or specified, match the material, gage, and finish of the exterior panels.

E. Miscellaneous Materials:
1. Provide manufacturer's standard 1/4-inch diameter, stainless steel, self-tapping concealed fasteners and stainless steel brackets, clips, anchoring devices and other components needed for a complete, permanently weatherproof installation. Provide stainless steel complying with ASTM A 666.
2. Provide manufacturer's standard exposed 1/4-inch diameter, stainless steel, self-tapping fasteners, and other components needed for a complete, permanently weatherproof installation, finished to match the color of the substrate. Provide stainless steel complying with ASTM A 666.
3. Sealant: Provide manufacturer's standard elastomeric sealant for use within this Section of the Work.

2.3 METAL WALL PANEL FABRICATION

A. General:
   1. Comply with the dimensions, profile limitations, gages and fabrication details shown.
   2. Prefabricate all components of the system at the factory, ready for field assembly of exterior panels, liner panels, trim and accessories.
   3. Fabricate components and assemble units to comply with the system performance requirements specified for the completed installation of the Work.
   4. Condensation Control: Provide panel manufacturer's standard method of sealing the inside faces and venting the exterior faces of sandwich panels of the assembly so that internal condensation will be prevented for a 75°F temperature differential with 35 percent relative interior humidity.
   5. Products and Manufacturers: Provide one of the following:
      a. KS Optimo, flat, vertical panels by Kingspan.
      b. Or Approved Equal.

B. Flat panels with integral reveals
   1. 2-inch thickness in the main panel field and 3/8 inch thick in the reveal area.
   2. 40 -inch standard panel module.
   3. 10-inch minimum to 40-inch maximum custom panel modules, where indicate or as require for design elevations.
   4. Minimum width of the main panel field is 12 inches.
   5. The face of the panel shall be non-directionally smooth. Exterior skin of the flat panels with integral reveals shall be ASTM A653, grade 37, 22 gage G90 galvanized steel.
   6. The liner of the panel shall be non-directionally smooth flat. Interior skin for all panels shall be ASTM A653, grade 37, 22 gage G90 galvanized steel.

C. Joinery for flat and profiled panels
   1. Universal double tongue and groove joint that can be used vertically and horizontally and can join any combination of flat and profiled panel units.
   2. Adjustable plus 1/16-inch to minus 1/8-inch from the specified panel module.
   3. Horizontal joints shall have a positive drip edge, sloped drain shelf and integral venting to the exterior where required along the panel length and a 2-3/8-inch gutter interlock to provide effective rain screen and pressure equalized performance as demonstrated by testing specified in 1.04, D, 6.
   4. Joinery shall be designed to be fully drainable to prevent entrapment of moisture present during the storage and construction processor due to dynamically driven rain. Gutter interlock shall be designed to prevent

moisture from becoming trapped within the foam core and shall clearly demonstrate the ability of moisture to escape to the exterior.

D. Trimless ends shall be integral to the panel face or tabbed and effectively sealed to the inside surface of the panel face with no edges exposed to view.
   1. Provide custom corner sections. Mitered corners will not be accepted.

E. Panels shall be foamed in-place between the metal skins so that no internal voids exist that could trap moisture or condensation and so that the initial insulating integrity of the foam core is preserved by the impermeable steel skins.

F. All panel skins shall be roll formed to insure consistency of shape and joinery.
   1. Panel attachment clips shall be designed to prevent crushing of the foam core during fastening and shall mechanically engage both face and liner elements to the panel supports.

2.4 TRIM

A. Extruded trim shall be furnished by the metal wall panel manufacturer. Installation shall be by the certified wall systems contractor except for those that require completion of work by roofing trades such as gravel stops.

B. Extrusion material shall be 6063-T5 aluminum.

C. All exposed extrusion areas shall be finished. Finish shall match metal wall panels.

2.5 METAL WALL PANEL COATINGS

A. Concealed Steel Coating: On internal surfaces of metal wall panels, where coatings will be concealed from either exterior or interior view, provide metal siding manufacturer's standard rust-inhibitive coating. After proper cleaning, pretreatment, and conversion coating, apply one coat of rust-inhibitive metal primer and one coat of metal enamel, 1.0 mil dry film thickness.

B. Exposed Steel Coating (Exposed to either interior or exterior view): Apply full strength polyvinylidene fluoride-based coatings at the factory by coil coating for sheet material and spray coating for extruded or factory-fabricated material. Provide the following four coat finish system complying with the following:
   1. Alkali clean and hot water rinse all surfaces to receive polyvinylidene fluoride-based finish.
   2. Prepare a chemical conversion coating on the surface, using phosphates or chromates followed by a cold water rinse. Seal with a chromic acid rinse and dry, except where manufacturer recommends another method to achieve greater coating reliability.

3. Apply a base prime coat of epoxy paint to the prepared surface in its coil form, by reverse roller coating. Fully cure in a gas-fired oven to a dry film thickness of 0.2 to 0.4-mils. Follow with a barrier coat, 0.75 to 1.0-mil thick.
4. Apply color coat containing mica pearlescent or metallic flakes over the barrier coat by roller coating for coil material and airless or Ransburg Elastrostatic Hand Spray for extrusions and fuse at a peak metal temperature of 440°F. Apply to a dry film thickness of 0.7 mils for coil coating and 1.2 mils for spray coating so that the total dry film is approximately 1.0 mil thick for coil material and 1.5 mils thick for extruded material.
5. Apply clear fluoropolymer topcoat to provide a dry film thickness of 0.4 to 0.8 mils. The entire four coat system shall have a dry film thickness of 2.6 mils, minimum.
6. Provide the following physical properties, as proven by the following laboratory test methods acceptable to Engineer:
    a. Weathering, ASTM D 4214: Chalking, not more than No. 8, after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
    b. Color Change, ASTM D 2244: No greater than 5 N.B.S. units after removal of external deposits and after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
    c. Humidity Resistance, ASTM D 2247: No blisters after 3000 hours.
    d. Salt Spray, ASTM B 117: Few scattered blisters no larger than ASTM No. 4, and no more than 1/16-inch creep from areas scribed to bare metal after 3000 hours.
    e. Dry Adhesion: No pick-off when tape tested over 1/16-inch cross hatch.
    f. Wet Adhesion: No pick-off when tape tested over 1/16-inch cross hatch; extruded material only.
    g. Boiling Water Adhesion: No pick-off when tape tested over cross hatch area after one hour immersion in distilled boiling water.
    h. Water Immersion: No pick-off when tape tested over cross hatch area after immersion in aerated distilled water 80 ±10°F after 500 hours.
    i. Abrasion Resistance, ASTM D 968: Coefficient of abrasion of 67, minimum.
    j. Gloss, ASTM D 523: 30±5 reflectivity at 60°F.
    k. Pencil Hardness, ASTM D 3363: HB-H minimum.
    l. Dry Film Thickness, ASTM D 3363: Primer, 0.2 to 0.4 mils; barrier coat, 1.0 mils; color coating, 0.7 to 1.5 mils; clear topcoat, 0.4 to 0.8 mils.
    m. Solvent Resistance: 100 Double MEK rubs minimum.

n. Flexibility, ASTM D 522: No cracking prior to metal fracture.
o. Acid Resistance, ASTM D 1308: 16 hour spot test with 5 percent hydrochloric acid - no effect.
p. Alkali Resistance, ASTM D 1308: 16 hour spot test with 5 percent sodium hydroxide - no effect.

C. Colors: Provide the following:
1. Full selection of manufacturer's standard, custom and premium colors for final selection by Engineer.
2. Engineer will select custom special extended life premium colors for metal wall panel system at time of Shop Drawing and Sample submission review.
3. Interior panels, exterior panels, flashing, trim and other accessories will, at the discretion of Engineer, have different finished colors. Provide the following colors:
a. A maximum of four exterior colors and two interior colors.
4. Color coating of panels already fabricated into panel profiles shall not be permitted.

D. Protective Coating: Immediately upon completion of the metal wall panel finish, apply a transparent, color-coded, strippable-film coating, not less than 1.0 mil dry film thickness, suitable for protection of the finish through completion of erection.

E. Products and Manufacturers: Provide one of the following:
1. Duranar Metallic XL Specialty Color 4-Coat System by PPG Industries Coatings and Resins Division, Incorporated.
2. Or Approved Equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor and installer shall examine the alignment of the structural steel before erection of the metal wall panels begins and notify Engineer, in writing, of unsatisfactory conditions. Do not proceed with the metal wall panel Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

3.2 PREPARATION

A. Take field measurements, prior to submission of Shop Drawings. Do not delay Project progress. Allow for trimming where final dimensions cannot be established before fabrication. Identify all such areas to Engineer on Shop Drawings.

3.3 INSTALLATION

A. Section 01 70 00 – Execution and Closeout: Requirements for installation.

B. Comply with metal wall panel manufacturer's instructions for assembly, installation, and erection of metal wall panels.

C. Install metal wall panels with the longitudinal configuration and joints in the vertical position.

D. Where metal wall panels are to be replaced, inspect existing support framing. Replace corroded and damaged sections, allow for 50% replacement. Provide new fasteners, washers, and gaskets.

E. Anchor component parts of metal wall panels securely in place at each girt or framing member providing for necessary thermal and structural movement, and meeting wind loads specified.

F. Do not exceed fastener spacing recommended by the metal wall panel manufacturer or approved structural framing submittal.

G. Locate metal wall panel joints as shown.

H. Install corner metal wall panels as performed corner units with a minimum of 12-inches at each leg. Locate end joints at structural supports.

I. All fasteners must be long enough to penetrate through the entire wall panel assembly and penetrate into the structural support a minimum of 1/2-inch.

J. Fasten flashings and accessories 12 inches on center.

K. Use exposed fasteners, on non insulated panels only, which have been prefinished to match finish of panels and trim. Limit exposure of fasteners to extent indicated in manufacturer's data and instructions.

L. Do not use exposed fasteners either on the exterior panel faces.

M. Drive all fasteners normal to the surface and to a uniform depth.

N. Install sealants for the metal wall panel Work as specified, and as required for watertight performance. Comply with sealant manufacturer's instructions for installation and curing.

O. Minimize field cutting of metal wall panels and associated Work as far as practicable. Perform necessary field cutting using skilled workmen with proper tools.

P. Do not fabricate flashings, closures and associated trim at the connection of metal wall panel adjacent materials.

Q. Install all special flashing and trim shapes, contour closure strips and calking compounds required to maintain complete weathertightness wherever pipes, ducts or other mechanical appurtenances penetrate metal wall panels. Refer to Section 07 62 00, Sheet Metal Flashing and Trim for flashing.

R. Remove strippable protection coating immediately after completion of erection and completion of adjoining construction Work which might damage panel finish. In any case, do not leave strippable coating on faces of preformed metal panels beyond the amount of exposure time recommended by the metal wall panel manufacturer.

S. Comply with panel manufacturer's instructions and recommendations.

3.4 DAMAGED MATERIAL

A. Damage caused by the manufacturer or contractors shall be replaced or repaired to as new condition at no cost to Owner.

3.5 FIELD QUALITY CONTROL

A. Section 01 45 00 – Quality Control: Requirements for manufacturer’s field services.

B. Determine conformity of metal wall panel finish to this Section as follows:
   1. Manufacturer of the metal wall panels shall set aside a labeled sample of the metal wall panels from each production lot of panels for the Project. Protect sample metal wall panels from weather.
   2. Make sample metal wall panel available at all times, for comparison with installed metal wall panels, as requested by OWNER, for the full time of the warranty.

3. Make color comparison measurements with a Hunter Tristimulus Color Difference Meter employing methods of computation in use at the National Bureau of Standards conforming to ASTM D 2224.

3.6 ADJUSTMENT AND CLEANING

A. Set metal wall panels plumb, level, and true to line, without warp or rack.

B. Clean exterior and interior exposed surfaces of metal wall panel Work promptly after completion of installation, including removal of strippable coating. Comply with recommendations of both the metal wall panels and coating manufacturer.

C. Leave metal wall panels and flashing perfectly flat, free from dents, burrs, scratches, holes, or other blemishes. Paint all scratches, on the finish of the panels, flashing and all associated material, to be indistinguishable from adjacent un-scarred areas.

D. Do not erect components which have become scarred, chipped or otherwise damaged or defaced.

E. Remove and replace with new metal wall panel materials and component parts of the Work, including finish, which have been damaged beyond successful repair, as directed by the Engineer, in writing. Repair minor damage.

F. Do not use exterior sheets, trim members, and flashing sheets, in which holes have been made in locations where fasteners are not required.

G. At the completion of the Work, clean or replace adjacent work, marred by the Work of this Section.

+ + END OF SECTION + +

SECTION 07 71 00

ROOF SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all roof specialties Work.
   2. The extent of the roof specialties is shown.
   3. The types of roof specialties Work required include, but is not necessarily limited to, the following:
      a. Exposed, surface-mounted gutters and downspouts.
      b. Welded miters, end caps, downspout elbows and downspouts.
      c. Complete selection of full-strength, polyvinylidene fluoride finishes and colors with extended life topcoat.
      d. Miscellaneous accessories, fasteners, cleats and incidental sheet metal flashing and trim system components necessary for a complete installation.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that shall be installed with the roof specialties Work.

C. Related Sections:
   1. Section 07 41 13, Metal Roof Panels.
   2. Section 09 91 00, Painting.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. AAMA 621, Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
   2. FM Global, Loss Prevention Data for Roofing Contractors, 1-49 - Perimeter Flashing.
   3. FS H-C-494, Coating Compound, Bituminous, Solvent Type, Acid Resistant.
   4. FS TT-C-494, Federal Specification, Coating Compound, Bituminous, Solvent Type, Acid Resistant.
   5. NRCA, The Roofing Manual.
   6. SMACNA : Architectural Sheet Metal Manual.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Engage a single installer who is a recognized roof specialties installer, skilled and experienced in the type of roof specialties Work required, and equipped to perform workmanship in accordance with recognized standards so that there will be undivided responsibility for the performance of the Work. Submit name and qualifications to ENGINEER along with at least three successfully completed Projects including names and telephone numbers of owners, architects and engineers, responsible for the project and the approximate contract price for roof specialties work.
   2. The installer of the roof specialties Work shall be franchised or otherwise accepted in writing by the roofing materials manufacturer for installation of fully guaranteed roofing Work in accordance with these Specifications.

B. Design Criteria:
   1. Standards: Comply with applicable standards and recommendations of SMACNA, Architectural Sheet Metal Manual, for the fabrication and installation of roof specialties Work, except to the extent more stringent requirements are specified.

C. Component Supply and Compatibility: Provide roof specialties as a complete unit produced by a single manufacturer specializing in the production of this type of Work, including hardware, accessories, mounting and installation components.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Shop Drawings showing the manner of forming, jointing and securing the metal to form roof specialties Work. Show expansion joint details and water-proof connections to adjoining work and at obstructions and penetrations.
      b. Drawings showing the coordination of the Work of this Section with Section 07 41 13, Metal Roof Panels. Provide detailed Shop Drawings showing large scale details of sections and profiles of all roof specialties to be used in the Work, with all items, including fastener locations, cleats and other miscellaneous accessories necessary to complete the Work, fully dimensioned, properly located, quantified and presented such that sequence of installation is acceptable to each roofing system and adjacent construction material installer.
   2. Product Data:
      a. Copies of manufacturer's specifications, recommendations and installation instructions for roof specialties applications. Include manufacturer's certification or other data substantiating that the materials comply with the requirements.

3. Samples:
    a. Each item of roof specialty, demonstrating assembly of system joint components and fasteners, securely mounted to substrate simulating actual installation in the Work.
    b. Polyvinylidene fluoride manufacturer's color samples for final selection by ENGINEER. After initial selection of colors by ENGINEER from manufacturer's color charts, submit ENGINEER'S preliminary color choices on actual samples of metal substrate for final color selections by ENGINEER.
    c. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is the responsibility of CONTRACTOR.

B. Informational Submittals: Submit the following:
1. Qualifications Statements:
    a. Installer's qualifications

C. Closeout Submittals: Submit the following:
1. Warranty
    a. Submit warranty as specified in section 1.7

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:
1. Deliver, store and handle materials to preclude denting, scratching or otherwise marring the surface and finish of the roof specialties material.
2. Items delivered in broken, damaged, rusted, or unlabeled condition shall immediately be removed from Site and not offered again for approval by ENGINEER.

B. Storage of Materials:
1. Store materials in an area undercover and protected from construction traffic.
2. Store materials in same package in which they were shipped, off the ground and on platforms protected from dirt and other contamination.
3. Store in a manner which does not permit water to remain on roof specialties materials and system components.

C. Handling of Materials:
1. Protect roof specialties from dents, scratches, warps and bends.
2. Remove strippable protective film, immediately preceding installation of each system component.

1.6 JOB CONDITIONS

A. Scheduling:

1. Coordinate roof specialties Work with roofing, flashing, trim, and the construction of decks, parapets and other adjoining work, to provide a permanently watertight, leak-proof, secure and non-corrosive installation.
2. Deliver materials to the Site in sufficient quantities to ensure uninterrupted progress of the Work.
3. Schedule the installation of roof specialties to coincide with the installation of roofing, waterproofing, drains, piping, blocking, nailers, reglets, framing at openings, curbs, parapets and other adjoining and substrate Work.
4. Proceed with and complete the Work only when materials, equipment, and knowledgeable tradesmen, required for the installation of roof specialties, are at the Site and are ready to follow, and integrate roof specialties Work with roofing Work, in order to maintain watertight conditions.

1.7 WARRANTY

A. Provide coping and cap flashing manufacturer's fifteen-year warranty against blow-off, leak, or premature membrane failure in winds of up to 90 miles per hour.

B. Provide manufacturer's twenty-year warranty on the specified polyvinylidene fluoride-based coating.

C. Guarantee that the polyvinylidene fluoride-based coating meets all criteria specified and will not spall, check, craze, peel or otherwise lose adhesion for a period of twenty years from the date of installation, to the extent that such shall create unsightly conditions or otherwise impair the intended architectural qualities of the building.

D. In the event that the polyvinylidene fluoride-based coating fails to meet the specified standards the manufacturer shall, at their own expense, replace or field paint, at the discretion of OWNER, all areas affected by the failure. In the event that repainting is selected, it shall be done at mutually agreeable intervals throughout the term of the warranty.

E. The warranty specified shall not deprive OWNER of other rights OWNER may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by CONTRACTOR under requirements of the Contract Documents.

F. The warranty does not apply where failure is caused by accidents, or external conditions or forces beyond the control of the manufacturer.

PART 2 – PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Performance Criteria:

1. Roof specialties shall be permanently watertight, and not deteriorate in excess of manufacturer's published limitations.
2. Comply with fabrication details recommended by FM Global, Loss Prevention Data for Roofing Contractors; SMACNA, Architectural Sheet Metal Manual; The NRCA Roofing Manual, and the requirements of the roof specialties manufacturer, and as shown on approved Shop Drawings.

2.2 MATERIALS

A. Custom Gutters and Downspouts:
   1. Provide aluminum sheet 6063-T6 alloy, with smooth finish; in accordance with SMACNA.
   2. Size, Thickness, and Profile:
      1. Gutters and Downspouts: 1/8-inch thick; As shown.
   3. Products and Manufacturers: Provide one of the following:
      a. Custom Gutters and Downspouts by Architectural Products Company.
      b. Custom Seal-Tite Gutters and Industrial Downspouts by Metal-Era Incorporated.
      c. Or equal.
   4. Miscellaneous Materials:
      a. Provide the materials and types of fasteners, solder, welding rods, coatings, separators, aluminum wall penetration, sealants, and accessory items as recommended by the sheet metal manufacturer for roof specialties Work, except as otherwise shown.
      b. Cleats and Straps: Same metal as roof specialties Work being anchored or supported.
      c. Roofing Cement: Neoprene adhesive, compatible with substrate and adjoining work.
      d. Bituminous Coating: Cold-applied asphaltic coating, FS TT-C-494, Type II, compounded for minimum thickness per coat of 15-mils (dry).
      e. Miscellaneous steel scuppers, escutcheons, and bearing plates: Refer to Section 05 50 13, Miscellaneous Metal Fabrications.

2.3 FABRICATION

A. General:
   1. The fabrication requirements for roof specialty Work apply to both shop-fabricated and on-site-fabricated Work.
   2. Manufacturer's Recommendations: Except as otherwise shown or specified, comply with the recommendations and instructions of the manufacturer of the roof specialty being fabricated.
   3. Provide for thermal expansion of exposed items. Maintain a water-tight seal at expansion joints. Locate expansion joints at the following maximum spacings:
      a. Midpoint of run.
   4. Fabricate Work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering the temper and reflectivity of the metal. Provide uniform,

neat seams with minimum exposure of solder, welds, and sealant. Fold back the sheet metal to form a hem on the concealed side of exposed edges.

5. Fabricate drainage sumps and downspouts and supports as shown.
6. Support and Anchorage: Fabricate units with adequate provisions for support and anchorage, of the types required for the indicated method of installation.

2.4 FINISHES

A. High-Performance Organic Finish (Three-Coat Fluoropolymer): AAMA 2605: manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 621 and the coating and resin manufacturers' written instructions.

1. Colors: Provide the following:
   a. Full selection of manufacturer’s standard colors for final selection by ENGINEER.
2. Products and Manufacturers: Provide one of the following:
   a. Kynar 500 Fluropon by the Valspar Corporation.
   b. Kynar 500 Duranar XL by PPG Industries.
   c. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR and installer shall examine the supporting structure and other elements of the substrate and conditions under which the roof specialties Work is to be performed and notify ENGINEER, in writing, of any conditions detrimental to the proper and timely completion of the Work and performance of the gutters and downspouts. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

A. Wherever possible, take field measurements, prior to completion of shop fabrication and finishing of roof specialties Work. Do not delay job progress. Allow for erection tolerances corresponding with specified tolerances where final dimensions cannot be established before fabrication.

B. Coordinate the installation of the roof specialty system with the roofing system. Refer to Section 07 41 13, Metal Roof Panels for details.

3.3 INSTALLATION

A. Comply with manufacturer's recommendations and installation instructions.

B. Protection of Aluminum from Dissimilar Materials: Coat all aluminum surfaces in contact with dissimilar materials such as concrete, masonry, steel and other metals as specified in Section 09 91 00, Painting.

C. Conceal fasteners and expansion provisions, wherever possible, in exposed Work, and locate so as to minimize the possibility of leakage. Cover and seal Work, as required, for a tight installation.

D. Provide concealed cleat-type anchorages wherever practical and arrange to relieve stresses in the roof specialties Work which result from building movement and thermal expansion.

E. Splice and Expansion Units: Use 0.050-inch thick splice plates.

F. Bed flashing flanges in a bed of roofing cement or other setting compound which is compatible with adjoining work and substrate.

G. On vertical overlaps, lap sheet metal a minimum of 3-inches.

H. On sloping overlaps, of slopes of not less than 6-inches in 12-inches, lap unsealed overlaps a minimum of 6-inches.

I. For embedment of metal flanges in elastic sheet flashing or stripping, extend flanges for a minimum of 4-inches embedment.

J. Support and anchor each unit of Work in the manner as shown, but in no case in a manner which would be inadequate for thermal expansion stresses and the normal loading of water, wind and similar loadings.

K. Install units with lines and corners true and accurate in alignment and location. Install drainage sumps to assure positive drainage to downspouts.

3.4 FIELD QUALITY CONTROL

A. Polyvinylidene Fluoride Based Coatings: Determine conformity of sheet metal flashing and trim Work requiring painted finish to these Specifications as follows:
   1. The manufacturer of the roofing specialties Work shall set aside and label samples of each component of the sheet metal flashing and trim Work from each production lot for the Project. Protect samples from weather.
   2. Make samples of sheet metal flashing and trim Work available at all times, for comparison with installed sheet metal flashing and trim Work as requested by OWNER, for the full time of the warranty.
   3. Make color comparison measurements with a Hunter Tristimulus Color Difference Meter employing methods of computation in use at the National Bureau of Standards.

3.5 CLEANING AND PROTECTION

A. Protect the roof specialties from all damage until Final Completion.

B. Roof specialties damaged before Final Completion shall be replaced with new material as specified herein, at no additional cost to OWNER.

C. Clean exposed surfaces of every substance which is visible or might cause corrosion of the metal or deterioration of the finish.

++ END OF SECTION ++

SECTION 07 92 00

JOINT SEALANTS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install joint sealants.
   2. Extent of each type of calking and sealant is shown or indicated and includes the following:
      a. Interior and exterior joints in equipment and construction systems not filled by another material, and that are not required to be open for operation.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate installation of items to be installed with or before joint sealants.
   2. Coordinate final selection of joint sealants so that materials are compatible with all calking and sealant substrates specified.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASTM C510, Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
   2. ASTM C661, Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
   3. ASTM C793, Test Method for Effects of Accelerated Weathering on Elastomeric Joint Sealants.
   4. ASTM C794, Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
   5. ASTM C920, Specification for Elastomeric Joint Sealants.
   6. ASTM C1021, Practice for Laboratories Engaged in Testing Building Sealants.
   7. ASTM C1087, Test method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
   8. ASTM C1193, Guide for Use of Joint Sealants.
   9. ASTM C1247, Practice for Durability of Sealants Exposed to Continuous Immersion in Liquids.
   10. BAAQMD Regulation 8, Rule 51.
   11. FS TT-S-00227, Sealing Compound: Elastomeric Type, Multi-component (for Calking, Sealing, and Glazing in Buildings and Other Structures).

12. FS TT-S-00230 Sealing Compound: Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures).
13. NSF/ANSI Standard 61, Drinking Water System Components - Health Effects.
14. SCAQMD Rule 1168.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Installer:
      a. Engage a single installer, approved by product manufacturer, regularly engaged in calking and sealant installation and with successful experience in applying types of products required, and who employs only tradesmen with specific skill and successful experience in the type of Work required.
   2. Testing Laboratory:
      a. Furnish services of independent testing laboratory qualified according to ASTM C1021, for conducting testing required.

B. Component Supply and Compatibility:
   1. Obtain materials only from manufacturers who will, if required:
      a. Furnish at the Site services of a qualified technical representative to advise installer of proper procedures and precautions for using materials.
      b. Test joint sealants for compatibility with substrates for conformance with FS-TT-S-00227, and recommend remedial procedures as required.
   2. Before purchasing each sealant, investigate its compatibility with joint surfaces, joint fillers, and other materials in joint system. Provide products that are fully compatible with actual installation condition, verified by manufacturer's published data or certification, and as shown on approved Shop Drawings and other approved submittals.

C. Product Testing: Provide test results of laboratory pre-construction compatibility and adhesion testing, as specified in Article 3.1 of this Section, by qualified testing laboratory, based on testing of current sealant formulations within a 36-month period preceding the Notice to Proceed for the Work.
   1. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920 and, where applicable, to other standard test methods.
   2. Test other joint sealants for compliance using specified post-construction field adhesion test.

D. Mock-ups:
   1. Prior to installing joint sealant Work but after ENGINEER's approval of Samples, provide Sample of each type of calking and sealant in areas selected by ENGINEER to show representative installation of calkings and sealants. Obtain ENGINEER's approval of visual qualities of mock-ups before starting

calking and sealant Work. Retain and protect mock-ups during construction as a standard for judging completed calking and sealant Work. Do not alter or destroy mock-ups until so allowed by ENGINEER.

2. Perform the following testing on calking and sealant mock-up, as specified in this Section: Post-construction field adhesion testing and water leak test.
3. Work that does not comply with test requirements on Sample areas will be considered defective.

E. Pre-installation Conference:
   1. Prior to installing joint sealants and associated Work, schedule and meet at the Site with calking and sealant installer, calking and sealant manufacturer's technical representative, other trades involved in coordinating with calking and sealant Work, ENGINEER, and OWNER. Record discussions of pre-installation conference and decisions, agreements, and disagreements, and furnish copy of record to each party attending conference. Review foreseeable methods and procedures related to calking and sealant Work, including reviewing:
      a. Required submittals, both completed and yet to be completed.
      b. Status of test reports.
      c. Mock-up construction results.
      d. Status of substrate and similar considerations.
      e. Each major calking and sealant application required.
      f. Availability of products, tradesmen, equipment, and facilities required for avoiding delays.
   2. Reconvene conference at earliest opportunity if additional information must be developed to conclude subjects under consideration.
   3. Record revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Schedule of joint sealants installation, indication each specific surface where calking or sealants are to be provided and the material proposed for each application.
   2. Product Data:
      a. Copies of manufacturer's data sheets including color charts, specifications, recommendations, and installation instructions for each type of sealant, calking compound, and associated miscellaneous material required. Include manufacturer's published data, indicating that each product complies with the Contract Documents and is intended for the applications shown or indicated.
      b. Product test reports.
   3. Samples:
      a. Each type of actual cured material of each calking and sealant specified, in each of manufacturer's standard colors.

b. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is responsibility of CONTRACTOR.

B. Informational Submittals: Submit the following:
1. Certificates:
a. Certify that materials are suitable for intended use and materials meet or exceed requirements of the Contract Documents.
b. Certification from manufacturer that products furnished are appropriate for surfaces and conditions to which they will be applied.
c. Certify that applicator is approved by manufacturer.
2. Field Quality Control Submittals:
a. Results of tests on job mock-ups.
b. Pre-construction and post-construction field test reports.
c. Compatibility and adhesion test reports.
d. Contractor's Field Test Report Logs:
1) Indicate time present at the Site.
2) Include observations and results of field tests, and document compliance with manufacturer's installation instructions and supplemental instructions provided to installers.
3. Pre-installation conference record.
4. Qualifications: Submit qualifications for:
a. Installer.
b. Testing laboratory (if not already submitted under Section 01 45 23, Testing Laboratory Services Furnished by Owner, or Section 01 45 13, Testing Laboratory Services Furnished by Contractor).

C. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data:
a. Recommended inspection intervals.
b. Instructions for repairing and replacing failed sealant joints.
2. Warranty: Submit written warranties as specified in this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 01 65 00, Product Delivery Requirements, and Section 01 66 00, Product Storage and Handling Requirements, and the following:
1. Delivery of Products:
a. Deliver products in calking and sealant manufacturer's original unopened, undamaged containers, indicating compliance with approved Shop Drawings and approved Sample color selections.
b. Include the following information on label:
1) Name of material and Supplier.
2) Formula or Specification Section number, lot number, color and date of manufacture.
3) Mixing instructions, shelf life, and curing time, when applicable.

2. Storage of Products:
    a. Do not store or expose materials to temperature above 90 degrees F or store in direct sunlight.
    b. Do not use materials that are outdated as indicated by shelf life.
    c. Store sealant tape in manner that will not deform tape.
    d. In cool or cold weather, store containers for sixteen hours before using in temperature of approximately 75 degrees F.
    e. When high temperatures prevail, store mixed sealants in a cool place.
3. Handling:
    a. Do not open containers or mix components until necessary preparatory Work and priming are complete.

1.6 JOB CONDITIONS

A. Environmental Conditions:
    1. Do not install joint sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
    2. Proceed with the Work when forecasted weather conditions are favorable for proper cure and development of high-early bond strength.
    3. Where joint width is affected by ambient temperature variations, install elastomeric sealants when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.
    4. When high temperatures prevail, avoid mixing sealants in direct sunlight.
    5. Supplemental heat sources required to maintain both ambient and surface temperatures within the range recommended by manufacturer for material applications are not available at the Site.
    6. Provide supplemental heat and energy sources, power, equipment, and operating, maintenance, and temperature monitoring personnel.
    7. Do not use heat sources that emit carbon dioxide or carbon monoxide into areas of calking, sealants, and painting Work, and areas where OWNER's personnel or construction personnel may work. Properly locate and vent such heat sources to outdoors so that joint sealants and other Work are unaffected by exhaust.

1.7 WARRANTY

A. Provide written warranty, signed by manufacturer and CONTRACTOR, agreeing to repair or replace sealants that fail to perform as air-tight and watertight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified in approved Shop Drawings and other submittals, as an inherent quality of material for exposure indicated.
    1. Provide manufacturer warranty for period of one year from date of Substantial Completion of joint sealants Work.

2. Provide installer warranty for period of two years from date of Substantial Completion of joint sealants Work.

PART 2 – PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Provide elastomeric joint sealants for interior and exterior joint applications that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. VOC Performance Criteria:
   1. VOC content of sealants used shall comply with current VOC content limits of SCAQMD Rule 1168. Sealants used as fillers shall comply with or exceed requirements of BAAQMD Regulation 8, Rule 51.
      a. Sealants: 250 g/L.
      b. Sealant Primers for Nonporous Substrates: 250 g/L.
      c. Sealant Primers for Porous Substrates: 775 g/L.

C. Provide colors selected by ENGINEER from calking and sealant manufacturer's standard and custom color charts. "Or equal" manufacturers shall provide same generic products and colors as available from manufacturers specified.

2.2 MATERIALS

A. Exterior and Interior Vertical Joints; Non-submerged:
   1. Two-component Polyurethane Sealant:
      a. Products and Manufacturers: Provide one of the following:
         1) Sikaflex- 2c NS by Sika Corporation.
         2) Dymeric 240 FC by Tremco Sealant/Waterproofing Division of RPM International, Inc.
         3) Or equal.
      b. Polyurethane based, two-component elastomeric sealant complying with:
         1) FS TT-S-00227E: Type II (non-sag) Class A and ASTM C920, Type M, Grade NS, Class 25.
         2) Adhesion-in-Peel, FS TT-S-00227E and ASTM C794: (Minimum five pounds per linear inch with no adhesion failure): 10 pounds.
         3) Hardness (Standard Conditions), ASTM C661: 25 to 35 (Shore A).
         4) Stain and color change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
         5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
         6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.
         7) VOC Content: 100 g/L, maximum.

B. Exterior and Interior Horizontal Joints; Non-submerged:
   1. Two-component Polyurethane Sealant:
      a. Products and Manufacturers: Provide one of the following:
         1) Sikaflex- 2c SL by Sika Corporation.
         2) THC/900 by Tremco Sealant/Waterproofing Division of RPM International, Inc.
         3) Or equal.
      b. Polyurethane based, two-component elastomeric, self-leveling sealant complying with the following:
         1) FS TT-S-00227E, Type I (self-leveling) Class A. and ASTM C920, Type M, Grade P, Class 25
         2) Water Immersion Bond, FS TT-S-00227E: Elongation of 50 percent with no adhesive failure.
         3) Hardness (Standard Conditions), ASTM C661: 35 to 45.
         4) Stain and Color Change, FS TT-S-00227E and ASTM C510: No discoloration or stain.
         5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.
         6) VOC Content: 165 g/L, maximum.

C. Miscellaneous Materials:
   1. Joint Cleaner: As recommended by calking and sealant manufacturer.
   2. Joint Primer and Sealer: As recommended for compatibility with calking and sealant by calking and sealant manufacturer.
   3. Bond Breaker Type: Polyethylene tape or other plastic tape as recommended for compatibility with calking and sealant by calking and sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of calking and sealant. Provide self-adhesive tape where applicable.
   4. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable nonabsorptive material as recommended for compatibility with calking and sealant by calking and sealant manufacturer. Provide size and shape of rod that will control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide highly-compressible backer to minimize possibility of sealant extrusion when joint is compressed.
   5. Low-temperature Catalyst: As recommended by calking and sealant manufacturer.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine joint surfaces, substrates, backing, and anchorage of units forming sealant rabbet, and conditions under which calking and sealant Work will be performed, and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work and performance of sealants. Do not proceed with calking and sealant Work until unsatisfactory conditions are corrected.

B. Laboratory Pre-construction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers for testing indicated below samples of materials that will contact or affect joint sealants.
   1. Use ASTM C1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit at least eight pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For products that fail tests, obtain joint-sealant manufacturer's written instructions for corrective measures including using specially formulated primers.
   5. Immersion Testing: ASTM C1247 for potable water and wastewater.
   6. Testing will not be required if joint sealant manufacturers submit joint preparation data based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted and mock-up field testing is acceptable.

3.2 PREPARATION

A. Protection: Do not allow joint sealants to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces including rough textured materials. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or calking and sealant materials.

B. Joint Surface Preparation:
   1. Clean joint surfaces immediately before installing sealant compound. Remove dirt, weakly adhering coatings, moisture and other substances that would interfere with bonds of sealant compound as recommended in sealant manufacturer's written instructions as shown on approved Shop Drawings.
   2. If necessary, clean porous materials by grinding, sandblasting, or mechanical abrading. Blow out joints with oil-free compressed air or by vacuuming joints prior to applying primer or sealant.
   3. Roughen joint surfaces on vitreous coated and similar non-porous materials, when sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or steel wool to produce a dull sheen.

C. Mixing:
   1. Comply with sealant manufacturer's written instructions for mixing multi-component sealants.
   2. Thoroughly mix components before use.
   3. Add entire contents of activator can to base container. Do not mix partial units.
   4. Mix contents for minimum of five minutes or as recommended by sealant manufacturer, until color and consistency are uniform.

3.3 INSTALLATION

A. Install joint sealants after adjacent areas have been cleaned and before joint has been cleaned and primed, to ensure calking and sealant joints will not be soiled. Replace calking and sealant joints soiled after installation.

B. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or indicated in the Contract Documents, and except where manufacturer's technical representative directs otherwise, only as acceptable to ENGINEER.

C. Prime or seal joint surfaces as shown on approved Shop Drawings and approved other submittals. Do not allow primer or sealer to spill or migrate onto adjoining surfaces. Allow primer to dry prior to applying sealants.

D. Apply masking tape before installing primer, in continuous strips in alignment with joint edge to produce sharp, clean interface with adjoining materials. Remove tape immediately after joints have been sealed and tooled as directed.

E. Confirm that compressible filler is installed before installing sealants.

F. Do not install sealants without backer rods and bond breaker tape.

G. Roll back-up rod stock into joint to avoid lengthwise stretching. Do not twist, braid, puncture, or prime backer rods.

H. Employ only proven installation techniques that will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

I. Install sealants to depths recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of bead.
   1. For horizontal joints in sidewalks, pavements, and similar locations sealed with elastomeric sealants and subject to traffic and other abrasion and

indentation exposures, fill joints to depth equal to 75 percent of joint width, but not more than 5/8-inch deep or less than 3/8-inch deep.

2. For vertical joints subjected to normal movement and sealed with elastomeric sealants and not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2-inch deep or less than 1/4-inch deep.

J. Remove excess and spillage of compounds promptly as the Work progresses.

K. Cure calking and sealant compounds in compliance with manufacturer's instructions and recommendations, to obtain high-early bond strength, internal cohesive strength, and surface durability.

3.4 FIELD QUALITY CONTROL

A. Post-construction Field Adhesion Testing: Before installing elastomeric sealants, field-test joint sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:
   a. Perform ten tests for the first 1,000 feet of joint length for each type of elastomeric sealant and joint substrate.
   b. Perform one test for each 1,000 feet of joint length thereafter, and minimum of one test per each floor per elevation.
   c. Test Method: Test joint sealants according to Method A, Field-applied Sealant Joint Hand Pull Tab, and Method D, Water Immersion in Appendix X1 of ASTM C1193. For joints with dissimilar substrates, verify adhesion to each substrate separately by extending cut along one side and verifying adhesion to opposite side. Repeat procedure for opposite side.
   d. Inspect joints for complete fill, absence of voids, and joint configuration complying with specified requirements. Record results in a log of field adhesion tests.
   e. Inspect tested joints and report on whether:
      1) Sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
      2) Sealants filled the joint cavities and are free of voids.
      3) Sealant dimensions and configurations comply with specified requirements.
   f. Record test results in a log of field adhesion tests. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
   g. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

h. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other requirements will be satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

i. Do not proceed with installation of elastomeric sealants over joint surfaces that have been painted, lacquered, waterproofed, or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with FS TT-S-00227, has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

B. Water Leak Testing: Field test for water leaks as follows:

1. Flood the joint exposure with water directed from a 3/4-inch diameter garden hose, without nozzle, held perpendicular to wall face, two feet from joint and connected to water system with 30 psi minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 feet per minute.
2. Test approximately five percent of total joint system, in locations that are typical of every joint condition, and that can be inspected easily for leakage on opposite face. Conduct test in presence of ENGINEER, who will determine actual percentage of joints to be tested and actual period of exposure to water from hose, based on extent of observed leakage or lack of observed leakage.
3. Where nature of observed leaks indicates potential of inadequate joint bond strength, ENGINEER may direct that additional testing be performed at a time when joints are fully cured, and before Substantial Completion.

3.5 ADJUSTING AND CLEANING

A. Where leaks and lack of adhesion are evident, replace sealant.

B. Clean adjacent surfaces of sealant and soiling resulting from the Work. Use solvent or cleaning agent recommended by sealant manufacturer. Leave all finish Work in neat, clean condition.

C. Protect sealants during construction so that they will be without deterioration, soiling, or damage at time of readiness for final payment of the Contract.

3.6 PROTECTION

A. During and after curing period, protect joint sealants from contact with contaminating substances and from damage resulting from construction operations or other causes, so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration

occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original Work.

+ + END OF SECTION + +

DIVISION 8 - OPENINGS

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SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install hollow metal doors and frames.
   2. Extent of hollow metal doors and frames is shown.
   3. Types of products required include the following:
      a. Standard, seamless, galvannealed steel, paper honeycomb core, internally reinforced, flush doors.
      b. Miscellaneous supports; special, supplemental, and standard finish hardware reinforcements and preparation items; fasteners and accessories; all for high frequency, high-endurance use.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before the hollow metal doors and frames Work.

C. Related Sections:
   1. Section 08 71 00, Door Hardware.
   2. Section 09 91 00, Painting.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. ANSI/DHI A115.1G, Installation Guide for Doors and Hardware.
   2. ANSI A250.4, Test Procedures and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.
   3. ANSI/SDI A250.6 Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
   4. ANSI/SDI A250.8 - 2003 Recommended Specifications for Standard Steel Doors and Frames.
   5. ANSI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
   6. ANSI/SDI A250.11, Recommended Erection Instructions for Steel Frames.
   7. ANSI/SDI A250.13 Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies
   8. ASTM A 153/A 153M, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

9. ASTM A 366, Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
10. ASTM A 653/A 653M, Specification for Steel Sheet, Zinc Coated (Galvannealed) or Zinc-Iron Alloy-Coated (Galvannealed) by The Hot-Dip Process.
11. ASTM A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
12. ASTM B 117, Practice for Operating Salt Spray (Fog) Apparatus.
13. ASTM C 518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
14. ASTM E 90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
15. ASTM E 329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
16. ASTM E 413, Classification for Rating Sound Insulation.
17. ASTM E 1408, Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems.
18. FEMA 320, Taking Shelter From the Storm: Building a Safe Room For Your Home or Small Business.
19. FEMA 361, Design and Construction Guidance For Community Shelters.
20. NFPA 80, Fire Doors and Fire Windows.
21. NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
22. NFPA 257, Standard on Fire Test for Window and Glass Block Assemblies.
22. SDI 111-B, Recommended Standard Details For Dutch Doors.
23. SDI/Door 117, Manufacturing Tolerances Standard Steel Doors and Frames.
24. SDI/Door 122, Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
25. SDI/Door 128, Guidelines for Acoustical Performance of Standard Steel Doors and Frames.
26. SSPC Paint 2, Cold Phosphate Surface Treatment.
27. SSPC Paint 27, Basic Zinc Chromate-Vinyl Butyral Wash Primer.
28. UL 10B, Fire Tests of Door Assemblies.
29. UL10C, Positive Pressure Fire Tests of Door Assemblies

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer shall have a minimum of five years experience producing substantially similar equipment and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
   2. Provide hollow metal doors, frames, and accessories manufactured by a single firm specializing in the production of this type of Work and complying with specified standards of ANSI, NFPA, SDI and UL.
   3. Provide hollow metal doors and frames from a manufacturer who is a member of SDI.

B. Component Supply and Compatibility:
   1. Obtain all equipment included in this Section regardless of the component manufacturer from a single hollow metal doors and frames manufacturer.
   2. The hollow metal doors and frames equipment manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the hollow metal doors and frames manufacturer.

C. Testing Agency Qualifications: The independent testing agency shall demonstrate to ENGINEER'S satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated in accordance with ASTM E 329, without delaying the Work.

D. Source Quality Control:
   1. Provide hollow metal door and frame products from a manufacturer who will provide test certificates for published fire, sound, hurricane and structural data covering systems designed and constructed according to its published specifications.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Elevations of each door design.
      b. Details of doors, including vertical and horizontal edge details and metal thicknesses.
      c. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
      d. Locations of reinforcement and preparations for hardware.
      e. Details of each different wall opening condition.
      f. Details of anchorages, joints, field splices, and connections.
      g. Details of accessories.
      h. Details of moldings, removable stops, and glazing.
      i. Details of conduit and preparations for power, signal, and control systems.
      j. Provide a schedule of doors and frames using same reference numbers for details and openings as those shown.
   2. Samples:
      a. Pressed metal corner section of frame, 12-inches by 12-inches minimum, showing all special, supplemental, and standard reinforcements, attachments, supports, and anchors specified. Provide corner sample for each type of frame specified. Provide sample for each type of frame specified. Show profile, corner joint, floor and wall anchors, and silencers.

b. Stick system components showing corner detail and glazing stops of all types specified, 12-inches by 12-inches, minimum.
c. Cut-away section of all door types specified, showing internal construction, edge details and reinforcements for butts, closers and similar items of finished hardware, 2 foot-0 inches by 2 foot-0 inches minimum. Include louver sections, vision panel and glazing stops. Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement.
d. ENGINEER reserves the right to require samples showing fabrication techniques and workmanships of all component parts, and the detailing and fabrication of accessories and auxiliary items for all door and frame Work, before fabrication of the Work proceeds.

B. Informational Submittals: Submit the following:
1. Test and Evaluation Reports:
a. Laboratory test report for required performance and specified feature verification for doors and frames selected at random by ENGINEER for testing.
b. Test reports indicating compliance with ANSI A250.4 and ANSI A250.5.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.
2. Deliver hollow metal doors and frames cartoned or crated to provide protection during transit and job storage.

B. Storage and Protection:
1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
2. Store doors and frames at the Site under cover.
3. Place units up off floors in a manner that will prevent rust and damage.
4. Avoid the use of non-vented plastic or canvas shelters, which could create a humidity chamber. If cardboard wrapper on the door becomes wet, remove the carton immediately.
5. Provide a 1/4-inch space between stacked doors to promote air circulation.

C. Acceptance at Site:
1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's

instructions.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Coordinate the wiring of electrified hardware. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design Criteria:
   1. Standard Door Classification: Provide hollow metal doors of Grades and Models in accordance with ANSI A250.8 as follows:
      a. Level 3, Extra Heavy-Duty, Physical Performance Level A, Model 2, Seamless.

2.2 MANUFACTURERS

A. Products and Manufacturers: Provide one of the following:
   1. Series CH Doors with Series F14 Frames by Pioneer Industries, Incorporated.
   2. LW14 Series Doors and F14 Series frames by Steelcraft, an Ingersoll-Rand Business.
   3. Regent Series Doors and SQ Frames by Ceco Door, an ASSA ABLOY Group Company.
   4. Or equal.

2.3 MATERIALS

A. Door Faces and Frames: Cold-rolled carbon steel sheets of commercial quality, complying with ASTM A 366, hot-dipped, zinc-iron alloy-coated, ASTM A924 and ASTM A 653/A 653M, A 60.

B. Polystyrene Core for hurricane-resistant doors: Rigid polystyrene, density of 1.0 lb/ft^3; R factor-7.142; U factor - 0.14.

C. Supports and Anchors: Formed sheet metal, hot-dip galvannealed after fabrication complying with ASTM A 153/A 153M, Class B, and in compliance with requirements of ANSI A250.8.

D. Inserts, Bolts and Fasteners: Sheet metal hot-dip galvanized complying with ASTM A 153/A 153M, Class C or D as applicable.

E. Miscellaneous Accessories:
   1. Head Strut Supports: 3/8-inch by 2-inch hot-dipped galvanized steel.
   2. Structural Reinforcing Members: Provide structural reinforcing members as part of frame assembly, where shown at mullions, transoms, or other locations that are to be built into frame.
   3. Head Reinforcing: For frames over 4 feet-0 inch wide, in masonry openings, provide continuous steel channel or angle stiffener, not less than 12-gauge for full width of opening, welded to back of frame at head.
   4. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
   5. Plaster Guards: 26-gauge minimum galvanized steel.
   6. Stops and Moldings: 16-gauge minimum, cold-rolled, hot-dipped galvanized, formed sheet metal.
   7. Insect Screen: 14 by 18 bronze wire mesh in a rigid, formed metal frame.

2.4 FABRICATION

A. General:
   1. Fabricate hollow metal units to be rigid, neat in appearance and free for defects, warp, or buckle. Accurately form metal to required sizes and profiles.
   2. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify Work that cannot be permanently factory-assembled before shipment, to assure proper assembly at the Site. Weld exposed joints continuously, grind, dress, and make smooth, flush, and invisible. Filler to conceal manufacturing defects shall not be acceptable.
   3. Exposed Fasteners: Unless otherwise shown or specified, do not use exposed fasteners in the Work. Where exposed fasteners are shown or specified, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.

B. Doors:
   1. Fabricate all hollow metal doors and panels in compliance with ANSI A250.5.
   2. Provide doors of two outer stretcher-leveled sheets, 14-gauge minimum. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or edges, except around glazed or louvered panel inserts. No fillers shall be used. Provide weep hole openings in the bottom of exterior doors to permit the escape of entrapped moisture.

3. Vertical edges of doors shall be continuously welded, for the whole length of the door, and ground smooth. No plastic or epoxy fillers shall be used.
4. Reinforce inside of doors with honeycomb core, unless indicated otherwise, completely filling the inside of the door and laminated to the inside of both face panels with an adhesive. The honeycomb material shall have a crushing strength not less than 6,000 pounds per square foot and the lamination shall withstand not less than 1,100 pounds per square foot in shear.
5. Fabricate all doors with flush top and bottom closing channel, without exposed fasteners. Reinforce tops and bottoms of doors with inverted, flush-mounted, minimum 16-gauge, horizontal steel channels fastened to internal reinforcement channel and with 20-gauge closing plate spot-welded to closure channel. Close top and bottom edges to provide weather seal, as integral part of door construction or by addition of inverted steel channels and plates.
6. Hollow Metal Transoms and Panels:
    a. Fabricate hollow metal transoms and panels of the same materials, construction, and finish as specified for hollow metal doors.
    b. Provide astragal integral with top of door where shown.
7. Edge profiles shall be provided on both stiles of doors beveled 1/8-inch in 2-inches, except where other profiles are required for certification.

C. Frame Construction:
1. Fabricate all hollow metal frames in compliance with ANSI A250.8 and as specified.
2. Form frames of cold-rolled sheet material, 14-gauge, minimum. Provide seamless frames for all Work, unless specifically specified and shown as permitting exposed fasteners.
3. Provide hollow metal frames for doors of size and profile as shown or specified.
4. Fabricate frames with reinforced, mitered corners that are continuously arc-welded for the full depth and width of the frame, with bottom spreader bar; except provide drywall frames as specified.
5. Grind all exposed welds flush and smooth.
6. Head Reinforcing: Where installed in masonry, leave vertical mullions in frames open at the top so they can be filled with grout.
7. Floor and Head Anchors: 14-gauge minimum, and of the following types:
    a. Monolithic Concrete Slabs: Clip-type, with two holes to receive fasteners, welded to bottom of jambs and mullions.
    b. Separate Topping Concrete Slabs: Adjustable-type with extension clips, allowing not less than 2-inches height adjustment. Terminate bottom of frames at finish floor surface.
8. Head Strut Supports: Provide vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable bolted anchorage to frame jamb members.
9. Jamb Anchors: 16-gauge minimum, and of the following types:

a. Steel Stud Construction: Two-piece compression anchors with exposed compression fasteners.

10. Rubber Door Silencers: Drill stop to receive three silencers on single-door frames and four silencers on double-door frames. Install plastic plugs to keep holes clear during construction.
11. Plaster Guards: Provide manufacturer's standard plaster guards or dust cover boxes.

D. Door Hardware Preparation:
1. General:
   a. Prepare hollow metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling, and tapping in accordance with approved Finish Hardware Schedule and templates provided by finish hardware supplier and as specified. Comply with applicable requirements of ANSI/DHI A115.1 to A115.17 and ANSI A250.4. Refer to Section 08 71 00, Door Hardware.
   b. Obtain approved hardware schedule, hardware templates, and samples of finish hardware where necessary to ensure correct detailing and fabrication of the hollow metal doors and frames, from finish hardware supplier.
2. Doors:
   a. Preparation includes sinkages and cut-outs for mortised and concealed finish hardware and reinforcements for both concealed and surface-applied finish hardware.
   b. Drill and tap mortise reinforcements at factory, using templates.
   c. Detail and fabricate reinforcements with concealed connections designed to develop full strength of reinforcements for high-frequency applications.
   d. Reinforce doors for required finish hardware, with minimum gauges of reinforcements provided as follows:
      1) Hinges: Steel plate 3/16-inches thick by 1-1/2-inches wide by 6-inches longer than hinge and secured by not less than six spot or projection welds with top hinge further reinforced with a high-frequency back-up reinforcement.
      2) Mortise Locksets and Dead Bolts: 12-gauge steel sheet, secured with not less than four spot or projection welds.
      3) Surface-Applied Closers and Overhead Stops: 3/16-inch steel plate, not less than 10-inches long, secured with not less than six spot or projection welds.
      4) Push Plates and Bars: 16-gauge steel sheet secured with not less than two spot or projection welds.
      5) Surface Panic Devices: 16-gauge sheet steel secured with not less than two spot or projection welds.
3. Frames:
   a. Reinforce frames for required finish hardware with minimum gauges as follows:

1) Hinges and Pivots: Special full width of frame, 3/16-inch thick steel plate by 8-inches longer than hinge, secured to both rabbets by not less than twelve spot or projection welds.
2) Strike Plate Clips: 10-gauge steel plate by 1-1/2-inches wide by 3-inches long with mortar guard boxout secured with not less than six spot or projection welds.
3) Surface-Applied Closers: 3/16-inch steel plate, secured with not less than six spot or projection welds. Coordinate closer function and presence of overhead stops and weather-stripping, with location of reinforcement plate.

E. Stops and Moldings:
1. Provide stops and moldings around solid and louvered panels in hollow metal units.
2. Fabricate fixed stops and moldings integral with frame. Provide fixed stops on inside of hollow metal units exposed to exterior and on corridor side of interior units.

2.5 SHOP PAINTING

A. Clean, treat and paint exposed surfaces of fabricated hollow metal units, including galvanized surfaces.

B. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before the application of the shop coat of paint.

C. Refer to Section 09 91 00, Painting, for field-applied primer and finish paint for exterior or interior exposed ferrous, non-ferrous, or galvanized surfaces.

D. Apply shop-coat of prime paint within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 1.5-mils.

E. Finish shall be rust inhibitive primer capable of passing a 500-hour salt spray and a 1,000-hour humidity test in accordance with ASTM B 117 as certified by an independent laboratory.

2.6 SOURCE QUALITY CONTROL

A. After Shop Drawings approval, manufacturer shall not make any further detailing, fabrication, or changes to approved methods of support and anchorage, nor shall doors and frames be brought to the Site, which do not conform, in all ways, to performance criteria specified.

B. Prepare a written report on the testing of up to one hollow metal flush doors and frames, selected at random by ENGINEER from those brought to the Site, for the purpose of verifying, by independent laboratory analysis, the provision of all

features specified and indicated on approved Shop Drawings, at no additional cost to OWNER. Any door and frame found failing to comply with specified features shall be cause for ENGINEER to require complete removal of all doors and frames from the Site, and the provision of new units complying with this Section, as confirmed by independent laboratory testing, at no additional cost to OWNER.

C. Allowable Tolerances: Provide door and frame manufacturing tolerances in compliance with SDI 117 and as follows:
   1. Nominal Clearance between Door and Frame Head and Jamb: 1/8-inch.
   2. Nominal Clearance between Meeting Edges of Pairs of Doors: 1/8-inch.
   3. Nominal Clearance at Bottom of Door: 3/4-inch.
   4. Nominal Clearance between Face of Door and Door Stop: 1/16-inch.
   5. Provide all Work plumb and true to adjoining surfaces with all miters and copes accurately formed.
   6. Provide completely water and vapor tight joints.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the substrate and conditions under which hollow metal doors and frames are to be installed and notify ENGINEER, in writing, of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

B. Frames that are bowed, twisted or otherwise unacceptable shall be removed from the Site and replaced with properly constructed frames.

3.2 PREPARATION

A. Drilling and tapping for surface-applied, finish hardware may be done at Site.

B. Protective Coating: Protect inside, concealed, faces of door frames in plaster or masonry construction using fibered asphalt emulsion coating. Apply over shop primer approximately 1/8-inches thick and allow to dry before installation.

C. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

3.3 INSTALLATION

A. Install hollow metal units and accessories in accordance with approved Shop Drawings, SDI 105, and ANSI/SDI A250.11 as shown and specified.
   1. Do not install doors and frames until all the Work, which could damage doors and frames, has been completed.
   2. Provide temporary doors until construction sequencing allows installation of permanent doors and frames.
   3. Do not proceed with the installation of permanent hollow metal doors until CONTRACTOR can provide finished Work complying with all requirements of these Specifications.
   4. Protect built-in frame Work with temporary wood protection.

B. Placing Frames:
   1. Install frames plumb, level, rigid, and in true alignment in accordance with ANSI A250.11 and DHI A115.1G.
   2. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged. Remove spreader bars only after frames have been properly set and secured.
   3. Make field splices in frames as detailed on approved Shop Drawings, welded, and finished to match factory work.

C. Setting Masonry Anchorage Devices:
   1. In masonry construction, building in of anchors and grouting of frames is included in Section 04 05 05, Unit Masonry Construction.
   2. Set anchorage devices opposite each anchor location, in accordance with details on approved Shop Drawings and anchorage device manufacturer's instructions as follows:
      a. Structural Steel: Secure frames to structural steel framing using machine bolts inserted through tubular steel pipe sleeves reinforcement concealed in hollow metal frames at 6-inches from top and bottom and 2 foot-0 inches on center. Apply removable stop to cover anchor bolts.
      b. Steel Stud Construction: Secure knocked-down-type drywall frames to gypsum wallboard metal studs using compression anchor assemblies. Install at least three jamb anchors per jamb up to 7 feet-6 inches height; four anchors up to 8 feet-0 inch jamb height; one additional anchor for each 2 foot-0 inch or fraction thereof over 8 feet-0 inch height.
   3. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on approved Shop Drawings.

D. Door Installation:

1. Fit hollow metal doors accurately in their respective frames, with the following clearances:
   a. Jambs and Head: 1/8-inch.
   b. Bottom: At threshold, 3/8-inch.
2. Finish hardware installation is specified under Section 08 71 00, Door Hardware. Locate finish hardware as shown on approved Shop Drawings, in accordance with hardware templates provided by finish hardware manufacturers and in accordance with Door and Hardware Institute, Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.

3.4 ADJUSTMENT AND CLEANING

A. Check and readjust operating finish hardware items in hollow metal door and frame Work just prior to final inspection. Leave Work in complete and proper operating conditions.

B. Where problems of installation or damage are cause for rejection of hollow metal door and frame Work, consult SDI 122 and the recommendations of the hollow metal door and frame manufacturer, for suggestions concerning required adjustments in the Work. Submit recommendations to ENGINEER for approval. Replace and repair unacceptable Work, as directed by ENGINEER, so that there will be no doubt as to the acceptability of the Work at the time of Substantial Completion.

C. Prime Coat Touch-Up: Immediately after installation, sand smooth all rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

D. Protection: Protect installed hollow metal doors and frames against damage from other construction activities.

++ END OF SECTION ++

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install overhead coiling doors.
   2. Extent of overhead coiling doors is shown.
   3. Types of products required include:
      a. Galvanized steel, very high cycle, heavy-duty, overhead coiling doors with insulated slats and full perimeter weather-stripping.
      b. Chain operators.
      c. Angles, brackets, hoods, and supports.
      d. Inserts and anchoring devices.
      e. Miscellaneous materials and accessories for complete, functional system.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before overhead coiling door Work.

C. Related Sections:
   1. Section 09 91 000, Painting.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. AAMA 611, Voluntary Standards for Anodized Architectural Aluminum.
   2. AAMA 2603, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   3. ANSI A250.4, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.
   4. ANSI A250.8, Recommended Specifications for Standard Steel Doors and Frames.
   5. ASTM A36/A36M, Specification for Carbon Structural Steel.
   6. ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   7. ASTM A366/A366M, Specification for Commercial Steel Sheet, Carbon, (0.15 maximum percent) Cold-Rolled.

8. ASTM B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. ASTM E84, Test Method for Surface Burning Characteristics of Building Materials.
10. ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
11. ASTM E329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
12. ASTM E413, Classification for Rating Sound Insulation.
13. ASTM E1886, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
14. ASTM E1996, Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
15. FEMA 320, Taking Shelter From the Storm: Building a Safe Room For Your Home or Small Business.
16. FEMA 361, Design and Construction Guidance for Community Safe Rooms
17. NEMA MG 1, Motors and Generators.
18. NFPA 70, National Electrical Code.
19. NFPA 80, Standard for Fire Doors and Fire Windows.
20. SEI/ASCE 7, Minimum Design Loads for Buildings and Other Structures.
21. UBC Standard 7-2, Fire Tests of Door Assemblies.
22. UL 10B, Fire Tests of Door Assemblies.
23. UL, Building Materials Directory.
24. U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.3 DEFINITIONS

A. Operating Cycle: One complete cycle of an overhead coiling door begins in closed position. Door is then moved to open position and back to closed position.

B. Listed and Labeled: Per NFPA 70, Article 100.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Supplier Qualifications: Supplier shall have a minimum of five years experience producing substantially similar products to those required and shall be able to document at least five installations in satisfactory operation for at least five years.
   2. Installer Qualifications:
      a. Retain a single installer for all overhead coiling door Work, with documented and successful experience in type of Work required, and who is authorized representative of overhead coiling door manufacturer for installing and maintaining products required.

Installer shall employ only tradesmen with successful experience in type of Work required.

b. References: Provide names and telephone numbers of architects or engineers as applicable, and owner's representatives for at least three successful projects performed by proposed installer, similar to the Work required for this Project.

B. Component Supply and Compatibility:
   1. Obtain all products included in this Section regardless of component Supplier from one overhead coiling door manufacturer.
   2. Overhead coiling door Supplier shall review and approve or to prepare all Shop Drawings and submittals for all products provided under this Section.
   3. Components shall be suitable for specified service conditions and be integrated into overall assembly by overhead coiling door Supplier.

C. Testing Agency Qualifications: The independent testing agency shall demonstrate to ENGINEER'S satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated in accordance with ASTM E 329, without delaying the Work.

D. Source Quality Control:
   1. Provide overhead coiling door products from a manufacturer who will provide test certificates for published fire, sound, hurricane, and structural data covering systems designed and constructed according to its published specifications.

E. Regulatory Requirements:
   1. Comply with requirements of codes listed in Section 01 42 00, References.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Drawings showing all components and their assembly, all with accurate dimensions. Include details at frames, elevations of each overhead coiling door design type, details of construction and conditions at openings.
   2. Product Data:
      a. Manufacturer's specifications and data sheets, roughing-in diagrams, and installation instructions for each type and size of overhead coiling door.
      b. Include manufacturer's data on operators, operating instructions, and maintenance data. Indicate by transmittal form that installer has received a copy of diagrams and installation instructions.
   3. Delegated-Design:
      a. For overhead coiling grilles indicated to comply with performance requirements and design criteria, including analysis data signed and

sealed by the qualified professional engineer responsible for their preparation.

b. Detail fabrication and assembly of seismic restraints.

Include a summary of forces and loads on walls and jambs.

B. Informational Submittals: Submit the following:
   1. Design Data:
      a. Calculations showing that detailing and fabrication of components complies with structural performance specified.
   2. Supplier Instructions:
      a. Provide manufacturer instructions for handling and installing specified products.
      b. Setting drawings; summary of loads on walls, jambs and structural elements; templates; and instructions and directions for installation of inserts and anchorage devices, furnished by overhead coiling door Supplier and installed under other Sections of these Specifications.
   3. Site Quality Control Submittals:
      a. Provide report of all operating tests, problems encountered, and corrective actions implemented. Document successful completion of field operating test for all products.
      b. Provide report of each visit to Site by Supplier's representative.
      c. Manufacturer Reports: Provide report of each visit to Site by Supplier's representative.
   4. Qualifications Statements:
      a. Supplier.
      b. Installer.

C. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data:
      a. Provide complete operation and maintenance manuals, including test reports, maintenance data and schedules, description of operation, and information on recommended spare parts.
      b. Provide operation and maintenance manuals per Section 01 78 23, Operation and Maintenance Data.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
   1. Deliver products to Site to ensure uninterrupted progress of the Work. Deliver anchorage devices to be embedded in concrete in ample time to prevent delaying the Work.
   2. Deliver products to Site suitably crated, braced, and protected against distortion and damage during transit and unloading. Label all parts to comply with approved Shop Drawings and submittals.
   3. Upon delivery, inspect products for damage. Notify ENGINEER in writing of loss or damage to products. Replace loss and repair damage to new condition in accordance with manufacturer's instructions. Minor damage

may be repaired provided finished items are equal in all respects to new items and acceptable to ENGINEER; otherwise, remove and replace damaged items.

4. Conform to Section 01 65 00, Product Handling Requirements.

B. Storage and Protection:
   1. Store materials to allow easy access for inspection and identification. Keep all material off ground using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
   2. Store doors and frames under cover.
   3. Place units up off floor in manner that prevents rust and damage.
   4. Avoid using non-vented plastic or canvas shelters.
   5. Conform to Section 01 66 00, Product Storage and Handling Requirements.

1.7 WARRANTY

A. Provide manufacturer's standard one year warranty.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   1. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.

B. Design Criteria:
   1. Structural: Overhead coiling door components shall be capable of resistance to these loads:
      a. Wind Loading:
         i. Ultimate uniform inward wind pressure = 34 psf.
         ii. Ultimate uniform outward wind pressure = 37 psf.
      b. Basic Wind Speed: 114 mph.
      c. Exposure Category: C.
   2. Dead Loading: Provide resistance to deformation of door components caused by effects of gravity loads.
   3. Applied loadings shall not cause short-term or permanent deformation of system components. Doors shall remain operable and undamaged during and after application of specified wind pressure loading.
   4. Windborne-Debris-Impact-Resistance Performance: Provide impact-protective overhead coiling doors that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and ASTM E 1996.

5. Large Missile Test: For overhead coiling doors located within 30 feet of grade.

C. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
   1. Helically-Wound Torsion Springs: Provide Very-High-Cycle design capable of performing for 100,000 operational cycles. Provide non-resettable electric counters for overhead coiling doors.
   2. Chain Hoist Operation: Reduction roller chain and sprocket drive or suitable gearing, mounted on counterbalance shaft, shall operate with a maximum 35 pounds of pulling force.

2.2 MANUFACTURERS

A. Non-fire Resistance-Rated, Insulated, Overhead Coiling Doors:
   1. Products and Manufacturers: Provide products of one of the following:
      a. Model ESD30 Insulated Rolling Service Doors, by Cornell Iron Works, Incorporated.
      b. Thermiser Max Insulated Roll Up Doors by The Cookson Company.
      c. Or equal.

2.3 MATERIALS

A. Door Curtain:
   1. Door Curtain Slats: Fabricate door curtain of flat, interlocking slats, designed in compliance with structural performance criteria specified, but not less than 20-gauge back and front panels, of continuous length for width of door, without splices.
   2. Unless otherwise shown or specified, provide double-panel flat slats, as follows:
      a. Steel Door Curtain Slats: Structural quality, cold-rolled, galvanized carbon steel sheets of commercial quality, complying with ASTM A653/A653M, G60 zinc coating, mill-phosphatized.
      b. Slat Size and Features: 3/4-inches by three inches; pressure filled, foamed-in-place polyisocyanurate plastic insulation with minimum resistance to thermal flow (R) value of 6.25 and UL Tested Flame Spread of 75 maximum, according to ASTM E84; thermal-break construction.
      c. Interior Curtain Slat Facing: Same as exterior curtain slats.
      d. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.

3. Endlocks: Heavy malleable iron castings, galvanized after casting, secured to curtain slats with two galvanized rivets. Provide endlocks on alternate curtain slats for curtain alignment and resistance against lateral movement.
4. Windlocks: Heavy malleable iron castings, galvanized after casting, and secured to curtain slats with three galvanized rivets. Space windlocks 2.0 feet on centers on both edges of curtain, or as required to comply with structural performance criteria specified.
5. Bottom Bar: Consisting of two galvanized steel angles, each not less than 1.5 inches by 1.5 inches by 1/8-inch thick.

B. Curtain Jamb Guides:
1. Fabricate curtain jamb guides of steel shapes with sufficient depth and strength to retain curtain against specified wind loading. Build-up units with minimum 1/4-inch thick steel sections complying with ASTM A36/A36M. Slot bolt holes for track adjustment.
2. Secure continuous wall angle to wall framing by 3/8-inch minimum diameter bolts at not more than 2.6 feet on centers, unless otherwise recommended by door manufacturer. Extend wall angles above door opening head to support coil brackets, unless otherwise shown. Place and locate anchor bolts on exterior wall guides so that they are concealed when door is closed.
3. Provide removable stops on guides to prevent over-travel of curtain, and a continuous bar for holding windlocks, if any.

C. Weather Seals:
1. Provide replaceable, compressible, and adjustable natural rubber or neoprene rubber weather-stripping for exterior doors. Secure weather seals with continuous metal pressure bars. At door heads, use a 1/8-inch thick replaceable, continuous sheet secured to inside of curtain coil hood. At door jambs, use a 1/8-inch thick continuous strip secured to exterior side of jamb guide.
2. Provide double guide weather-stripping that, when tested at 1.30 pounds per square foot pressure differential, allows maximum of 3.75 cubic feet per minute air infiltration per linear foot of overhead coiling door perimeter.
3. Provide weather-stripping continuously around all perimeter edges of door including hood baffle, astragal, and guide weather-stripping.

D. Counterbalancing Mechanism:
1. Counterbalance doors by an adjustable-tension, steel helical torsion spring, mounted around steel shaft, mounted in spring barrel, and connected to door curtain with required barrel rings. Use grease-sealed ball bearings or self-lubricating graphite bearings for rotating members.
2. Counterbalance Barrel:
    a. Fabricate spring barrel of hot-formed structural quality carbon-steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up of curtain without distorting slats and limiting barrel deflection to no more than 0.03-inch per foot of span under full load.

b. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance the weight of curtain with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.
c. Fabricate torsion rod for counterbalance shaft of case-hardened steel, of required size to hold fixed spring ends and carry torsional load.

3. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

E. Weather and Waterproof Hoods:
1. Form to entirely enclose coiled curtain and operating mechanism at opening head, and act as weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.
2. Fabricate steel hoods from 22-gauge hot-dip galvanized steel coating, complying with ASTM A653/A653M, phosphate-treat before fabrication.

2.4 ACCESSORIES

A. Chain Hoist Operator:
1. Provide manual direct drive chain hoist side-mounted operator consisting of endless stainless steel hand chain, chain cast-iron pocket wheel, and chain guard.
2. Provide chain hoist with self-locking mechanism allowing curtain to be stopped at all points in its travel and remain in position until movement is reactivated. Furnish hand chain with chain holder secured to operator guide.
3. Provide endless chain length that extends to 3.0 feet above floor.
4. Gears shall be high grade gray cast-iron.

B. Safety Stop Lock Bearings: Provide overhead coiling doors with safety stop lock bearings that will stop downward travel of overhead coiling door upon sensing a sudden, rapid acceleration of pipe shaft.

2.5 STEEL AND GALVANIZED-STEEL FINISHES

A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

2.7 PAINTING

A. Surface-prepare in the shop and shop-prime all ferrous metal and galvanized surfaces, exposed and unexposed, except lubricated surfaces, with door manufacturer's standard rust inhibitive primer, drying to a flat sheen.

B. Refer to Section 09 91 00, Painting, and coordinate compatibility of shop and Site-primed and finished paint for interior and exterior ferrous and non-ferrous metals.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrates and conditions under which overhead coiling doors are to be installed and notify ENGINEER of conditions detrimental to proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

A. Install, and adjust doors, per manufacturer's written instructions, approved Shop Drawings and submittals, and the Contract Documents.

B. Lubricate bearings and sliding parts and adjust mechanism so moving parts operate smoothly and are free of warp, twist, or distortion and fit watertight for door's entire perimeter.

C. Adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment. Test door closing when activated by detector or alarm connected fire release system. Reset door-closing mechanism after successful test.

D. Repair damaged products and restore finish to match manufacturer's original finish.

3.3 FIELD QUALITY CONTROL

A. Tests: Perform operating tests on all products at the Site following installation of products, including controls. Should tests indicate malfunction, make necessary repairs and adjustments. Repeat tests and adjustments until, in opinion of ENGINEER, installation is complete, and products are functioning properly and are ready for permanent operation.

B. Supplier's Services:

1. Provide services of factory-trained representative of Supplier for installation supervision, start-up, operation testing, and training of OWNER's operating and maintenance personnel. Representative shall make at least two visits to the Site with at least two hours on-Site per visit (excluding travel time). First visit shall be to assist in installing products. Subsequent visits shall be for checking completed installation, start-up, and training. Supplier's representative shall test-operate system in presence of ENGINEER and verify that each overhead coiling door conforms to requirements. Supplier's representative shall revisit Site as often as necessary until all installation is entirely satisfactory.
2. Costs, including travel, lodging, meals, and incidentals, for Supplier's representative's visits shall be at no additional cost to OWNER.

+ + END OF SECTION + +

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install door hardware. Furnish door hardware for all doors in compliance with these Specifications herein.
   2. Extent of door hardware is specified. Door hardware is defined to include all items known commercially as door hardware, except special types of unique and non-matching hardware specified in the same Section as the door and door frame.
   3. Types of products required include the following:
      a. Mortise hinges.
      b. High-security mortise locksets.
      c. Panic exit devices.
      d. Heavy-duty, overhead, surface-mounted, door closers.
      e. Cylinders for doors specified in other Sections.
      f. Stripping and seals.
      g. Thresholds.
      h. Silencers.
      i. Floor stops.
      j. Miscellaneous items and accessories for a complete installation functioning in compliance with the requirements of governing authorities having jurisdiction at the Site.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or before, the door hardware.
   2. Coordinate the Work of other Sections to provide clearances and accurate positioning of recessed or cast-in-place items.

C. Related Sections:
   1. Section 08 11 13, Hollow Metal Doors and Frames.
   2. Section 08 33 23, Overhead Coiling Doors.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. ANSI A117.1, Accessible and Usable Buildings and Facilities.
   2. ANSI/BHMA A156.1, Butts and Hinges.

3. ANSI/BHMA A156.3, Exit Devices.
4. ANSI/BHMA A156.4, Door Controls - Closers.
5. ANSI/BHMA A156.5, Auxiliary Locks and Associated Products.
6. ANSI/BHMA A156.6, Architectural Door Trim.
7. ANSI/BHMA A156.7, Template Hinge Dimensions.
8. ANSI/BHMA A156.8, Door Controls - Overhead Stops and Holders.
9. ANSI/BHMA A156.13, Mortise Locks and Latches, Series 1000.
10. ANSI/BHMA A156.16, American National Standard for Auxiliary Hard-ware.
11. ANSI/BHMA A156.18, Hardware - Materials and Finishes.
12. ANSI/BHMA A156.21, Thresholds.
13. ANSI/BHMA A156.22, Door Gasketing and Edge Seal Systems.
14. ANSI/BHMA A156.24, Delayed Egress Locks.
15. ANSI/BHMA A156.25, Electrified Locking Devices.
16. ANSI/BHMA A156.26, Continuous Hinges.
17. ANSI/DHI A115.1, Preparation of Mortise Locks in 1-3/8-inch and 1-3/4-inch Standard Steel Doors and Frames.
18. ANSI/NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
19. ASTM E329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
20. BMHA, Certified Product Directory.
21. DHI, Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
22. DHI, Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames.
23. DHI, Sequencing and Format for the Hardware Schedule.
24. FF-TT-S-00227,
25. HMMA 830, Hardware Preparation and Locations for Hollow Metal Doors and Frames.
26. NIST, U. S. Standard.
27. NFPA 70, National Electric Code.
28. NFPA 80, Fire Doors and Fire Windows.
29. NFPA 101, Life Safety Code.
30. SDI 109, Hardware for Standard Steel Doors and Frames.
31. SDI 118, Basic Fire Door Requirements.
32. UL 10B, Fire Tests of Door Assemblies.
33. UL 10C, Positive Pressure Fire Tests of Door Assemblies.
34. UL 305, Panic Hardware.
35. UL, Building Materials Directory.
36. UL, List of Inspected Fire Protection Equipment and Material.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Provide door hardware and accessories manufactured by firms specializing in the production of this type of Work and complying with specified standards of ANSI, BHMA, DHI, NFPA, HMMA, SDI and UL.

2. Provide door hardware from manufacturers who are members of BHMA and participate in BHMA certification programs.

B. Installer's Qualifications:
   1. The door hardware installer shall have in his employ an architectural hardware consultant. The architectural hardware consultant shall be a member of the Door and Hardware Institute, (DHI), who has passed the DHI certification examine and successfully completed an apprenticeship program. The architectural hardware consultant shall be responsible for preparing door hardware schedules and Shop Drawings and be present at the Site for the purpose of checking and supervising the Work of the installer during the time of installation and adjustment of the door hardware Work, and shall prepare a written field report on status of completed door hardware installation as specified.
   2. Submit name and qualifications of the installer to ENGINEER.

C. Architectural Hardware Consultant Qualifications:
   1. A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations and electrified door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

D. Component Supply and Compatibility:
   1. Finish hardware equipment manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
   2. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the finish hardware manufacturer.
   3. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

E. Testing Agency Qualifications: The independent testing agency shall demonstrate to ENGINEER'S satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated in accordance with ASTM E 329, without delaying the Work.

F. Regulatory Requirements:
   1. Provide door hardware for fire-resistance-rated openings in compliance with NFPA 80.
   2. Provide only door hardware that has been tested, listed and labeled by UL for the types and sizes of doors required, and complies with the requirements of the door and door frame labels.

3. Modify features of door hardware items specified, and provide additional accessories and features as required to meet UL and NFPA requirements, at no additional cost to the OWNER.
4. Codes: Comply with applicable requirements of codes.

G. Source Quality Control:
1. Obtain each type of door hardware item from only one manufacturer.
2. Provide door hardware schedule, for submission to, and for approval by, ENGINEER, prepared in compliance with DHI standards.
3. Comply with specified BHMA standards.

H. Requirements of Regulatory Agencies:
1. Provide finish hardware for fire-resistance-rated openings in compliance with NFPA 80.
2. Provide only finish hardware that has been tested, listed and labeled by UL for the types and sizes of doors required, and complies with the requirements of the door and door frame labels.
3. Modify features of finish hardware items specified, and provide additional accessories and features as required to meet UL and NFPA 80 requirements, at no additional cost to the OWNER.
4. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.

I. Preconstruction and Keying Conference: Conduct conference at Project site to comply with requirements in Section 01 31 19.13, Preconstruction Conference. In addition to OWNER, CONTRACTOR, and ENGINEER, conference participants shall also include Architectural Hardware Consultant and OWNER's security consultant. Review methods and procedures related to electrified door hardware including, but not limited to, the following:
1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.
5. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
    a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
    b. Preliminary key system schematic diagram.
    c. Requirements for key control system.
    d. OWNER entities responsible for signing off on keying and authorization to allow copies of keys.
    e. Address for delivery of keys.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Copies of the Door Hardware Schedule in the manner and format specified, complying with the actual construction Progress Schedule requirements (for each draft). Include explanation of abbreviations, symbols, and codes used to present scheduled information.
         1) Prepare and submit Door Hardware Schedule in compliance with HDI standards.
      b. Based on the door hardware requirements specified, organize the final Door Hardware Schedule into "hardware sets," indicating complete designation of every item required for each door or opening. Furnish initial draft of schedule at the earliest possible date, in order to facilitate the fabrication of other Work (such as hollow metal frames) which may be critical in the Project Schedule. Furnish final draft of schedule after Samples, manufacturer's data sheets, coordination with Shop Drawings for other Work, delivery schedules and similar information have been completed and accepted.
      c. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
      d. Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
      e. Include a separate key schedule, showing clearly how OWNER'S final instructions on keying of locks have been fulfilled.
      f. Door Hardware Schedules are intended for coordination of the Work. Review and acceptance by ENGINEER does not relieve CONTRACTOR of responsibility to fulfill the requirements as shown and specified.
   2. Product Data:
      a. Copies of manufacturer's data for each item of door hardware. Include whatever information may be required to show compliance with specified requirements, and include instructions for installation and for maintenance of operating parts and exposed finishes. Include mounting heights and locations for each item of door hardware. Provide ENGINEER with latest complete technical catalogue of all available door hardware manufactured by proposed manufacturers, even if manufacturer specified by ENGINEER is submitted by CONTRACTOR to perform the Work. Furnish templates to fabricators of other Work, which is to receive door hardware.
   3. Samples: Submit the following:
      a. Actual unit of each door hardware item specified incorporating all standard and special features and finishes specified, demonstrated and identified by manufacturer's representative to ENGINEER. Samples shall be presented at time of Shop Drawing submittal, as ENGINEER

will not review or approve Shop Drawings without concurrent sample submissions.

b. Approved samples may be incorporated into the door hardware Work.

c. ENGINEER'S review will be for appearance and for general compliance with required features. Compliance with all other requirements is the responsibility of CONTRACTOR.

B. Informational Submittals: Submit the following:

1. Certificates:
   a. Certify that electrified door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
2. Test and Evaluation Reports:
   a. Certified independent laboratory test reports for BHMA certification program and certification tests for each type of product specified.
3. Site Quality Control Submittals:
   a. Field Report: Architectural Hardware Consultant's Report.
4. Qualifications Statements:
   a. Installer.

C. Closeout Submittals: Submit the following:

1. Operation and Maintenance Documentation: Upon completion of the Work, furnish five copies of detailed maintenance manuals, including the following information:
   a. Product name and manufacturer.
   b. Name, address, e-mail address and telephone number of manufacturer and local distributor.
   c. Detailed procedure for routine maintenance and cleaning.
   d. Detailed procedures for repairs such as dents, scratches and staining.
   e. Parts identification manual and maintenance manuals for each piece of door hardware.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
2. Deliver all items of door hardware in manufacturer's original, undamaged packages, bearing accurate representation of the item within each package.
3. Pack each piece of door hardware separately, complete with screws, keying, instructions and templates, tagged to correspond with items submitted on approved Shop Drawings and as specified.

B. Storage and Protection:

1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
2. Provide secure storage area for door hardware items, secured by locks and accessible only to door hardware installer, ENGINEER and CONTRACTOR.

3. Store door hardware in manufacturers' original packages.

C. Acceptance at Site:
1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Items that arrive in a damaged condition shall be removed from the Site and not offered again for acceptance. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

1.6 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of operators and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period: 3 years from date of Substantial Completion, except as follows:
a. Exit Devices: 2 years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE

A. Extra Materials
1. Furnish full-size units of door hardware described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
a. Finish Hardware: One unit of each type of hardware specified.
b. Electrical Parts: One unit of each type of hardware specified.

B. Maintenance Service
   1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
   2. Maintenance Service: Beginning at Substantial Completion, provide 6 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design Criteria:
   1. Where the door, shape, size, fire-resistance-rating, frequency of use, or function of a member receiving door hardware is such as to prevent, or make unsuitable, the types of door hardware specified, furnish similar types having as nearly as practicable the same operation but of type or kind more appropriate to the design intention and requirements of governing authorities having jurisdiction at the Site. Clearly identify and highlight to ENGINEER all such required modifications on Shop Drawings submitted for approval.
   2. If door hardware for any location is not specified, provide door hardware equal in design and quality to adjacent door hardware specified for comparable openings at no additional cost to OWNER.
   3. Furnish door hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements, as necessary for proper installation and function.
   4. Unless otherwise specified, comply with DHI, Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames and Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames.

2.2 DETAILS OF CONSTRUCTION

A. General:
   1. Hand of Door: The Drawings show the swing or hand of each door leaf (left, right, reverse bevel, etc.). Furnish each item of door hardware for proper installation and operation of the door swing as shown.
   2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with labels required by governing authorities having jurisdiction at the Site.
   3. Base Metals: Produce door hardware units of the basic metal and forming method specified, using the manufacturer's standard metal alloy, composition,

temper and hardness. Do not substitute materials or forming methods for those specified.

4. Fasteners: Manufacture door hardware to conform to published templates, generally prepared for machine screw installation. Do not provide door hardware, which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
5. Furnish screws for installation, with each door hardware item. Provide Phillips flat-head screws except as otherwise specified. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces on other Work, to match the finish of such other Work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
6. Provide fasteners which are compatible with both the unit fastened and the substrate, and which will not cause corrosion or deterioration of door hardware, base material or fastener.
7. Provide concealed fasteners for door hardware units, which are not exposed when the door is closed, except to the extent no standard manufacturer units of the type specified are available with concealed fasteners. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed in other Work under any condition, except where it is not possible to adequately reinforce the Work and use machine screws or concealed fasteners of another standard type to satisfactorily avoid the use of through bolts.
8. Tools for Maintenance: Furnish two complete sets of specialized tools as required for OWNER'S continued adjustment, maintenance, removal and replacement of door hardware.

2.3 HARDWARE TYPES

A. Mortise Hinges:
   1. Templates and Screws: Provide only template-produced units.
   2. Base Metal: Except as otherwise specified, fabricate hinges from stainless steel and finish to match the latch and lock set.
   3. Number of Hinges: Provide three hinges on each door leaf of less than 60-inches in height; provide one additional hinge for next 30-inches of door height or fraction thereof; provide two additional hinges for each 30-inches, or fraction thereof, for doors above 90-inches tall.
   4. Hinge Size: Except as otherwise specified or as required to comply with UL and NFPA, provide hinges of the following sizes:
      a. Exterior Doors, Maximum 36-Inches Wide: 4-1/2-inch heavy-weight (0.180-inch).
   5. Types of Hinges: Provide full-mortise type, ball-bearing hinges, swaged for mortise applications, inner leaf beveled, square cornered, unless manufacturer's recommendations indicate that half-mortise, half-surface, full-surface or other type should be used for the frame and door type or condition.
   6. Hinge Pins: Except as otherwise specified, provide hinge pins as follows:
      a. Pins: Stainless steel.

b. Exterior Doors: Non-removable pins. Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed.
c. Tips: Slope ends of hinge barrel.

7. Conform to ANSI/BHMA A156.7.
8. Comply with UL, List of Inspected Fire Protection Equipment and Materials and NFPA 80 requirements.
9. Products and Manufacturers: Provide one of the following:
   a. FBB 199, FBB 191 by Stanley Commercial Hardware, Division of The Stanley Works.
   b. T4B3386, TB3313 by McKinney Products Company, an ASSA ABLOY Group company.
   c. Or equal.

B. High-Security Mortise Locks Sets:
1. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with ADAAG.
2. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
3. Strikes: Provide manufacturer's standard wrought box strike, for each location and use shown. Provide stainless steel curved lip strikes, unless otherwise recommended by manufacturer, finished to match lock or latch set trim.
4. Lock Throw: Provide minimum of 3/4-inch anti-friction latch bolt and 1-inch dead bolt throw. Comply with UL requirements for throw of latch bolts and deadbolts on fire-resistance-rated openings.
5. Materials: Provide the following features and materials:
   a. Latch Bolt: Two-piece; mechanical; anti-friction, stainless steel.
   b. Dead Bolt: One-piece, stainless steel with two enclosed hardened-steel roller armor pins.
   c. Case: Wrought steel, zinc dichromatized.
   d. Cylinders: High-security; brass; pick- and drill-resistant; ANSI/BHMA A156.5 - E09211A.
   e. Armor Front: 8-inches by 1-1/4-inches wide, minimum; steel.
   f. Escutcheon: 8-inches by 2-1/2-inches wide by 3/16-inches thick, minimum; stainless steel, US 32D.
   g. Hubs: Sintered steel, copper infiltrated.
   h. Lever with Stop Pin: Brass, plated to match stainless steel, with additional built-in stop to prevent over-torquing of lever.
   i. All components shall be of marine quality, wherever possible.
6. Backset: 2-3/4-inches.
7. Modify specified locks and latches to comply with UL, Building Materials Directory, and List of Inspected Fire Protection Equipment and Materials and NFPA 80 requirements.
8. Latches and Locks for Means of Egress Doors: Comply with NFPA 101.
9. Electrified Locking Devices: BHMA A156.25.
10. Finish: US 32D satin.
11. Conform to ANSI/BHMA A156.13, Series 1000, Security Grade 1.

12. Products and Manufacturers: Provide one of the following:
    a. High Security SL8800 Mortise Lockset and Securex Electrified High Security SL8800 Mortise Lockset with Augusta - AUSL Lever Handles and Trim by Yale Commercial Locks and Hardware, an ASSA ABLOY Group company.
    b. ML2000 Series Mortise Lockset and ML20900 ECL Series Electrically Controlled Mortise Lockset with Newport NSM Lever Handles and Trim by Corbin Russwin Architectural Hardware, an ASSA ABLOY Group Company.
    c. Or equal.

C. Panic Exit Devices:
1. Strikes: Provide manufacturer's standard wrought stainless steel jamb-mounted top latch bolt and bottom latch bolt for each location and use shown to allow independent opening and closing of each leaf of double doors with panic exit devices; complying with UL List of Inspected Fire Protection Equipment and Materials and NFPA 80 requirements.
2. Lock Throws: Provide minimum of 3/4-inch latch bolt throw complying with UL List of Inspected Fire Protection Equipment and Materials and NFPA 80 requirements.
3. Strikes: Provide manufacturer's standard wrought stainless steel jamb-mounted top latch bolt and bottom latch bolt for each location and use shown to allow independent opening and closing of each leaf of double doors with panic exit devices; complying with UL List of Inspected Fire Protection Equipment and Materials and NFPA 80 requirements.
4. Lock Throws: Provide minimum of 3/4-inch latch bolt throw complying with UL List of Inspected Fire Protection Equipment and Materials and NFPA 80 requirements.
5. Provide concealed vertical rod type exit device and mortise type exit devices as specified.
6. Provide the following features and materials:
    a. Latch Bolt: Two-piece; mechanical; anti-friction, stainless steel.
    b. Dead Bolt: One-piece, stainless steel with two enclosed hardened-steel roller armor pins.
    c. Case: Wrought steel, zinc dichromatized.
    d. Cylinders: High-security; brass; pick- and drill-resistant; ANSI/BHMA A156.5 - E09211A.
    e. Armor Front: 8-inches by 1-1/4-inches wide, minimum; steel.
    f. Escutcheon: 8-inches by 2-1/2-inches wide by 3/16-inches thick, minimum; stainless steel, US 32D.
    g. Hubs: Sintered steel, copper infiltrated.
    h. Crossbar: Oval, seamless with interlocking expansion collets and roll pins; knurled, satin stainless steel, 0.062-inches minimum thickness, with steel reinforcing tube.
    i. Concealed bolts: Minimum 1/2-inch diameter, stainless steel.
7. Backset: Provide minimum backset of 2-3/4-inches.
8. Finish: US 32D satin.

9. ANSI/BHMA: A156.3, Type 3 and Type 8, Grade 1; F08, entrance by lever, key locks or unlocks lever for entrances shown as accessible to people with disabilities as required by ADAAG; and F05, entrance by thumb piece, key locks or unlocks thumb piece.
10. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
11. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
12. Products and Manufacturers: Provide one of the following:
    a. 1530-L8 (F) and -T8 (F) Series Mortise Exit Devices; with Escutcheon Trim and Augusta - ASL Lever Handles and Thumbpiece/Handle/Cylinder Unit by Yale Commercial Locks and Hardware, an ASSA ABLOY Group company.
    b. ED6600Series Mortise Exit Devices; with Escutcheon Trim and Newport – N4M Lever Handles and D Grip T7M Thumb piece/Handle/Cylinder Unit by Corbin Russwin Architectural Hardware, an ASSA ABLOY Group company.
    c. Or equal.

D. Cylinders and Keying System:
1. Review the keying system with OWNER'S and provide the type required (master, grandmaster or great grandmaster), either new or integrated with OWNER'S existing system.
2. Furnish all locks with manufacturer's cylinders for interchangeable-core pin tumbler inserts. Furnish only temporary inserts for the construction period, and remove these before Substantial Completion. Construction control keys and cores shall not be part of OWNER'S permanent keying system. Permanent cores and keys shall be furnished to OWNER prior to Substantial Completion.
3. Comply with the OWNER'S instructions for master keying and, except as otherwise specified, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
4. Permanent keys and cores shall be stamped with the applicable key mark for identification. These visual key control marks or codes shall not include the actual key cuts. Permanent keys shall also be stamped "DO NOT DUPLICATE".
5. Cylinder Material: Brass, bronze or Series 300 stainless steels.
6. Cylinder Features: Seven-pin, high-security, removable core.
7. Key Material: Nickel silver.
8. Key Quantity: Furnish three keys for each lock and five keys for each master and grandmaster system. Provide one extra key blank for each lock.
9. Coordinate cylinder installation with locks furnished in Section 08 33 23, Overhead Coiling Doors.

E. Overhead, Surface-Mounted, Door Closers:
   1. Provide all doors, unless specially shown or specified as being provided with floor-mounted or concealed overhead closers, with surface-mounted overhead door closers. Provide both active and inactive door leafs with closers.
   2. Size of Units: Except as otherwise specified, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather, and anticipated frequency of use.
   3. Where parallel arms are specified, and for closers on exterior doors, provide closer unit one size larger than recommended for use with standard arms.
   4. Use parallel arm arrangement for doors that would otherwise have the door closer appearing in finished corridors or entries.
   5. Comply with UL, Building Materials Directory, and List of Inspected Fire Protection Equipment and Materials, and NFPA 80. Modify closers specified as required.
   6. Provide hold open feature for all non-fire-resistant-rated doors, unless otherwise specified.
   7. Provide corner bracket mounting on exterior doors. Select all arms to clear weather-stripping, and overhead door holders.
   8. Provide long arm to allow door to swing 180 degrees where long arm will eliminate floor-mounted stops.
   9. Provide closers with spring power adjustment feature capable of increasing spring power 15 percent minimum in all closer sizes.
   10. Provide individual regulating valves for closing and latching speeds, and separate adjustable back check valve.
   11. Provide delayed closing action feature on all door closers. Position valve at top of closure.
   12. Provide the following materials and features:
      a. Full Metal Cover: Aluminum.
      b. Case: Cast-iron.
      c. Arms: Plated to match full metal covers.
      d. Other Parts: Steel.
      e. Extreme temperature fluid.
      f. Security torx machine screws.
      g. Ten-year warranty.
      h. Provide manufacturer's optional corrosion protection.
   13. Finishes: US 26D satin chrome. Color coordinate all arms and other accessories.
   14. Highly Corrosive Atmospheres: Provide all closers with specified manufacturer's optional corrosion protection.
   15. ANSI/BHMA: A156.4, C02011, in compliance with PT 1 and PT 4.
   16. Products and Manufacturers: Provide one of the following:
      a. DC8000 Series by Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
      b. 4040 Series by LCN Closers, an Ingersoll Rand Company.
      c. Or equal.

F. Weatherstrip Gasketing:
   1. Provide perimeter weather stripping at all exterior doors. Provide stripping and seals for interior doors where scheduled in List of Door Hardware Items at end of Part 3.
   2. Continuity of Stripping: Except as otherwise specified, stripping at each opening shall be continuous and without unnecessary interruptions at door corners and hardware.
   3. Replaceable Seal Strips: Resilient or flexible seal strip of every unit shall be easily replaceable and readily available from stocks maintained by the manufacturer.
   4. Provide bumper-type weather-stripping at jambs and head, including a resilient insert and metal retainer strip, surface-applied, of the following metal, finish and resilient bumper material:
      a. Housing: Extruded aluminum with clear anodized finish; 0.062-inch minimum thickness of main walls and flanges.
      b. Dimensions: 1-3/8-inches by 7/8-inches, stop-mounted.
      c. Seals: Closed-cell extruded silicone.
      d. ANSI/BHMA: A156.22, R3E264.
      e. Products and Manufacturers: Provide one of the following:
         1) No. 2891 APK (for parallel arms) by Pemko Manufacturing Company.
         2) No. 429A (for parallel arms) by Zero International.
         3) Or equal.
   5. Provide heavy-duty, surface-mounted, door-bottom sweep unit of manufacturer's standard design retained in an extruded metal bar and capable of closing a 3/4-inch gap (from door bottom to floor or threshold).
      a. Housing: Extruded aluminum, 0.062-inch thick, with mill aluminum finish.
      b. Seal: Eco-V.
      c. Mounting: Surface-mounted.
      d. ANSI/BHMA: A156.22, R3D534.
      e. Products and Manufacturers: Provide one of the following:
         1) No. 345AV for exterior doors and No. 307AV for interior doors by Pemko Manufacturing Company.
         2) Or equal.

G. Thermal Barrier Thresholds:
   1. All exterior doors shall be provided with thermal barrier thresholds.
   2. Metal: Extruded aluminum.
   3. Surface Pattern: Fluted tread, manufacturer's standard.
   4. Provide countersunk stainless steel screws and expansion shields.
   5. Width: 5 1/8-inches wide and of length sufficient to span full width of rough openings, coped and scribed neatly at and around door frames.
   6. Construction:
      a. Two-piece, with ridgid vinyl keycomplying with manufacturer's recommendations.
   7. Profile: Provide manufacturer's unit, which conforms to the minimum size and profile requirements specified.

a. For doors equipped with panic hardware, including floor bolts, provide profile with stop bar of proper size and shape to function as the strike plate for the floor bolts.

8. Thickness: 1/2-inch.
9. ANSI/BHMA: A156.21, J12100.
10. Products and Manufacturers: Provide one of the following:
    a. 252X2AFG by Pemko Manufacturing Company.
    b. 625 A by Zero International.
    b. Or equal.

H. Silencers:
1. Provide silencers for all door frames.
2. Provide pneumatic design that, once installed, forms an air pocket to reduce noise.
3. Provide minimum of three per strike side of door jambs.
4. ANSI/BHMA: A156.16, BHMA 6.5, L03011.
5. Products and Manufacturers: Provide one of the following:
    a. SR64 by IVES Hardware, an Ingersoll-Rand Company.
    b. Series 307D by Hager Companies.
    c. Or equal.

I. Floor Stops: Provide the following where scheduled in List of Door Hardware Items at end of Part 3:
1. Dome-Type Floor Stops:
    a. Cast bronze extra heavy-duty wall mounted door stop, one per leaf.
    b. Coordinate height of dome-type floor mounted doors stops with threshold condition and undercut of door.
    c. Finish: US 26D satin chrome.
    d. ANSI/BHMA: A156.16, L12161.
    e. Products and Manufacturers: Provide one of the following:
        1) FS13/ R14, FS17 by IVES Hardware, an Ingersoll-Rand Company.
        2) Trimco BL243F by Triangle Brass Manufacturing Company.
        3) Or equal.

J. Sealants: Provide elastomeric sealant complying with FS TT-S-00227, Type 2 (non-sag) Class A for use with thresholds.

2.3 HARDWARE FINISHES

A. Provide matching finishes for door hardware units at each door or opening, to the greatest extent possible in compliance with ANSI/BHMA A156.18.

B. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of door hardware exposed at the same door or opening. In general, match all items to the manufacturer's standard finish for the latch and lock set for color and texture.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the substrate to receive door hardware, and the conditions under which the Work will be performed, and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the door hardware Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

A. Templates: Furnish door hardware templates to each fabricator of doors, frames and other Work to be factory-prepared for the installation of door hardware. Check the Shop Drawings of such other Work, to confirm that adequate provisions are made for the proper installation of the door hardware.

B. Prepare Work to receive door hardware Work in compliance with ANSI/DHI A115.1.

C. Surface-Applied Door Hardware: NFPA 80: Drill and tap doors and frames according to ANSI A250.6.

3.3 INSTALLATION

A. Installer shall check and approve the installation before operation. Installer shall assure that the system operates to the OWNER'S satisfaction.

B. Mount door hardware units at heights recommended in, Door and Hardware Institute, “Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames” and “Recommended Locations for Builders’ Hardware for Custom Steel Doors and Frames", except as otherwise specified or required to comply with governing authorities having jurisdiction at the Site, HMMA 830 and ADAAG requirements.

C. Install each door hardware item in compliance with the manufacturer's instructions and recommendations and approved Shop Drawings. Wherever cutting and fitting is required to install door hardware onto or into surfaces that are later to be painted or finished in another way, install each item completely, then remove, and store in a secure place during the finishapplication. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.

G. Screw thresholds to substrate with No. 10 or larger screws, of the proper type for permanent anchorage and of bronze or stainless steel that will not corrode in contact with the threshold metal.

H. Set thresholds in a bead of elastomeric sealant to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealant before sealant cures to a firm set.

I. Initial Adjustment: Adjust and check each operating item of door hardware and each door, to ensure proper operation or function of every unit. Lubricate moving parts with the type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units that cannot be adjusted and lubricated to operate freely and smoothly as intended for the application. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

J. Final Adjustment: Where door hardware installation is made more than one month prior to Substantial Completion, return to the Work during the week prior to acceptance or occupancy, and make a final check and adjustment of all door hardware items in each space and area. Clean and re-lubricate operating items as necessary to restore proper function and finish of door hardware and doors. Adjust door control devices to compensate for final operating of heating and ventilating equipment.

K. Provide manufacturer’s authorized representative to instruct and train OWNER'S personnel in proper adjustment and maintenance of door hardware during the final adjustment of door hardware.

L. Door hardware, which is blemished or defective, will be rejected even though it was set in place before defects were discovered. Remove and replace with new door hardware. Repair all resultant damage to other Work.

M. Continued Maintenance Service: Approximately six months after the acceptance of door hardware in each area, the installer, accompanied by the representative of the

latch and lock manufacturer, shall return to the Project and re-adjust every item of hardware to restore proper function of doors and door hardware. Consult with and instruct OWNER'S personnel in recommended additions to the maintenance procedures. Clean and lubricate operational items wherever required. Replace door hardware items that have deteriorated or failed due to faulty design, materials or installation of door hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance or the door hardware.

3.4 FIELD QUALITY CONTROL

A. Provide a written field report, prepared by installer's architectural hardware consultant, identifying actual condition, location, manufacturer, and product designation for each item of door hardware actually present on each door at the Site, including whether door hardware is adjusted and operating properly, compared with each item referenced to approved Shop Drawings and Contract requirements.

B. Installer's hardware consultant shall provide opinions to, and assist ENGINEER in determining, acceptability of installation as Work proceeds. All comments and discussions, conversations and meetings with ENGINEER shall be included in written field report for submission to ENGINEER for review and approval at completion of door hardware installation.

C. As part of written field report to be submitted to ENGINEER for approval, recommend remedial actions for Work not in compliance with these Specifications. No payment for Work shall be made until remedial recommendations and actions have been approved by ENGINEER and incorporated into the Work.

3.5 LIST OF DOOR HARDWARE ITEMS

A. Scheduled items for each door are generic and rely on information specified above. The listing of hardware functions and types provided are only a general guideline for the final Door Hardware Schedule. CONTRACTOR shall submit a Door Hardware Schedule acceptable to all governing authorities having jurisdiction at the Site.

B. Provide the following door hardware items:
   1. Trilith Pump Station.
      a. Door No. 100-01, Exterior, 3'-0"x7'-0", Hollow Metal.
         1) Mortise Hinges.
         2) Mortise Lock (F04).
         3) Panic Exit Device.
         4) Overhead, Surface-Mounted Door Closers.
         5) Stripping and Seals.
         5) Floor Stop.
         6) Threshold.

+ + END OF SECTION + +

SECTION 08 90 00

LOUVERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all louvers Work.
   2. Extent of louvers Work is shown.
   3. Types of products required include the following:
      a. Six-inch fixed, drainable, extruded-aluminum louvers.
      b. Sill extensions, bird screens, insect screens, and other miscellaneous trim, fasteners, blank-off panels, supports and other accessories.
      c. Polyvinylidene fluoride finish.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the louvers Work.
   2. Verify size, location and placement of louver prior to fabrication, wherever possible. Coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units. Preassemble units in as large sections as practicable.

C. Related Sections:
   1. Section 07 92 00, Joint Sealants.
   2. Section 09 91 00, Painting.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   2. ASCE 7-2002: Minimum Design Loads for Buildings and Other Structures.
   3. ASCE/SEI 24-14: Flood Resistant Design and Construction.
   4. AMCA Standard 501, Application Manual for Air Louvers.
   5. AMCA Standard 500-L, Test Methods for Louvers, Dampers.
   6. AMCA Certified Ratings Program.
   7. ASTM B 26, Standard Specification for Aluminum-Alloy Sand Castings.

8. ASTM B 209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. ASTM B 221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
10. ASTM E 90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
11. ASTM E 329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
12. ASTM E 488, Standard Test Method for Strength of Anchors in Concrete and Masonry Elements.
13. AWS D1.2/D1.2M, Structural Welding Code – Aluminum.
14. AWS D1.3, Structural Welding Code – Sheet Steel.
15. AWS D1.6, Structural Welding Code - Stainless Steel.
16. FEMA FNFIP, Technical Bulletin 1, Requirements for Flood Openings in Foundation Walls and Walls of Enclosures.
17. NEMA MG 1 Motors and Generators.
18. SMACNA, Architectural Sheet Metal Manual.
19. UL 1400, Standard for Electric Motors.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Supplier Qualifications: Supplier shall have a minimum of five years experience producing substantially similar products to those required and shall be able to document at least five installations in satisfactory operation for at least five years.

B. Performance Criteria: Comply with Sheet Metal and Air Conditioning Contractor's National Association, Architectural Sheet Metal Manual,

recommendations for fabrication, construction details, and installation procedures, except as otherwise shown on the Drawings or specified.

C. Component Supply and Compatibility:
   1. Obtain each separate type of louver from a single supplier and from a single manufacturer.

D. Regulatory Requirements:
   1. Miami- Dade County Product Control Approval System or the Florida Building Code Approval System.

E. Testing Agency Qualifications: The independent testing agency shall demonstrate to ENGINEER'S satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated in accordance with ASTM E 329, without delaying the Work.

F. UL and NEMA Compliance: Provide motors and related components for motor-operated louvers that are listed and labeled by UL and comply with applicable NEMA standards.

G. AMCA Certified Ratings Seal: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

H. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   2. AWS D1.3, "Structural Welding Code - Sheet Steel."
   3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.5 SUBMITTALS

A. Action Submittals: Submit the following
   1. Shop Drawings:
      a. Include plans, elevations, sections, details and attachments to other work. Show blade profiles, angles and spacing.
   2. Product Data:
      a. Copies of manufacturer's material specifications, recommended written installation instructions and manufacturer's specifications showing
   3. Delegated Design Submittals:
      a. For installed louvers indicated to comply with design loads, include structural analysis data signed and sealed by a Registered Professional Engineer licensed in the State of Georgia, who is responsible for their preparation.

a. For installed louvers indicated to comply with design loads, include structural analysis data signed and sealed by a Registered Professional Engineer, who is responsible for their preparation.

b. Wiring Diagrams: Power, signal, and control wiring for motorized adjustable louvers.

4. Samples: For units with factory-applied color finishes.

a. Cut-a-way samples of corner section of each type of louver made from 12-inch lengths of full size components and showing the proposed details of joinery, anchorage, movement, glazing, flashing and drainage and with specified finish, prior to fabrication of the Work.

1). ENGINEER reserves the right to require samples demonstrating design, detailing and fabrication techniques and workmanship for each auxiliary louver component and accessory, before fabrication proceeds.

b. Provide polyvinylidene fluoride coating manufacturer's complete color charts showing all colors and finishes, including custom, special and premium colors, available from the manufacturer.

c. Where normal color and texture variations are to be expected, include three or more 12-inch by 12-inch by 1/16-inch aluminum plates, painted as specified, to show the range of such variations. Provide minimum possible color range variation. ENGINEER reserves the right to reject material finishes with objectionable variations from the established samples.

d. Provide anodized finish manufacturer's complete color charts.

e. One of each type fastener employed, with statement of intended use.

f. Samples will be reviewed by ENGINEER for materials, fabrication techniques, proposed system components, workmanship and color. Compliance with other requirements is the responsibility of CONTRACTOR.

C. Informational Submittals: Submit the following:

1. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

2. Source Quality Control Submittals:

a. Comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Provide written warranty agreeing to replace louver Work which fails in materials or workmanship within three years of the date of Final Acceptance. Failure of materials or workmanship shall include, but is not limited to, excessive leakage or air infiltration, excessive deflections, deterioration of finish or metal in excess of normal weathering, and defects in accessories, weatherstripping, and other components of the Work.

B. Guarantee that the polyvinylidene fluoride based coating meets all criteria specified and will not spall, check, craze, peel or otherwise lose adhesion for a period of twenty years from the date of Final Acceptance, to the extent that such shall create unsightly conditions or otherwise impair the intended architectural qualities of the building.

C. In the event that the polyvinylidene fluoride based coating fails to meet the specified standards, the manufacturer shall, at his own expense, replace or field paint, as directed by ENGINEER, all areas affected by the failure. In the event that repainting is selected, it shall be done at mutually agreeable intervals throughout the term of the warranty.

D. The warranty does not apply where failure is caused by accidents, or external conditions or forces beyond the control of the manufacturer.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.
   1. Wind Loads:
      a. Ultimate uniform inward wind pressure = 38 psf.
      b. Ultimate uniform outward wind pressure = 41 psf.

B. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions determined according to the International Building Code and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads".
   1. Seismic Design Criteria:
      a. Risk Category: III.

b. Seismic Importance Factor, I_E= 1.25.
c. Mapped Spectral Response Accelerations:
   1) Ss = 16.3%.
   2) S_1 = 8.2%.
d. Site Class = D.
e. Spectral Response Coefficients:
   1) S_{DS} = 17.3%.
   2) S_{D1} = 13.0%.
f. Seismic Design Category: B.

C. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 20°F, ambient; 120°F, material surfaces.

2.2 MATERIALS

A. Aluminum Sheet: ASTM B 209, Alloy 5005 with temper as required for forming or as otherwise recommended by the metal producer to provide the required finish.

B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T52.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.

D. Fastenings: Stainless steel. Provide types, gages and lengths to suit unit installation conditions. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise specified. Use continuous aluminum closure angles on the inside perimeter frame of all louver Work, finished to match louvers.

E. Protection of aluminum from dissimilar materials shall conform to Section 09 91 00, Painting.

F. Recycled Content, Pre-Consumer:
   1. Extruded aluminum: 45 per cent by weight,
   2. Fabricated sheet aluminum: 28 per cent by weight,
   3. Aluminum bird screen: 38 per cent by weight.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes as shown, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Channel, unless otherwise shown and as specified.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Where shown, provide subsills made of same material as louvers.

F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise shown or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, DRAINABLE, EXTRUDED-ALUMINUM LOUVERS

A. Furnish six-inch fixed louvers where shown, or scheduled. Drainable blades shall incorporate a front lip gutter and recessed second gutter, both of which direct water to jamb and mullion drains.

B. Free Area Velocity:
   1. 6-inch: Maximum 1200 feet per minute free area velocity at a pressure drop of not more than 0.22-inches water gage carrying less than 0.01 ounces of water per square foot of free area.

C. All blades shall be 0.081-inch thick. Provide all blades with integral drainage trough along edge of blades. Frame shall be 0.081-inches thick. Mullions shall be of the sliding interlock type.

D. Free Area: For a 48-inch by 48-inch high louver.
   1. 6-inch: 52.1 percent.

E. Install screen behind the louver.

F. Products and Manufacturers: Provide one of the following:
   1. No. 6097 by Construction Specialties, Incorporated.
   2. No. K6846 by the Airolite Company, LLC.
   3. Or equal.

2.5 LOUVER SCREENS

A. Provide removable screens for all louvers.

B. Fabricate screen frames of the same metal and finish as the louver units to which secured. Provide frames consisting of extra heavy duty extruded 0.090-inch aluminum for permanently securing screen mesh. Frames shall be rewirable.

C. Provide bird screen, 1/2-inch square stainless steel wire, 0.047-inch diameter wire.

D. Locate screens on inside face of louvers. Secure screens to louver frames with machine screws, spaced at each corner and at 12-inches on centers.

E. Provide minimum No. 8 stainless steel metal screws, unless larger screws are required by screen size.

F. Provide cross bar screen reinforcement of same material and finish as louver which subdivides screens into maximum area of 50 square feet.

2.6 SILL EXTENSION

A. Gage and Finish: Same as louver.

2.7 ATTACHMENT FRAME

A. Gage and Finish: Same as louver.

B. Size: As shown on the Drawings.

2.8 FINISHES

A. Three Coat Fluorocarbon Coating:
   1. Louvers to be finished with a minimum 1.4 mil thick full strength 70% resin, 3 coat Fluoropolymer system, meeting AAMA 2605 performance requirements.
   2. All aluminum shall be thoroughly cleaned, etched and given a chromated conversion pretreatment before application of the Kynar/Hylar coating. The coating shall consist of a primer, a high metallic color coat and a clear PVF2 topcoat. It shall receive a bake cycle of 17 minutes at 4500F. All finishing procedures shall be one continuous operation in the plant of the manufacturer.
   3. Manufacturer to furnish an extended 20 limited warranty for the Kynar/Hylar coating. This limited warranty shall begin on the date of material shipment.
   4. Provide the following colors:

a. Full selection of manufacturer's standard, custom and premium colors for final selection by ENGINEER.
b. ENGINEER will select custom special extended life premium colors for louvers Work at time of Shop Drawing and Sample submission review.
c. Provide custom colors to match adjacent metal wall panels:
1) Cool Charcoal (PPG 1007-6).
2) Greyhound (PPG 1008-3).

5. Products and Manufacturers: Provide one of the following:
a. Duranar Metallic XL Specialty Color 4-System by PPG Industries Coatings and Resins Division, Incorporated.
b. Fluoropon Premeire by Valspar Crporation.
c. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR and his installer must examine the areas and conditions under which louvers Work and associated items are to be installed and notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for the installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to the Site.

3.3 INSTALLATION

A. Locate and place louver units plumb, level and in proper alignment with adjacent work.

B. Use stainless steel expansion bolt anchors with stainless steel washers and neoprene gaskets. Use spring clips at all anchors to stop deflection of the louver frame. Provide anchors spaced 2 feet-0 inches on centers.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers, as shown.

D. Repair finishes damaged by cutting, welding, soldering and grinding operations required for fitting and jointing. Restore finishes and prime coats of paint so that there is no evidence of corrective Work. Return items which cannot be refinished

in the field to the shop, make the required alterations, and refinish the entire unit, or provide new units, as determined by ENGINEER.

E. Protection of Aluminum from Dissimilar Materials: Coat all aluminum surfaces in contact with dissimilar materials such as concrete, masonry, steel and other metals as specified in Section 09 91 00, Painting.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00, Joint Sealants, for sealants applied during louver installation.

3.4 FIELD QUALITY CONTROL

A. Determine conformity of louver polyvinylidene fluoride finish to these Specifications, as follows:
   1. The manufacturer of the louver shall set aside and label samples of the metal from each production lot for the job. Protect samples from weather.
   2. Make sample louver available at all times, for comparison with installed louver Work as requested by OWNER, for the full time of the warranty.
   3. Make color comparison measurements with a Hunter Tristimulus Color Difference Meter employing methods of computation in use at the National Bureau of Standards conforming to ASTM D 2224.

3.5 ADJUSTMENT AND CLEANING

A. Clean exposed surfaces of louvers that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Louvers with dents, warps, gouges or scratches shall be replaced with new louvers, at no additional cost to OWNER.

++ END OF SECTION ++

DIVISION 9 - FINISHES

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SECTION 09 61 53

CONCRETE HARDENER

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all concrete hardener Work.
   2. The extent of the concrete hardener includes all interior concrete floors not shown or scheduled to be finished with another material.
   3. The types of concrete hardener Work required include, but are not necessarily limited to, silicate penetrant.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the concrete hardener Work.

C. Related Sections:
   1. Section 03 30 00, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

A. Installer's Qualifications: Engage a single installer regularly engaged in the installation of concrete hardeners with five years experience in the application of the types of materials required, and who agrees to employ only tradesmen with specific skills and experience in this type of Work. Installer shall meet the requirements of the concrete hardener manufacturer for providing guarantee coverage. Submit name and qualifications to ENGINEER.

B. Source Quality Control: Obtain all material from only one manufacturer who will send a qualified technical representative to the Site for the purpose of advising the installer of proper procedures and precautions for the use of the material, at no additional cost to the OWNER.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Copies of manufacturer’s specifications, recommendations and installation instructions. Include manufacturer’s published data,

indicating the material complies with the requirements and is intended for the application shown.

b. Submit installer's qualifications in accordance with Article 1.2, above.

B. Informational Submittals: Submit the following:

1. Certificates: Submit a certificate of coverage signed by a duly authorized representative of the manufacturer.

C. Closeout Submittals: Submit the following:

1. Maintenance Data: Upon completion of the Work, furnish five copies of detailed maintenance manual including the following information:
   a. Product name and number.
   b. Name, address and telephone number of manufacturer and local distributor.
   c. Detailed procedures for routine maintenance and cleaning.
   d. Detailed procedure for light repair such as scratches and staining.

2. Guarantee Documentation:
   a. Submit for approval written guarantee agreeing to replace the concrete hardener should it fail to perform as specified in Article 1.6, below.

1.4 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded, in ample time to prevent delay of that Work.
2. Deliver materials in concrete hardener manufacturer’s original unopened containers.
3. Include the following information on the label:
   a. Name of material and supplier.
   b. Formula or specification number, lot number and date of manufacturer.
   c. Mixing instructions, shelf life and curing time when applicable.
4. Failure to comply with these requirements shall be sufficient cause for the rejection of the material in question, by ENGINEER, and requiring its removal from the Site. In such a case, supply new material conforming to the specified requirements, at no additional cost to OWNER.
5. Handle materials carefully to prevent inclusion of foreign materials.
6. Do not open containers or mix components until all necessary preparatory Work has been completed.

B. Storage and Protection:

1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

2. Store materials so as to preclude the inclusion of foreign material.
3. Protect material from freezing.

C. Acceptance at Site:
1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

1.5 JOB CONDITIONS

A. Environmental Conditions:
1. Do not apply concrete hardener to uncured concrete. Comply with manufacturer's written instructions for minimum ten days of curing time.
2. Apply hardener only when temperature of concrete is 50°F or above.

B. Protection:
1. Do not allow concrete hardener to overflow or spill onto adjoining surfaces.
2. Remove concrete hardener that is splashed on surfaces not designated to receive concrete hardener immediately by flushing with water.

C. Sequencing:
1. Coordinate the Work so that the concrete hardener is installed when best results will be obtained, as recommended by the manufacturer's technical representative.

1.6 GUARANTEE

A. Provide a five year written guarantee, signed by CONTRACTOR and installer, stating that should concrete floors show signs of dusting because of wear and abrasion they will be re-installed, in the manner specified herein, at no additional cost to OWNER, from the date of Final Acceptance of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Hardener: Provide a clear, colorless, aqueous solution of chemically active, magnesium, silicates and fluosilicates plus a wetting and penetrating agent, that reacts with the free lime and calcium carbonates to bind soft, loose particles together and form a hard dense vitreous surface which is resistant to chemical attack and the growth of mildew, fungi and other organisms. Use potable water only.

2.2 MANUFACTURERS

A. Products and Manufacturers: Provide one of the following:
   1. MasterKure HD 300WB by Master Builders Solutions Construction Systems US, LLC.
   2. Armortop by Anti-Hydro Waterproofing Company.
   3. Or equal.

2.3 MIXES

A. Follow manufacturer's written instructions for the proper mixing, dilution and coverage of each coat.

2.4 FINISH

A. The finished installation of the concrete hardener shall have a smooth, uniform even finish without discontinuities or discolorations.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the substrates and the conditions under which the concrete hardener Work is to be performed and notify ENGINEER, in writing, of any conditions detrimental to the proper and timely completion of the Work and performance of the concrete hardener. Do not proceed with the concrete hardener Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 SUBSTRATE PREPARATION

A. Steel trowel concrete in strict accordance with printed directions supplied by the concrete hardener manufacturer.

B. Provide concrete free of all honeycombing and fins.

C. Do not use sealers, curing or parting compounds on the concrete.

D. Provide wet curing only.

E. Surfaces to receive concrete hardener shall be clean, dry and free of all loose dirt, oil, wax and other foreign matter.

3.3 INSTALLATION

A. Provide the services of a manufacturer's technical representative for the purpose of advising the installer of proper procedures and precautions for the use of the material prior and during the installation of the concrete hardener.

B. Apply concrete hardener using the coverage recommended by the manufacturer per coat.

C. Apply a minimum of three separate coats.

D. Apply a fourth coat using undiluted material should the manufacturer's technical representative recommend this procedure, based on field conditions, and as directed by ENGINEER.

E. Apply each coat by spray.

F. Mop up excess solution or puddles.

G. After each of the first and second applications, allow the floor to dry until no longer visibly wet.

H. To avoid the development of crystals, when applying the third coat, flush the surface liberally with clean, hot water. At the same time, brush the floor rapidly with a stiff-bristle broom. Mop up excess water.

I. Follow manufacturer's written instructions should white crystals develop after the first or second coat. Consult manufacturer's technical representative.

3.4 ADJUSTMENT AND CLEANING

A. Clean adjacent surfaces of concrete hardener resulting from the Work. Use solvent or cleaning agent recommended by the concrete hardener manufacturer. Leave all finished Work in a clean neat appearance.

B. Protect the concrete hardener until fully cured.

++ END OF SECTION ++

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and apply paint systems.
      a. CONTRACTOR is responsible for surface preparation and painting of all new and existing interior and exterior items and surfaces throughout the Project areas included under this and other Sections.
   2. Extent of painting includes the Work specified below. Painting shown in schedules may not provide CONTRACTOR with complete indication of all painting Work. Refer to Article 2.2 of this Section where all surfaces of generic types specified are specified for preparation and painting according to their status, intended function, and location, using the painting system for that surface, function, and location as specified, unless specifically identified on the Drawings as a surface not to receive specified painting system.
      a. All new and specifically identified existing surfaces and items except where the natural finish of the material is specified as a corrosion-resistant material not requiring paint; or is specifically indicated in the Contract Documents as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint them the same as adjacent similar materials or areas.
      b. Mechanical and process items to be painted include:
         1) Piping, pipe hangers, and supports, including electrical conduit.
         2) Tanks.
         3) Motors, mechanical equipment, and supports.
         4) Accessory items.
      c. Surface preparation and painting of all new items, both interior and exterior, and other surfaces, including items furnished by OWNER, are included in the Work, except as otherwise shown or specified.
      d. Approved stepped-down mock-ups for all painting systems showing all components of the surface preparation and paint system application before start of Work. Check all dry film thicknesses; demonstrate methods of surface preparation, and methods of application, and obtain ENGINEER's approval of colors and textures to be used in the Work.

B. Coordination:
   1. Review installation, removal, and demolition procedures under other Sections and coordinate them with the Work specified in this Section.
   2. Coordinate painting of areas that will become inaccessible once equipment, and similar fixed items have been installed.

3. Coordinate primers with finish paint materials to provide primers that are compatible with finish paint materials. Review other Sections where primed surfaces are provided, to ensure compatibility of total painting system for each surface. CONTRACTOR is responsible for coordinating compatibility of all shop primed and field painted items in other Sections and in general contract.
4. Furnish information to ENGINEER on characteristics of finish materials proposed for use and ensure compatibility with prime coats used. Provide barrier coats over incompatible primers or remove and repaint as required. Notify ENGINEER in writing of anticipated problems using specified painting systems with surfaces primed by others. Reprime equipment primed in factory and other factory-primed items that are damaged or scratched.

C. Related Sections:
1. Section 07 92 00, Joint Sealants.
2. Section 43 41 13, Elevated Steel Water Storage Tank.

D. Work Not Included: The following Work is not included as painting Work, or are included under other Sections:
1. Shop Priming: Shop priming of structural metal, miscellaneous metal fabrications, other metal items and fabricated components such as shop-fabricated or factory-painted process equipment, plumbing equipment, heating and ventilating equipment, electrical equipment, and accessories shall conform to applicable requirements of this Section but are included under other Sections or in other contracts.
2. Pre-finished Items:
    a. Items furnished with such finishes as baked-on enamel, porcelain, and polyvinylidene fluoride shall only be touched up at Site by CONTRACTOR using manufacturer's recommended compatible field-applied touchup paint.
    b. Items furnished with finishes such as chrome plating or anodizing.
3. Concealed Surfaces: Non-metallic wall or ceiling surfaces in areas not exposed to view, and generally inaccessible areas, such as furred spaces, pipe chases, duct shafts, and elevator shafts.
4. Concrete surfaces, unless otherwise shown or specified.
5. Concrete floors, unless specifically shown as a surface to be painted.
6. Face brick, glazed structural tile, and prefaced, ground-faced or split-faced concrete unit masonry.
7. Exterior face of architectural precast concrete.
8. Collector bearings, shafts and chains, wood flights, wood stop logs, and wood or fiberglass baffles.
9. Corrosion-Resistant Metal Surfaces: Where the natural oxide of item forms a barrier to corrosion, whether factory- or Site-formed, including such materials as copper, bronze, muntz metal, terne metal, and stainless steel.
10. Operating Parts and Labels:
    a. Do not paint moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sensing devices, interior of motors, and fan shafts.

b. Do not paint over labels required by governing authorities having jurisdiction at Site, or equipment identification, performance rating, nameplates, and nomenclature plates.
c. Cover moving parts and labels during the painting with protective masking. Remove all protective masking upon completion of Work. Remove all paint, coatings, and splatter that comes in contact with such labels.

11. Structural and miscellaneous metals covered with concrete need not receive primers, intermediate, or finish coats of paint.
12. Existing structures, equipment, and other existing surfaces and items unless otherwise shown or specified.

E. Description of Colors and Finishes:
1. Color Selection:
a. A maximum of six different colors will be selected by ENGINEER in addition to color coding of pipelines, valves, equipment, ducts, and electrical conduit.
b. ENGINEER reserves the right to select non-standard colors for paint systems specified within ability of paint manufacturer to produce such non-standard colors. Provide such colors at no additional expense to OWNER.
2. Color Coding of Pipelines, Valves, Equipment, and Ducts:
a. In general, color-coding of pipelines, valves, equipment and ducts shall comply with applicable standards of ANSI A13.1, ANSI Z535.1 and 40 CFR 1910.144. Provide color-coding for pipelines per Table 09 91 00-B, Pipeline Color Table.
b. For equipment on roofs or exposed to view, such as on exterior building facades and in offices and lobbies, color shall be selected by ENGINEER.
3. Color Coding of Pipelines and Equipment:
a. Finish coats of paint for pipelines and equipment shall be coded in basic colors. Colors shall be brilliant, distinctive shades matching the following safety and pipeline colors per ANSI Z535.1, Recommended Standards for Water Works; Recommended Standards for Wastewater Facilities, color specifications for safety colors and other primary colors:

Color	Designation*
Aqua	Aqua Sky: 10GN
Black	Black; 35GR
Blue	True/Safety Blue; 11SF
Brown	Terra Cotta; 07RD
Charcoal	Deep Space; 34GR
Dark Blue	Academy Blue; 35BL
Dark Brown	Medium Bronze; 85BR
Dark Gray	Slate Gray; 31GR
Gray	Gray-ANSI 61; 33GR
Green	Spearmint/Safety Green; 09SF
Light Blue	Fontain Bleau; 25BL
Light Brown	Twine; 68BR
Light Gray	Light Gray; 32GR

Light Green	Margarita; 38 GN
Olive	Clover; 110GN
Orange	Tangerine/Safety Orange; 04SF
Red	Candy Apple/Safety Red; 06SF
White	White; 11WH
Yellow	Lemon/Safety Yellow; 02SF

* Color designations are provided per Tnemec Company, Inc. paint color numbers and are provided as a standard of quality; equivalent colors matching these colors are acceptable. Provide with Shop Drawing submittal direct color comparisons of color numbers available from manufacturer submitted.

b. General Color Code: Unless otherwise specified, use the following color code:

TABLE 09 91 00-B
PIPELINE COLOR TABLE

Pipeline	**Color**
WATER	
Potable Water	Dark Blue
Sump Drains	Gray

c. Color of final coats shall match as closely as possible, without custom blending, color tabulated for specific pipeline service.

4. After approval by ENGINEER of colors and Shop Drawings and prior to commencing painting Work, ENGINEER will furnish color schedules for surfaces to be painted.

F. Abbreviations and Symbols:
1. Abbreviations and symbols used in painting systems are explained in Article 2.2 of this Section and provide information on generic composition of required materials, manufacturers, number of coats and dry mil film thickness per coat (DMFTPC), and coverage for determining required number of gallons for the Work.

1.2 REFERENCES

A. Referenced Standards: Standards referenced in this Section are:
1. ANSI A13.1, Scheme for Identification of Piping Systems.
2. ANSI Z535.1, Safety Color Code.
3. ANSI/NSF Standard 60, Drinking Water Treatment Chemicals - Health Effects.
4. ANSI/NSF Standard 61, Drinking Water System Components – Health Effects.
5. ASTM D16, Terminology for Paint, Related Coatings, Materials and Applications.
6. ASTM D2200, Pictoral Surface Preparation Standards for Painting Steel Surfaces.
7. ASTM D4258, Practice for Surface Cleaning Concrete for Coating.
8. ASTM D4259, Practice for Abrading Concrete.
9. ASTM D4262, Testing Method for pH of Chemically Cleaned or Etched Concrete Surfaces.

10. ASTM D4263, Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
11. ASTM D4285, Test Method for Indicating Oil or Water in Compressed Air.
12. ASTM D4417, Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.
13. ASTM D4541, Test Methods for Pull-Off Strength of Coatings Using Portable Adhesion-Testers.
14. ASTM E329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
15. AWWA C652, Disinfection of Water-Storage Facilities.
16. AWWA D102, Coating Steel Water-Storage Tanks.
17. California Air Resources Board (CARB) Revised Suggested Control Measure (SCM).
18. 29 CFR 1910.144, Safety Color Code for Marking Physical Hazards.
19. 40 CFR, Subpart D-2001, National Volatile Organic Compound Emission Standards for Architectural Coatings.
20 South Coast Air Quality Management District (SCAQMD) Rule 1113.
21. Green Seal, Inc. Paint, (GS-11).
22. Maricopa County, Arizona Architectural Coatings Rule 335.
23. National Association of Piping Fabricators, NAPF 500-03, Surface Preparation Standard For Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings And/or Special Internal Linings.
24. Ozone Transport Commission, (OTC), OTC Model Rule for Architectural and Industrial Maintenance Coatings.
25. Resource Conservation and Recovery Act of 1976 (RCRA).
26. SSPC PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
27. SSPC SP 1, Solvent Cleaning.
28. SSPC SP 3, Power Tool Cleaning.
29. SSPC SP 6, Commercial Blast Cleaning.
30. SSPC SP 10, Near-White Blast Cleaning.
31. SSPC SP 11, Power Tool Cleaning To Bare Metal.
32. SSPC VIS 1, Visual Standard for Abrasive Blast Cleaned Steel.
33. SSPC VIS 2, Method of Evaluating Degree of Rusting/Painted Steel Surfaces.
34. SSPC Volume 2, Systems and Specifications.

1.3 DEFINITIONS

A. Standard coating terms defined in ASTM D16 apply to this Section, including:
   1. Paint: Pretreatment and all painting system materials, such as primer, emulsion, enamel, organic/inorganic polymer coating, stain sealer and filler, and other applied materials whether used as prime, filler, intermediate, or finish coats.
   2. Exposed: All items not covered with cement plaster, concrete, or fireproofing. Items covered with these materials shall be provided with specified primer only, except where specified as a surface not to be painted. Exposed-to-view surfaces include areas visible after permanent or built-in fixtures, convector covers, ceiling

tile, covers for finned tube radiation, grilles, and similar covering products are in areas scheduled to be painted.

3. Low VOC: All interior and exterior field-applied coatings that have maximum VOC content as listed in OTC Model Rule for Architectural and Industrial Maintenance Coatings.
4. OTC: Ozone Transport Commission, which recommends standard VOC content levels in several Northeastern and Mid-Atlantic states.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Engage a single applicator that regularly performs installation of paint materials, with documented skill and successful experience in installing types of products required and that agrees to employ only trained, skilled tradesmen who have successful experience in installing types of products specified.
   2. Submit name and qualifications to ENGINEER along with following information for at least three successful, completed projects:
      a. Names and telephone numbers of owner and design professional responsible for project.
      b. Approximate contract cost of paint products.
      c. Amount of area painted.
   3. Submit to ENGINEER proof of acceptability of applicator by manufacturer.

B. Testing Agency Qualifications: Provide an independent testing agency for testing specified in this Section. Testing agency shall be selected by OWNER and paid for by CONTRACTOR. When requested, submit documentation demonstrating to satisfaction of ENGINEER, that testing agency has experience and capability to satisfactorily conduct testing required without delaying the Work, in accordance with ASTM E329.

C. Source Quality Control:
   1. Obtain materials from manufacturers that will provide services of a qualified manufacturer's representative at Site at commencement of painting Work, to advise on products, mock-ups, installation, and finishing techniques and, at completion of Work, to advise ENGINEER on acceptability of completed Work and during the course of the Work as may be requested by ENGINEER.
   2. Certify long-term compatibility of all coatings with surfaces.
   3. Do not submit products that decrease number of coats, surface preparation, or generic type and formulation of coatings specified. Products exceeding VOC limits and chemical content specified will not be approved.
   4. ENGINEER may review manufacturers' recommendations concerning methods of installation and number of coats of paint for each painting system. CONTRACTOR shall prepare construction costs based on painting systems, number of coats, coverage's and installation methods specified.
   5. Submit "or equal" products, when proposed, with direct comparison to products specified, including information on durability, adhesion, color and gloss retention, percent solids, VOC's grams per liter, and recoatability after curing.

6. "Or equal" manufacturers shall furnish same color selection as manufacturers specified, including intense chroma and custom pigmented colors in all painting systems.
7. Color Pigments: Provide pure, non-fading, applicable types to suit surfaces and services to be painted. Comply with:
    a. Lead and Chromate: Lead and chromate content shall not exceed amount permitted by authorities having jurisdiction.
    b. Areas subject to hydrogen sulfide fume exposure will be identified by ENGINEER. Through CONTRACTOR, paint manufacturer shall notify ENGINEER of colors that are not suitable for long-term color retention in such areas.
    c. Manufacturer shall identify colors that meet the requirements of authorities having jurisdiction at Site for use in locations subject to contact with potable water or water being prepared for use as potable water.
    d. Comply with paint manufacturer's recommendations on preventing coating contact with levels of carbon dioxide and carbon monoxide that may cause yellowing during application and initial stages of curing of paint.
8. Obtain each product from one manufacturer. Multiple manufacturing sources for the same system component are unacceptable.
9. Certify product shelf life history for each product source for materials manufactured by the same manufacturer, but purchased and stored at different locations or obtained from different sources.
10. Constantly store materials to be used for painting Work between 60 degrees F and 90 degrees F, and per paint manufacturer's written recommendations, for not more than six months. Certify to ENGINEER that painting materials have been manufactured within six months of installation and have not, nor will be, subjected to freezing temperatures.

D. Regulatory Requirements:
1. Painting systems for surfaces in contact with potable water, or water being treated for potable use, shall not impart any taste or odor to the water or result in any organic or inorganic content in excess of the maximum allowable contaminant level established by authorities having jurisdiction at Site. Such painting systems shall be approved by the regulatory agency. Revise painting systems specified herein to provide manufacturer's regulatory agency approved painting system(s) where required.
2. Comply with VOC content limits of OTC Model Rule for Architectural and Industrial Maintenance Coatings:
    a. Industrial Maintenance Coatings: 340 grams per liter.
    b. Interior and Exterior Non-Flat Coatings: 150 grams per liter.
3. Comply with the following:
    a. 29 CFR 1910.144, Safety Color Code for Marking Physical Hazards.
    b. 40 CFR, Subpart D-2001, National Volatile Organic Compound Emission Standards for Architectural Coatings.
    c. Resource Conservation and Recovery Act of 1976 (RCRA).
    d. SW-846, Toxic Characteristic Leaching Procedure (TCLP).

4. Comply with authorities having jurisdiction at Site for blast cleaning, confined space entry, and disposition of spent abrasive and debris.

E. Mock-ups:
   1. Demonstrate installation of specified painting systems on actual wall surfaces and building components at locations selected by ENGINEER.
   2. Provide 4-foot by 8-foot stepped-down sample area for each painting system. Prior to application of painting system, but after ENGINEER's approval of the components of each painting system, apply a 4-foot wide sample of each operation and application step required by this Section and specified manufacturer's written application recommendations. Show each application step as a 2-foot long section that shall remain exposed to demonstrate work performed in that step. Continue application procedures until topcoat is provided. Topcoat shall be a minimum of two feet long. When completed, finished mock-up for each paint system shall reveal each step and each coat of paint required for paint system with 2-foot wide strips revealing Work performed to prepare surface and apply each coat. Lengthen overall mock-up as required to completely demonstrate each painting system. Use tinted shades differing from coat to coat for each component of each painting system.
   3. ENGINEER may approve or disapprove each component of each painting system on an individual component basis.
   4. Painting Work that does not meet standard approved on sample areas shall be removed and replaced.
   5. Painting Work advanced without approved mock-ups shall stop, and mock-ups prepared for approval by ENGINEER.

F. Pre-painting Conference:
   1. Prior to installing painting systems, arrange a meeting at Site with painting applicator and its foreman, paint manufacturer's technical representative, installers of other work in and around painting that must follow painting Work, ENGINEER, and other representatives directly concerned with performance of painting Work. Record discussions of conference and decisions and agreements and disagreements and furnish a copy of record to each party attending. Review foreseeable methods and procedures relating to painting Work including:
      a. Review Project requirements including Contract Documents, approved Shop Drawings, pending and approved Change Orders, requests for information that submitted by CONTRACTOR to ENGINEER, and other pertinent documents.
      b. Review required samples and submittals, both completed and to be completed.
      c. Review status of surfaces including drying, surface preparations, and similar considerations.
      d. Review availability of materials, tradesmen, equipment, and facilities required for progress, to avoid delays, and to protect Work from damage.
      e. Review required inspection, testing, certifying, and quality control procedures.
      f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions. Supplemental heating sources required to for

working in low-temperature conditions, shall be operating and acceptable to paint applicator and ENGINEER.

g. Review methods for complying with regulations of authorities having jurisdiction at Site, such as compliance with environmental protection, health, safety, fire, and similar regulations.

h. Review laws and procedures covering removal and disposal of blast debris.

2. Reconvene meeting at earliest opportunity if additional information must be developed to conclude the required topics of the meeting.

3. Record revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:

1. Product Data:

a. Copies of manufacturer's technical information and test performance data, including paint analysis, VOC and chemical component content in comparison to maximum allowed by the Contract Documents, and application instructions for each product proposed for use.

b. Submit proof of acceptability of proposed application techniques by paint manufacturer selected.

c. Copies of CONTRACTOR's proposed protection procedures in each area of the Work explaining methods of protecting adjacent surfaces from splatter, for confining application procedures in a manner that allows other work adjacent to surface preparation and painting Work to proceed safely and without interruption, and for maintaining acceptable application, curing, and environmental conditions during and after painting systems application.

d. List each material and cross-reference to the specific painting system and application, including a list of site-specific surfaces to which painting system will be applied. Identify by manufacturer's catalog number and general classification. State number of gallons of each product being purchased for delivery to Site and square foot area calculated to be covered by each painting system specified based on theoretical loss of 20 percent. Where actual area to be covered by paint system exceeds area submitted to ENGINEER for that system, proof of additional material purchase shall be provided to ENGINEER. Calculated coverage shall be as specified for each component of each painting system specified. This requirement does not take precedence over CONTRACTOR's responsibility to provide dry film thickness required for each component of each painting system.

e. Identify maximum exposure times allowable for each paint system component before next coat of paint can be applied. Submit proposed methods for preparing surfaces for subsequent coats if maximum exposure times are exceeded.

f. Information on curing times and environmental conditions that affect curing time of each paint system component and proposed methods for

accommodating variations in curing time. Identify this information for each painting system in the Work.

g. Specification for spray equipment with cross-reference to paint manufacturer's recommended equipment requirements.

2. Samples:
   a. Copies of manufacturer's complete color charts for each coating system.
   b. Mock-ups specified for the Site.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Certificate from paint manufacturer stating that materials meet or exceed Contract Documents requirements.
      b. Evidence of shelf life history for all products verifying compliance with the requirements of the Contract Documents.
      c. CONTRACTOR shall provide notarized statement verifying that all painting systems are compatible with surfaces specified. All painting systems components shall be reviewed by an authorized technical representative of paint manufacturer for use as a compatible system. Verify that all painting systems are acceptable for exposures specified and that paint manufacturer is in agreement that selected systems are proper, compatible, and are not in conflict with paint manufacturer's recommended specifications. Show by copy of transmittal form that a copy of letter has been transmitted to paint applicator.
   2. Test Reports:
      a. Certified laboratory test reports for required performance and analysis testing in compliance with ASTM E329.
      b. Adhesion testing plan and procedures.
      c. Results of adhesion testing on existing surfaces containing paints or other coatings to be topcoated with paint systems specified. Prior to adhesion testing, submit a testing plan establishing methods, procedures and number of tests in each area where existing coatings are to remain and become substrate for painting Work. Based on results of adhesion testing, recommend methods, procedures, and painting system modifications, if necessary, for proceeding with Work.
      d. Locations of and test methods for soil sampling before beginning Work and after Substantial Completion.
      e. Proposed methods for testing, handling, and disposal of waste generated during Work.
      f. Results of alkalinity and moisture content tests performed in accordance with ASTM D4262 and ASTM D4263.
      g. Results of tests of film thickness, holidays, and imperfections.
   3. Manufacturer's Instructions: Provide paint manufacturer's storage, handling, and application instructions prior to commencing painting Work at Site.
   4. Manufacturer's Site Reports: Provide report of paint manufacturer's representative for each visit to Site by paint manufacturer's representative.

5. Special Procedure Submittals:
    a. Proposed protection procedures for each area of Work, explaining methods of protecting adjacent surfaces from splatter, for confining application procedures in a manner that allows other work adjacent to surface preparation and painting Work to proceed safely and without interruption.
    b. Site-specific health and safety plan.
    c. Procedures for maintaining acceptable application, curing and environmental conditions during and after painting systems application.
    d. Procedures for providing adequate lighting, ventilation, and personal protection equipment relative to painting Work.
6. Qualifications:
    a. Applicator.
    b. Testing laboratory

C. Closeout Submittals: Submit the following:
1. Operations and Maintenance Data: Upon completion of the painting Work, furnish ENGINEER five copies of detailed maintenance manual including the following information:
    a. Complete and updated product catalog of paint manufacturer's currently available products including complete technical information on each product. Identify product names and numbers of each product used in the painting Work.
    b. Name, address, e-mail address and telephone number of manufacturer, local distributor, applicator and technical representative.
    c. Detailed procedures for routine maintenance and cleaning.
    d. Detailed procedures for light repairs such as dents, scratches and staining.
2. Record Documentation: Statement of Application: Upon completion of the painting Work, submit a notarized statement to ENGINEER signed by CONTRACTOR and painting applicator stating that Work complies with requirements of the Contract Documents and that application methods, equipment, and environmental conditions were proper and adequate for conditions of installation and use.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Product Delivery Requirements: Deliver products to Site in original, new, and unopened packages and containers, accurately and legibly and accurately labeled with the following:
1. Container contents, including name and generic description of product.
2. Manufacturer's stock number and date of manufacture.
3. Manufacturer's name.
4. Contents by volume, for major pigment and vehicle constituents.
5. Grams per liter of volatile organic compounds.
6. Thinning instructions, where recommended.
7. Application instructions.
8. Color name and number.

B. Product Storage Requirements:
   1. Store acceptable materials at Site.
   2. Store in an environmentally controlled location as recommended in paint manufacturer's written product information. Keep area clean and accessible. Prevent freezing of products.
   3. Store products that are not in actual use in tightly covered containers.
   4. Comply with health and fire regulations of authorities having jurisdiction at Site.

C. Product Handling Requirements:
   1. Handle products in a manner that minimizes the potential for contamination, or incorrect product catalyzation.
   2. Do not open containers or mix components until necessary preparatory work has been completed and approved by ENGINEER and painting Work will start immediately.
   3. Maintain containers used in storing, mixing, and applying paint in a clean condition, free of foreign materials and residue.

1.7 SITE CONDITIONS

A. Site Facilities:
   1. Supplemental heat sources, as required to maintain both ambient and surface temperatures within range recommended by paint manufacturer for paint system application, are not available at Site.
   2. Provision of supplemental heat energy sources, power, equipment, and operating, maintenance and temperature monitoring personnel is responsibility of CONTRACTOR.
   3. Do not use heat sources that emit carbon dioxide or carbon monoxide into areas being painted. Properly locate and vent such heat sources to exterior such that paint systems are unaffected by exhaust.

B. Existing Conditions:
   1. Existing surfaces to receive painting Work shall be surface-prepared to meet requirements of painting systems specified. Prior to commencing painting Work, perform adhesion tests on existing surfaces to be painted. Perform testing per ASTM D4541 or other method acceptable to ENGINEER. Number and location of tests shall be sufficient to determine condition of existing coatings and suitability of existing coatings to remain to provide acceptable substrate for new coatings. Submit testing plan prior to testing and provide ENGINEER a copy of adhesion test results.
   2. Provide abrasive blasting, scraping, or other abrading or surface film removal, or preparatory techniques accepted by ENGINEER.
   3. Before commencing painting in an area, surfaces to be painted and floors shall be cleaned of dust using commercial vacuum cleaning equipment equipped with high-efficiency particulate air (HEPA(filters and dust containment systems.

C. Environmental Requirements:
   1. Apply water-base paints when the temperature of surfaces to be painted and ambient air temperatures are between 55 degrees F and 90 degrees F, unless otherwise permitted by paint manufacturer's published instructions.
   2. Surfaces to be painted shall be at least 5 degrees F above dew point temperature and be dry to the touch. Apply paint only when temperature of surfaces to be painted, paint products, and ambient air temperatures are between 65 degrees F and 95 degrees F, unless otherwise permitted by paint manufacturer's published instructions.
   3. Apply paint system within shortest possible time consistent with manufacturer's recommended curing instructions for each coat. If chemical, salt, or other contamination contacts paint film between coats, remove contamination per SSPC SP 1 and restore surface before applying paint.
   4. Do not paint tanks or pipelines containing fluid without specific permission of ENGINEER and only under conditions where "sweating" of outside surface of vessel being painted is not likely to occur within 24 hours of paint application.
   5. Do not apply epoxy paints if ambient temperature is expected to go below 50 degrees F within twelve hours of application. Follow manufacturer's instructions when manufacturer's published recommendations require a higher minimum ambient temperature.
   6. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent. Do not apply paint to damp or wet surfaces or when surfaces will reach dew point due to falling or rising temperatures and humidity conditions during course of paint application, unless otherwise permitted by paint manufacturer's published instructions.
   7. Do not paint unacceptably hot or cold surfaces until such surfaces can be maintained within temperature and dew point ranges acceptable to paint manufacturer. Arrange for surfaces to be brought within acceptable temperature and dew point ranges as part of painting Work.
   8. Moisture content of surfaces shall be verified to ENGINEER as acceptable prior to commencement of painting using methods recommended by paint manufacturer.
   9. Painting may be continued during inclement weather only if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer for application and drying.
   10. Provide adequate illumination and ventilation where painting operations are in progress.

D. Protection:
   1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently, or not to be painted.
   2. During surface preparation and painting, facility shall remain in operation. Use procedures that prevent contamination of process or cause or require facility shutdown.
   3. Coordinate and schedule surface preparation and painting to avoid exposing personnel to hazards associated with painting Work. Provide required personnel safety equipment per requirements of authorities having jurisdiction at Site.

4. Submit protection procedures to be employed. Do not begin surface preparation and painting Work until ENGINEER accepts protection techniques proposed by CONTRACTOR.
5. When working with flammable materials, provide fire extinguishers and post temporary signs warning against smoking and open flame.

E. Testing:
1. Obtain and test eight soil samples from each Site, at locations within twenty feet of the tank and spaced equally around tank circumference. Four samples shall be taken and analyzed at Substantial Completion is achieved and all surface preparation and paint application operations are completed.
2. Test at a laboratory residue from sand blasting to determine whether blast residue can be landfilled as required by disposal facility.
3. Test at a laboratory sediment in tank prior to disposing of sediment to determine suitability of sediment for landfilling. Test for TCLP and RCRA characteristics. Perform additional tests as required by disposal facility.
4. Perform additional testing of waste materials and existing paint required under Federal, state, or local regulations not specifically addressed in this Section.

1.8 MAINTENANCE

A. Extra Materials: Furnish, tag, and store an additional one percent by volume of all coatings and colors installed. Provide a minimum of one gallon of each coating and color. Store in unopened containers as specified until turned over to OWNER.

PART 2 - PRODUCTS

2.1 PAINTING SYSTEM MANUFACTURERS

A. Products and Manufacturers: Where referenced under painting systems provide products manufactured by the following:
1. Tnemec Company, Inc. (TCI).
2. The Carboline Company, part of StonCor Group, an RMP Company (TCC).
3. Sherwin-Williams Company (SWC).
4. Benjamin Moore & Company (BMC).
5. Righter Group Inc. (RGI).
6. Duron Inc. (DI).

2.2 PAINTING SYSTEMS

Surface/ Exposure	Surf. Prep.	Primer/Surfacer System Type % Solids	(Coats) DFT (Mils) Max VOC g/l (EPA)	Intermediate System Type % Solids	(Coats) DFT (Mils) Max VOC g/l (EPA)	Finish System Type % Solids	(Coats) DFT (Mils) Max VOC g/l (EPA)
Ferrous Metals, Structural Steel, Exterior Surfaces of Valves, Pumps, and Piping, Doors							
TABLE 09 91 00-A							
Low VOC Content; Non-Submerged; Interior	1.5.A.2. 3.2.A. 3.2.C.1. 3.2.C2.	-Series L69 Epoxoline II (TCI) -Carboguard 890 (TCC) Epoxy 66%	(1) 2-10 234	Field Primer & Touch Up -Series V69 Epoxoline II (TCI) -Carboguard 954 HB (TCC) Epoxy 69%	(1) 2-10 228	-Series V69 Epoxoline II (TCI) -Carboguard 954 HB (TCC) Epoxy 69%	(1) 2-10 H (1) 4-6 V 228
Ferrous Metals Interior Surfaces of Potable Water Storage Reservoirs							
TABLE 09 91 00-B							
Submerged, Interior of Water Storage Tank, Exterior Surfaces of Piping Inside the Water Storage Tank	1.5.A.2. 3.2.A. 3.2.C.1. 3.2.C2. 3.2.D. 3.2.E.	[1.] -Series V140F Pota-Pox Plus (TCI) -Carboguard 891 (TCC) Epoxy 68%	(1) 5-10 221			[2.] -Series V140F Pota-Pox Plus (TCI) -Carboguard 891 (TCC) Epoxy 68%	(2) 5-10 221

1. At Ambient Temperatures of Greater Than 400,000 Gallon Capacity, Galvanized Metals and Non-ferrous metals, Exterior Surfaces of Piping; Non-Submerged and Intermittently Submerged, up to 4 feet above liquid level, ANSI/NSF Standard 61; Moderate VOC Content; Interior

2. To comply with ANSI/NSF 61 forced-cure requirements, CONTRACTOR shall provide surface temperatures of 75 degree F for 24 hours after applying prime coat.
3. To comply with ANSI/NSF 61 forced-cure requirements, CONTRACTOR shall immediately raise temperature of surface to 75 degree F for a minimum of two hours and for a maximum of four hours followed by increasing temperature of substrate to 150 degree F for 24 hours followed by 24 hours at temperature of 75 degree F after application of finish coat.

Ferrous Metals, Non-Ferrous Metals; Galvanized Metals, Including Water Storage Tanks							
TABLE 09 91 00-C							
Non-Submerged; Low VOC Content; Gloss; Exterior	1.5.A.2. 3.2.A. 3.2.C.1. 3.2.C2. 3.2.E.	Galvanized and Non-Ferrous Metal Primer -Series V69 Epoxoline II (TCI) -Carboguard 890 (TCC) Epoxy 67%	(1) 4-6 250	Ferrous Metal Touch Up Low Temperature - Series V69F Epoxoline II (TCI) -Carboguard 890 LT (TCC) Epoxy 69% Ferrous Metal Touch Up Warm Temperature - Series V69F Epoxoline II (TCI) -Carboguard 890 (TCC) Epoxy 69%	(1) 4-6 228 (1) 4-6 228	-Series 1075 Endura-Shield (TCI) -Carbothane 134 VOC (TCC) Polyureathane 70%	(2) 2-5 220

TABLE 09 91 00-D							
Aluminum in Contact With Dissimilar Materials; Interior and Exterior.	1.5.A.2. 3.2.A. 3.2.D.	-Series 22 Pota-Pox 100 (TCI) -Carboguard 954 HB (TCC) Epoxy 100%	(1) 12-16			-Series 22 Pota-Pox 100 (TCI) -Carboguard 954 HB (TCC) Epoxy 100%	(1) 12-16

			10				10

2.3 CALKING AND SEALANTS

A. Refer to Section 07 92 00, Joint Sealants.

2.4 INSTRUMENTS

A. Instruments:
   1. Provide one new dry-film thickness gauge for checking film thickness, one holiday detector to detect holidays or holes in the coating, and one set of visual standards to check surface preparation. Calibrate dry film thickness gauge at Site using Bureau of Standards standard shim blocks.
   2. Products and Manufacturers: Provide the following:
      a. Film Thickness Testers: Model FM-III manufactured by Mikrotest, or equal.
      b. Holiday detector shall be Model M-1 as manufactured by Tinker & Rasor, or equal.
      c. Visual Standards: ASTM D2200, Swedish Standards, SSPC VIS 1.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which painting Work is to be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film capable of performing in accordance with claims made in paint manufacturer's product literature for surfaces and conditions encountered.

C. Do not paint over existing paint where there is no assurance that existing paint will provide an acceptable surface for long-term adherence and durability of painting systems specified or where paint manufacturer requires removal of all existing paint to recommend use of specified painting system.

3.2 SURFACE PREPARATION

A. General:
   1. Test for moisture content of surfaces before commencement of painting Work. Test for moisture in concrete in compliance with ASTM D4263. Report results to ENGINEER before commencing Work.

2. Prepare existing surfaces to be painted as specified for new surfaces. Submit substitute methods of preparing existing surfaces, when proposed, with Shop Drawing submittal. ENGINEER's acceptance of substitute surface preparation methods does not relieve CONTRACTOR of performance required under the Contract Documents. To provide surfaces acceptable for application of painting system specified:
    a. Clean and roughen surfaces of existing paint and other decorative or protective toppings on surfaces to remain that are to receive a painting system under this Section.
    b. Where existing surfaces to be painted have corrosion, peeling paint, or unacceptably adhering coatings, remove all topcoats, primers, and intermediate coats of paint, and other protective or decorative coatings.
3. Perform preparation and cleaning procedures as specified herein and in strict accordance with paint manufacturer's approved instructions for each surface and atmospheric condition.
4. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items already in place that do not require field painting, or provide effective surface-applied protection prior to surface preparation and painting.
5. Remove as necessary items that must be field-painted where adjacent surfaces cannot be completely protected from splatter or overspray. Following completion of painting of each space or area, the removed items shall be reinstalled by workers skilled in the trades involved.
6. Clean surfaces to be painted before applying painting system components. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning.
7. Prepare surfaces that were improperly shop-painted and abraded or rusted shop-painted surfaces as specified.

B. Ferrous Metals:
    1. Ferrous Metals Except Ductile and Cast Iron:
        a. Comply with paint manufacturer's recommendations for type and size of abrasive to provide a surface profile that meets manufacturer's painting system requirements for type, function, and location of surface. Verify that paint manufacturer-recommended profiles have been achieved on prepared surfaces. Report profiles to ENGINEER using Test Method C of ASTM D4417.
        b. Clean non-submerged ferrous surfaces including structural steel and miscellaneous metal to be shop-primed, of all oil, grease, dirt, mill scale, and other contamination by commercial blast cleaning complying with SSPC SP 6 at time of paint system application, using SSPC VIS 1 as a standard of comparison.
        c. Clean submerged ferrous surfaces including structural steel and miscellaneous metal to be shop-primed of all oil, grease, dirt, mill scale, and other contamination by near-white blasting complying with

SSPC SP 10 at time of painting system application, using SSPC VIS 1 as a standard of comparison.

d. Clean non-submerged, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale, and other contamination by commercial blasting complying with SSPC SP 6 at the time of painting system application, using SSPC VIS 1 as a standard of comparison.
e. Clean submerged ferrous surfaces that have not been shop-coated or that have been improperly shop-coated of all oil, grease, dirt, mill scale, and other contamination by near-white blasting complying with SSPC SP 10 at time of painting system application, using SSPC VIS 1 as a standard of comparison.
f. Touch-up shop-applied prime coats that have damaged or have bare areas with primer recommended by paint manufacturer after commercial blasting complying with SSPC SP 6 at the time of painting system application, using SSPC VIS 1 as a standard of comparison, to provide a surface profile of not less than one mil.
g. Power tool-clean per SSPC SP 3 to remove welding splatter and slag.
h. Remove all rust and contamination on existing ferrous metals to sound surfaces by power tool-cleaning complying with SSPC SP 11 to provide a surface profile of not less than one mil.
i. Cleaning: Clean tank to remove sediment and coarse debris, including aluminum or magnesium anode rods, from tank floor and other horizontal surfaces. Sediment and debris shall be removed and disposed of in accordance with local, state, and federal regulations.

2. Ductile and Cast Iron:
   a. Comply with paint manufacturer's recommendations and NAPF 500-03 for type and size of abrasive to provide a surface profile meeting paint manufacturer's requirements for type, function and location of surface. Verify that paint manufacturer-recommended profiles are achieved on prepared surfaces.
   b. Clean submerged and non-submerged ductile and cast iron surfaces to be shop-primed of all oil, grease, dirt, mill scale, and other contamination by solvent cleaning and abrasive blasting complying with NAPF 500-03-01, NAPF 500-03-04, and NAPF 500-03-05 at time of paint system application.
   c. Clean submerged ductile and cast iron that have not been shop-coated or that have been improperly shop-coated of all oil, grease, dirt, mill scale, and other contamination by solvent cleaning and abrasive blasting complying with NAPF 500-03-01, NAPF 500-03-04, and NAPF 500-03-05 at time of paint system application.
   d. Touch-up shop-applied prime coats that are damaged or have bare areas with primer recommended by paint manufacturer, after power tooling complying with NAPF 500-03 at the time of painting system application.
   e. Remove all contamination on existing ductile and cast iron to sound surfaces by power tool cleaning complying with NAPF 500-03-03.

C. Non-Ferrous Metal Surfaces: Prepare non-ferrous metal surfaces for painting by light whip blasting or by lightly sanding with 60- to 80-mesh sandpaper.

D. Galvanized (Zinc-Coated) Surfaces: Prepare galvanized surfaces for painting by lightly sanding with 60- to 80-mesh sandpaper or by light whip blasting.

3.3 PROTECTION OF PROPERTY AND STRUCTURES

A. Protect property and structures adjacent to the Work from waste residues resulting from cleaning, surface preparation and paint application.

B. Use shrouding, vacuum blasting, or other approved methods for cleaning and surface preparation of exterior surfaces.

C. During blast cleaning and surface preparation of interior and exterior surfaces, control discharge of dust and grit, using shrouding, negative-pressure containment/dust collection systems, or other means to protect adjacent property and structures and prevent dust/grit from escaping. Similarly control removal and temporary storage of residues to protect adjacent property and structures.

D. For painting of exterior surfaces, use rollers, shrouding or other approved methods as required to protect adjacent property and structures from wind-blown paint residues.

E. Submit proposed procedures for cleaning, surface preparation and paint application describing methods for protecting adjacent property and structures from residues. Do not proceed with cleaning, surface preparation or painting until proposed procedures are approved by ENGINEER.

3.4 MATERIALS PREPARATION

A. General:
   1. Mix and prepare paint products in strict accordance with paint manufacturer's product literature.
   2. Do not mix painting materials produced by different manufacturers, unless otherwise permitted by paint manufacturer's instructions.
   3. Where thinners are required, they shall be produced by paint system manufacturer unless otherwise permitted by paint manufacturer's product literature and submitted to and accepted by ENGINEER with Shop Drawings.

B. Tinting:
   1. Where multiple coats of the same material are to be provided, tint each undercoat a lighter shade to facilitate identification of each coat of paint.

2. Tint undercoats to match color of finish coat of paint, but provide sufficient difference in shade of undercoats to distinguish each separate coat. Provide a code number to identify material tinted by manufacturer.

C. Mixing:
   1. For products requiring constant agitation, use methods in compliance with manufacturer's product literature to prevent settling during paint application.
   2. Mix in containers placed in suitably sized non-ferrous or oxide resistant metal pans to protect floors from slashes or spills that could stain the floor or react with subsequent finish floor material.
   3. Mix and apply paint in containers bearing accurate product name of material being mixed or applied.
   4. Stir products before application to produce a mixture of uniform density and as required during the application. Do not stir into the product film that forms on surface; instead, remove film and, if necessary, strain product before using.
   5. Strain products requiring such mixing procedures. After adjusting mixer speed to break up lumps and after components are thoroughly blended, strain through 35 to 50-mesh screen before application.

3.5 APPLICATION

A. General:
   1. Apply paint systems by brush, roller, or airless spray per manufacturer's recommendations and in compliance with Paint Application Specifications No. 1 in SSPC Volume 2, where applicable. Use brushes best suited for type of paint applied. Use rollers of carpet, velvet back, or high pile sheeps wool as recommended by paint manufacturer for product and texture required. Use air spray and airless spray equipment recommended by paint manufacturer for specific painting systems specified. Submit a list of application methods proposed, listing paint systems and location.
   2. Paint dry film thicknesses required are the same regardless of the application method. Do not apply succeeding coats until previous coat has completely dried.
   3. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is uniform finish, color, and appearance, particularly for intense chroma primary colors. Ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a film thickness equivalent to that of flat surfaces.
   4. Surfaces of items not normally exposed-to-view do not require the same color as other components of system of which they are part, but require the same painting system specified for exposed surfaces of system.
   5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint before final installation of registers or grilles.

6. Paint backs of access panels and removable or hinged covers to match exposed surfaces.
7. Paint aluminum parts in contact with dissimilar materials with specified paint system.
8. Paint tops, bottoms, and side edges of doors the same as exterior surfaces.
9. Omit field-applied primer on metal surfaces that have been primed in the shop. Touch-up paint shop-primed coats and pre-finished items only when approved by ENGINEER using compatible primers and manufacturer's recommended compatible field-applied finishes.
10. Welds shall be stripe-coated with intermediate or finish coat of paint after application of prime coat.
11. Paint steel water storage tanks per AWWA D102.

B. Minimum/Maximum Paint Film Thickness:
1. Apply each product at not less than, nor more than, manufacturer's recommended spreading rate, and provide total dry film thickness as specified.
2. Apply additional coats of paint if required to obtain specified total dry film thickness.
3. Maximum dry film thickness shall not exceed 100 percent of minimum dry film thickness, except where more stringent limitations are recommended by paint manufacturer for a specific product.

C. Scheduling Surface Preparation and Painting:
1. As soon as practical after preparation, apply first-coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting. Apply first-coat material before subsequent surface deterioration due to atmospheric conditions existing at time of surface preparation and painting. Surfaces that have started to rust before first-coat application is complete shall be brought back to required standard by abrasive blasting.
2. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and application of another coat of paint does not cause lifting or loss of adhesion to undercoat.
3. Scarify primers and other painting system components by brush-blasting if paint has been exposed for lengths of time or under conditions beyond manufacturer's written recommendations for painting systems required, intended use, or method of application proposed for subsequent coats of paint.
4. Schedule cleaning and painting so that dust and other contaminants from cleaning process do not fall on wet, newly painted surfaces.

D. Prime Coats: Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects caused by insufficient sealing.

E. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage.

F. Brush Application:
   1. Brush out and work all brush coats onto surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections are unacceptable. Neatly draw all glass and color break lines.
   2. Brush-apply primer or first coats, unless otherwise permitted to use mechanical applicators.

G. Mechanical Applicators:
   1. Use mechanical methods for paint application when permitted by governing ordinances, manufacturer, and approved by ENGINEER.
   2. Limit roller applications, if approved by ENGINEER, to interior wall finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.
   3. Where spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double back with spray equipment for purpose of building up film thickness of multiple coats in one pass.

H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint Work not in compliance with specified requirements as required by ENGINEER.

3.6 FIELD QUALITY CONTROL

A. ENGINEER may invoke the following material testing procedure at any time for a maximum of five times during field painting Work:
   1. CONTRACTOR shall engage service of an independent testing laboratory to sample paints used, as designated by ENGINEER. Samples of products delivered to Site shall be obtained, identified, sealed, and certified as to being products actually applied to surfaces in each area, in presence of CONTRACTOR.
   2. A testing laboratory selected by OWNER and paid for by CONTRACTOR shall perform appropriate tests for any or all of the following:
      a. Abrasion resistance.
      b. Apparent reflectivity.
      c. Flexibility.
      d. Washability.
      e. Absorption.
      f. Accelerated weathering.
      g. Dry opacity.
      h. Accelerated yellowness.
      i. Recoating.
      j. Skinning.

k. Color retention.
l. Alkali resistance.
m. Quantitative materials analysis.

3. If test results show that products being used do not comply with specified requirements, CONTRACTOR may be directed to stop painting Work and remove non-complying paint, and shall prepare and repaint surfaces coated with rejected paint with material complying with the Contract Documents.

B. Notify ENGINEER after completing each coat of paint. After inspection and checking of film thickness, holidays, and imperfections, and after acceptance by ENGINEER, proceed with succeeding coat. Perform testing using testing instruments specified in Article 2.4 of this Section.

1. ENGINEER will witness all testing and shall be notified of scheduled testing at least twenty-four hours in advance.
2. Apply additional coats, if required, to produce specified film thickness and to correct holidays and to completely fill all surface air holes.

C. For magnetic substrates, measure thickness of dry film nonmagnetic coatings following recommendations of SSPC PA-2. These procedures supplement manufacturers' approved instructions for manual operation of measurement gauges and do not replace such instructions.

D. Record time, location, number of coats, dry film thickness, holidays, and other imperfections and submit testing results to ENGINEER.

3.7 DISINFECTION

A. Disinfection shall conform to applicable requirements of AWWA C652, except as modified below.

B. After tank painting is complete and interior surfaces thoroughly dried, remove all visible dirt and contaminating materials. Disinfect interior of tank by spraying all surfaces, including underside of roof and roof support members, with a chlorine solution measuring at least 200 mg/L chlorine. Chlorine solution shall remain in contact with surfaces for at least thirty minutes. Provide a sterile environment inside tank. After spray-disinfection, flush tank contents to drain by spraying disinfected surfaces with potable water for at least ten minutes, then fill tank to result in overflow for another ten minutes, after which samples for bacteriological testing will be obtained by CONTRACTOR. CONTRACTOR shall provide proper disinfection until successful bacteriological testing results are achieved.

C. Water for initial disinfection and filling will be furnished by OWNER. CONTRACTOR shall provide pumps, hoses, and other temporary equipment required to fill tank. CONTRACTOR shall furnish chlorine.

D. First set of bacteriological testing will be paid for by OWNER.

E. If tank must be emptied, re-disinfected, flushed, and refilled to obtain satisfactory bacteriological samples, or because of extensive leakage, CONTRACTOR shall pay for additional chlorine, re-testing, and water at the utility owner's standard rates.

F. Water VOC Concentration Testing:
   1. After tank has filled and allowed to stand for twenty-four hours, OWNER will provide one set of water samples for testing for total volatile organic compounds per EPA Method 524.2 and bacteriological levels to confirm acceptability of water with applicable drinking water standards.
   2. If a sample does not meet applicable requirements, CONTRACTOR shall drain tank and allow the paint system to further cure. CONTRACTOR shall pay costs for additional refilling, testing, and disposal of water necessary to achieve compliance with applicable drinking water standards.

3.8 PROTECTION OF NEW FINISHES

A. Provide signs that read, "Wet Paint" as required to protect newly painted finishes. Remove temporary wrappings provided for protection of the Work after completion of painting.

3.9 ADJUSTING AND CLEANING

A. Correct damages to work of other trades through cleaning, repairing or replacing, and repainting, as acceptable to ENGINEER.

B. During progress of Work, remove from Site all discarded paint materials, rubbish, cans, and rags at end of each workday.

C. Upon completion of painting, clean paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, while avoiding scratching or otherwise damaging finished surfaces.

D. At completion of work of other trades, touch-up and restore damaged or defaced painted surfaces as determined by ENGINEER.

3.10 SCHEDULES

A. The schedules listed below, following the "End of Section" designation, are a part of this Specification section.
   1. Table 09 91 00-C, Painting Schedule.

TABLE 09 91 00-C
PAINTING SCHEDULE

Facility or Surface *	Room No.	Painting System **	Remarks
New Ferrous Metals Not Attached to the Water Storage Tank; Structural Steel, Exterior Surfaces of Valves, Pumps, and Piping, Doors		A	
Interior of Water Storage Tank; Exterior Surfaces of Piping Inside the Water Storage Tank		B	
Exterior of Water Storage Tank		C	Provide Sherwin Williams color SW 7004, Snowbound, or equal color match.
Aluminum in Contact With Dissimilar Materials		D	

* Refer to Drawings for facility locations and for facilities not listed above.

** Refer to Article 2.2 of this Section.

+ + END OF SECTION + +

DIVISION 10 - SPECIALTIES

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SECTION 10 14 00

SIGNAGE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install signage.
   2. Extent of signage is shown and specified.
   3. Types of products required include the following:
      a. Photo-luminescent exit signs.
      b. Room identification, information, entry and directional signs.
      c. Health, safety, warning, floor loading and fire extinguisher location signs.
      d. Pipe markers, tags, and equipment nameplates.
      e. Right-to-know labels, signs and tags.
      f. Exterior building identification signs.
      g. Stainless steel fasteners, supports, very-high-bond high-performance mounting tape, primers and other accessories.

B. Coordination:
   1. Coordinate adhesives and fasteners with mounting surfaces. Review other Sections to ensure compatibility of signage mounting accessories with various surfaces on which signage will be installed.
   2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before signage Work.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. AA DSA-45, Designation System for Aluminum Finishes.
   2. ASME A13.1 Scheme for the Identification of Piping Systems.
   3. ANSI/ICC A117.1, Accessible and Usable Buildings and Facilities.
   4. ANSI Z535.1, Marking Physical Hazards Safety Color Code.
   5. ANSI Z535.2, Environmental and Facility Safety Signs.
   6. ANSI Z535.3, Criteria for Safety Symbols.
   7. ASTM B26/B26M, Specification for Aluminum-Alloy Sand Castings.
   8. ASTM B584, Specification for Copper Alloy Sand Castings for General Applications.
   9. ASTM E527, Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS).

10. CDA, Properties of Cast Copper Alloys.
11. NFPA 704, System for the Identification of the Hazards of Materials for Emergency Response.
12. UL 924, Safety of Emergency Lighting and Power Equipment.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Signage Manufacturers:
      a. Engage firms specializing in producing types of products specified, in compliance with the Contract Documents, with documented record of successful in-service performance, and that possess sufficient production capacity to avoid delaying the Work.
      b. Submit to ENGINEER name and experience record of manufacturers.

B. Component Supply and Compatibility:
   1. Obtain each separate type of signage from a single Supplier and from a single manufacturer.

C. Regulatory Requirements: Comply with applicable requirements of the following:
   1. OSHA, 29 CFR Part 1910.1200, Hazard Communication Standard.
   2. OSHA, 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances.
   3. OSHA, 29 CFR Part 1910.144, Safety Color Code for Marking Physical Hazards.
   4. OSHA, 29 CFR Part 1910. 145, Specification for Accident Prevention Signs and Tags.
   5. United States Access Board, Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines.
   6. Americans with Disabilities Act (ADA), Public Law 101-36, 28 CFR Part 36, Appendix A, Accessibility Guidelines for Buildings and Facilities (ADAAG), relative to characters and symbols contrast only.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Schedule of all signage required for the Work, indicating signage type location, and other information to demonstrate compliance with the Contract Documents.
      b. Fabrication and erection information for each type of signage
      c. Valve schedule for small-diameter valves, in accordance with this Section.
      d. Complete, camera-ready, color graphic layouts of custom- designed signs based on specified requirements and manufacturer recommendations.

e Complete selection of each specified manufacturer's standard and custom graphic layouts and pictograms, colors, and alphabetic/text styles.

f. Full-size graphic layout drawings for plaques, individual dimensional letters and numbers, and other items where final graphic appearance is necessary prior to signage fabrication, incorporating all required graphic features specified or shown.

g. Mounting and Installation Data:
   1) Drawings of and information on anchorages and accessory items.
   2) Submit location template drawings for items supported or anchored to permanent construction.
   3) Coordinate mounting position, method, and proposed mounting accessories and fasteners with actual Project conditions. Indicate required mounting accessories on plan drawings showing locations of required exit signs based on measurements taken at the Site. Show final location and identify type of mounting surface for each exit sign. Coordinate location of exit signs for non-interference with other Work and as required by authorities having jurisdiction.

2. Product Data:
   a. Copies of manufacturer's technical data, including catalog information and specifications, for each product specified.

3. Samples:
   a. Each color and finish of exposed materials and accessories required for signage.
   b. Sample Signage:
      1) Full-size Sample of each type of permanent room and space identification sign, and informational and directional sign incorporating all features specified.
      2) Full-sized Sample of each type (such has snap-on, strap-on, and adhesive) of pipe marker proposed for use with mounting accessories.
      3) Full-sized Sample equipment nameplate, valve tag, pipe tag, and accessories. Stamp valve tag with information shown on valve schedules. When not indicated in the Contract Documents, information on the type of coding system will be furnished to CONTRACTOR by ENGINEER.
      4) Full-sized Sample right-to-know signs, labels and tags.
      5) Full-size representative sample of each individual-type letter and number specified, demonstrating alphabetic style/text type, material, color and finish specified.
   c. ENGINEER's review of Samples will be for color and texture only. Compliance with other requirements is CONTRACTOR's responsibility.

B. Informational Submittals: Submit the following:

1. Manufacturer's Instructions:
    a. Templates for anchorages to be installed in concrete or masonry.
    b. Manufacturer's instructions and recommendations for support and foundations of signs installed outdoors.

C. Closeout Submittals: Submit the following:
    1. Warranty Documentation:
        a. General and special warranties required under this Section.

D. Maintenance Material Submittals: Submit the following:
    1. Extra Stock Materials:
        a. Furnish extra stock materials from the same manufactured lot as the materials installed.
        b. Submit documentation of actual quantities of signage installed for the Project and calculations indicating the required quantity of extra stock materials.
        c. Furnish the following spare parts and accessories:
            1) For every 20 of each type (snap-on, strap-on, adhesive type) of pipe markers installed:
                a) One complete mounting assembly.
            2) For every 20 equipment nameplates installed:
                a) One complete nameplate mounting assembly.
            3) For every 20 valve tags and pipe tags installed:
                a) One stainless steel cable and splice.

1.5 WARRANTY

A. General Warranty: The special warranty specified for each type of sign in this Article shall not deprive OWNER of other rights or remedies OWNER may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by CONTRACTOR under the Contract Documents. The obligations of CONTRACTOR under the Contract Documents shall not be limited in any way by the provisions of the specified special warranty.

B. Special Warranty on Products:
    1. Provide each signage manufacturer’s written warranty, running to the benefit of OWNER, agreeing to correct, or at option of OWNER, remove or replace materials specified in this Section found to be defective during a period of five years after the date of Substantial Completion.
    2. Special warranty shall cover defective Work that includes, but is not limited to, the following:
        a. Deterioration of metal and polymer finishes beyond normal weathering.
        b. Deterioration of embedded graphic image colors and sign lamination.

PART 2 – PRODUCTS

2.1 SYSTEM PERFORMANCE

A. General:
   1. Details shown or indicated for signage, such as alpha-numeric and text type representation, letter spacing, designs of borders, and other graphic features, are generic and intended only to establish text, general positions, and symbols.
   2. Colors shall be brilliant, distinctive shades, matching the safety colors specified in ANSI Z535.1 and OSHA 1910.144.
   3. Permanent rooms and spaces, and directional and informational signage where specified as accessible to people with disabilities, shall comply with ANSI/ICC A117.1 and ADA-ABA Accessibility Guidelines.
   4. Accident prevention signs and tags shall comply with OSHA 1910.145.
   5. Health, safety, and warning signs shall comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, OSHA 1910.144, and 1910.145, unless otherwise shown or indicated. Colors shall be as indicated in Table 1 of ANSI Z535.1. In addition to text, safety symbol pictograms shall be incorporated into each sign.

2.2 PHOTO-LUMNINESCENT EXIT SIGNS

A. Products and Manufacturers: Provide one of the following:
   1. Series 90.8924 Photoluminescent Exit Signs by EverGlow NA, Inc.
   2. Series 2002 by Active Safety Corporation.
   3. Or equal.

B. Photo-luminescent Exit Signs:
   1. Provide photo-luminescent exit signs with single- and double-face dimensions of nine inches by 14.25 inches by 3/4-inch deep.
   2. Sign housing shall consist of an AA-A42 color anodized extruded aluminum frame and legend protected by a temper-resistant polycarbonate shield.
   3. Size, graphics, and background colors of sign legend shall comply with Laws and Regulations.
   4. Sign Letters and Directional Arrows. Furnish signs with photo-luminescent luminous letters and directional arrows.
   5. Signs shall comply with UL 924 and be constructed for 15-year service life each.
   6. Rated Viewing Distance: 75 feet.
   7. Provide manufacturer's standard universal mounting brackets, extended wall and ceiling mounting brackets, pendant mounting brackets, and recessed mounting brackets as required by mounting surface and exiting conditions, or as shown.

2.3 PANEL SIGNS – ROOM IDENTIFICATION, INFORMATION, ENTRY, AND DIRECTIONAL

A. Products and Manufacturers: Provide one of the following:
   1. Graphic Blast MP and FG ADA System and Custom Design ADA Series, by Best Sign Systems, Inc.
   2. Blast Etched Fiberglass and Blast Etched Melamine Signs, by Visigraph Corporation.
   3. Or equal.

B. Panel Signs – Room Identification, Information, Entry, and Directional:
   1. Product Description: Provide unframed signs, surface-etched, 1/32-inch raised tactile lettering and pictograms, sandblasted on an opaque sheet.
   2. Materials:
      a. Interior Signs: Three-ply, self-extinguishing melamine plastic.
      b. Exterior Signs: One-piece fiberglass.
   3. Size and Thickness: 0.125-inch thick; eight inches by eight inches with 1/2-inch radiused corners.
   4. Graphics and Text: White, Standard Helvetica Medium characters and matching arrow type-face; upper and lower case letters, one-inch high capitals and, in addition, Grade 2 Braille alphabet for room designation, directional, entry, and information signs.
   5. Colors and Contrast: Background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast by at least 70 percent with their background as determined by ADA formula in ADAAG Appendix A4.30.5.

2.4 PANEL SIGNS – HEALTH, SAFETY, WARNING, FLOOR LOADING, AND FIRE EXTINGUISHER LOCATION

A. Product Description: Provide rigid fiberglass reinforced plastic signs with fade-resistant embedded graphics.

B. Products and Manufacturers: Provide one of the following:
   1. Graphic Blast Word and Picture Series, by Best Sign Systems, Inc.
   2. Blast Etched Fiberglass Signs, by Visigraph Corporation.
   3. Or equal.

C. General:
   1. Size and Thickness: 0.125-inch thick; 10 inches by 14 inches, unless otherwise shown or indicated.
   2. Graphics and Text: Standard Helvetica Medium characters and matching arrow type-face; upper and lower case, one-inch high capitals and, in addition, Grade 2 Braille alphabet message designations and other text.

3. Exposure: As recommended by sign manufacturer for both indoor and outdoor use and with an upper service temperature limit of 190degrees F. Average durability for outdoor use shall be 15 years.

D. Safety Instruction Signs: Standard color of sign background shall be white; panel shall be green with white letters and numbers. Letters and numbers used against white background shall be black.

E. Caution Signs: Standard color of sign background shall be yellow; panel shall be black with yellow letters and numbers.

F. Danger Signs: Standard color of sign background shall be white; panel shall be black with red insert with white letters and numbers. Letters and numbers used against white background shall be black.

G. Warning Signs: Standard color of sign background shall be orange; panel shall be black with orange insert with black letters and numbers. Letters and numbers used against orange background shall be black.

H. No Smoking Signs: Standard color of sign background shall be white. Letters and numbers used against white background shall be red.

I. Fire Extinguisher Location Signs (surface-mounted units only): Standard color of sign background shall be red with white letters and numbers. Each sign shall include international fire extinguisher pictogram and directional arrow indicating location of fire extinguisher.

J. Auxiliary Products:
1. Mounting Brackets: Provide sign manufacturer's standard mounting brackets for installing projected or double-sided signs.

2.5 PIPE MARKERS

A. Description:
1. Provide pipe markers for each pipeline provided under the Contract, and for other piping indicated to receive pipe markers.

B. Products and Manufacturers: Provide one of the following:
1. Custom High Performance Pipe Markers (B-689), and SnapOn and StrapOn Pipe Markers (B-915), by Brady Worldwide, Inc., Signmark Division.
2. Custom Ultra-Mark High Performance Pipe Markers, by Seton Identification Products, a Tricor Direct Company.
3. Or equal.

C. Pipe Markers:

1. Lettering of Titles/Legend and Color Field Size:
   a. Letter size and color field length shall be as indicated in Table 10 14 00-A of this Section:

TABLE 10 14 00-A, PIPE MARKERS: SIZE OF TEXT AND COLOR FIELD

Outside Diameter of Pipeline or Covering* (inches)	Size of Text (Legend Characters)	Minimum Length of Color Field**
3/4 to 1.25	1/2-inch	8 inches
1.5 to 1-7/8	3/4-inch	8 inches
2 to 5-7/8	1.25-inch	12 inches
6 to 9-7/8	2.5-inch	24 inches
10 and Larger	3.5-inch	32 inches
*Outside diameter includes pipe diameter plus insulation and jacketing. **Length of sign and color field shall be as required to accommodate required legend, and shall not be less than minimum length indicated unless required otherwise by space constraints.		

   b. Text and symbols shall be Standard Helvetica Medium, all upper case. Pipe markers shall include text with separate arrow signs indicating direction of flow of pipeline contents. Pipe markers with arrows shall be located as specified in Part 3 of this Section.
   c. Pipe markers indicating pipeline contents shall identify pipeline contents by complete name, as indicated in Table 10 14 00-B of this Section. Obtain from ENGINEER interpretation of required pipe marker text for pipelines provided under the Project that are not listed in Table 10 14 00-B of this Section.
2. Pipe Marker Materials:
   a. General: The following are applicable to all types of pipe markers furnished under this Section:
      1) Provide pipe markers with ultraviolet light-resistant, sealed, subsurface color graphics, recommended by sign manufacturer, suitable for both indoor and outdoor use.
      2) Pipe markers shall be resistant to abrasion, chemical reagents, and physical agitation such as washdowns and wind.
      3) Provide manufacturer's full selection of standard and custom sizes and graphics.
      4) Where manufacturer has established minimum order quantities for custom units provide minimum order quantities at no additional cost to OWNER.
   b. Materials: Provide the following at CONTRACTOR's option, suitable for outside diameter of the associated pipe and pipe covering:
      1) Adhesive, Wrap-Around Pipe Markers: Adhesive pipe markers shall be coiled construction, 0.006-inch total thickness, PVF over

laminated polyester, with peel-off backing. Suitable for for service temperature ranging from -40 degrees F to 230 degrees F.

2) Snap-on Pipe Markers: Snap-on pipe markers shall be cylindrically coiled, printed plastic sheets. Pipe marker total thickness for pipe and pipe covering from 3/4-inch to 2-3/8-inch outside diameter shall be not less than 0.020-inch. Pipe marker total thickness for pipe and pipe covering from 2.5-inch through six-inch ourside diameter shall be not less than 0.030-inch. Suitable for service temperature ranging from -40 degrees F to 180 degrees F.

3) Strap-on Pipe Markers: Provide strap-on pipe markers where pipe diameter is large enough to preclude overlap of pipe marker material around the circumference of the pipe. Strap-on pipe markers shall be flat, printed plastic sheets, not less than 0.020-inch total thickness, constructed to be attached to the pipe with bands. Suitable for service temperature ranging from -40 degrees F to 180 degrees F. Provide each pipe marker with two 1/4-inch wide band straps of nylon, plastic, or stainless steel, lengths as required by circumference of pipe and pipe covering. Provide manufacturer's recommended banding tools for banding.

3. Legend for Pipe Markers: Pipe markers shall have the text or abbreviations in the color combinations indicated in Table 10 14 00-B of this Section to identify the pipeline service hazard. Pipe marker colors shall comply with ASME A13.1, unless otherewise indicated.

TABLE 10 14 00-B,
SCHEDULE OF PIPE MARKERS*

Pipeline Legend	Lettering/Text Color	Background Color
WATER		
Potable Water	White	Green
PROCESS		
Sump Drains	White	Gray

* Where shown or specified, the legend for blowoff, drain, metering, sump, vent, and similar pipelines shall also include the equipment number or structure name, as applicable, served by the pipeline. Provide the number in the same color as the pipeline.

2.6 EQUIPMENT NAMEPLATES

A. Description:

1. Provide equipment nameplate for each equipment item furnished under the Contract, and for other equipment items indicated to receive nameplates. Equipment nameplates specified in this Article are in addition to equipment

manufacturer's standard nameplate with manufacturer name, model number, serial number, and similar information.

2. Install equipment nameplates as indicated in Part 3 of this Section. Mechanically fasten equipment nameplates to the associated equipment item.

B. Products and Manufacturers: Provide one of the following:
   1. Engraved Plastic Tags (B-1), by Brady Worldwide, Inc.
   2. Custom Engraved Plastic Nameplates, by Seton Identification Products, a Tricor Direct Company
   3. Or equal.

C. Equipment Nameplates:
   1. Material: 1/16-inch thick satin-surfaced acrylic nameplates with beveled edges, front-engraved. Suitable for indoor and outdoor use. Suitable for temperatures ranging from -40 to 90 degrees C.
   2. Provide each equipment nameplate with not less than two holes, each approximately 3/16-inch diameter, for mechanically fastening nameplate to the associated equipment. Provide appropriate stainless steel fasteners.
   3. Nameplate Size:
      a. Size shall be as required for required text, and shall be not less than one-inch by four inches.
   4. Text Engraved on Nameplates:
      a. Text Size: Equipment nameplate titles shall have text as large as possible to fit on nameplate; text shall be not less than 1/2-inch high. All text on a given nameplate shall be one size.
      b. Text and symbols shall be Standard Helvetica Medium, all upper-case.
      c. Left-justify multiple lines of text
      d. Where more than one item of the same type of equipment is furnished, consecutively number each associated equipment nameplates as shown or indicated; for example "Pump No. 1", "Pump No. 2", "Pump No. 3", and so on.
   5. Legend for Nameplates:
      a. Nameplates for equipment, including operating stands for valves and gates, shall be in accordance with the required text and colors indicated in Table 10 14 00-C.
      b. Obtain interpretation from ENGINEER for equipment not included in Table 10 14 00-C.

TABLE 10 14 00-C, SCHEDULE OF EQUIPMENT NAMEPLATES*			
Legend		**Color**	
First Line	**Second Line**	**Lettering/Text**	**Background**
Water Pump 1 & 2	**		
Exhaust Fan	**		
Motorized Dampers	**		
Sump Pump 1 & 2	**		
Check Valves	**		
Pressure Sustaining Valve	**		

* Where equipment is installed on roofs or where exposed to the public view such as in lobby or office areas, color will be selected by ENGINEER.

** The legend on the indicated nameplates shall also include the appropriate number designation for such equipment, including valve stands and gate operators as shown on the Process and Instrumentation Drawings or as indicated by ENGINEER.

D. Operating Stands for Valves and Gates:
   1. Nameplate material, size, and text requirements are the same as indicated above for other equipment nameplates.
   2. Operating stands for valves and gates shall carry the respective legends "V. No. ___" or "S.G. No. ___," with the appropriate equipment number to be indicated by ENGINEER.

2.7 VALVE AND PIPELINE TAGS

A. Products and Manufacturers: Provide one of the following:
   1. Custom Engraved Stainless Steel Valve Tags, by Brady Worldwide, Inc.
   2. Custom Stainless Steel Valve Tags, by Seton Identification Products, a Tricor Direct Company
   3. Or equal.

B. Metal Tags:
   1. For each valve and for pipelines smaller than 3/4-inch outside diameter, provide permanently-legible, round metal tags, each two-inch diameter, Type 304 or Type 316 stainless steel, with engraved lettering filled with black enamel. Provide tags with 3/16-inch diameter hole located that does not interfere with legend.
   2. Legend for Valve Tags:

a. Based on information provided on the Drawings, submit to ENGINEER not less than 21 days before system startup, a valve schedule indicating all required valves.
b. For each valve, the valve schedule shall indicate: location, valve type, valve number, words to identify valve's function, type of operator, and normal operating position.
c. Information presented in the valve schedules shall be coded on tags in a system provided by or acceptable to OWNER. Each valve shall be coded and identified by ENGINEER utilizing a combination of up to twelve letters and numbers.

3. Legend for Small Pipeline Tags: Comply with requirements for pipe markers relative to legend. Where legend is not indicated, obtain interpretation from ENGINEER.
4. Miscellaneous Valve and Small Pipeline Tag Accessories:
   a. Stainless Steel Wire: Nylon-coated; 0.048-inch outside diameter.
   b. Clamps: Brass.
   c. Lead Seals: Monel; four ply, 0.014-inch by 10 inches long; for attaching tags.
   d. Hand Sealing Press: As recommended by tag manufacturer for crimping lead seals.

2.8 PANEL SIGNS – RIGHT-TO-KNOW LABELS, SIGNS, AND TAGS

A. Products and Manufacturers: Provide one of the following:
1. Custom B-302 Pressure Sensitive Polyester Right-To-Know Labels, B-120 Fiberglass Chemical Tank Signs, Front No. 1/Back No. 1 B-851 Right-To-Know Accident Prevention Tags and Right-To-Know Pictograms, by Brady Worldwide, Inc.
2. Right-to-Know & HazCom Signs, Labels, and Tags, by Seton Identification Products, a Tricor Direct Company.
3. Or equal.

B. General:
1. Right-to-know signs, labels, and tags shall use NFPA 704 “diamond” hazard identification systems and shall comply with OSHA 1910.1200 and OSHA Subpart Z.

C. Tank Signs:
1. Provide quantity of signs shown or indicated, identifying the chemical stored in the tank, chemical's hazards, required protective equipment in text and pictograms, first-aid for eyes, skin, ingestion and inhalation, information on confined space entry and NFPA 704-required hazard rating system information.
2. Right-to-know fiberglass signs for storage tanks shall have pressure-sensitive adhesive backs and be provided with subsurface numbers,

symbols, text, and legends. Labels shall indicate chemical name and chemical abstracts service number, fire and health hazard potential, reactivity, personal protection and target organ legends in compliance with NFPA 704 format and OSHA 1910.1200.

D. Labels: Provide right-to-know polyester labels for each hazardous chemical container. Provide labels seven inches by ten inches with information pre-printed by manufacturer. Provide labels with two-mil polyester overlaminate and with a complete line of all standard and custom pictograms.

E. Tags: Provide 15-mil right-to-know vinyl tags with self-adhering clear polyester overlaminate. Tags shall be laminated plastic and provided with nylon tie fasteners. Provide tags three inches by 5.75 inches with two chamfered corners with reinforced 3/16-inch diameter grommeted hole.

2.9 PANEL SIGNS – EXTERIOR BUILDING IDENTIFICATION

A. Products and Manufacturers: Provide one of the following:
   1. Graphic Blast Wall Mounted Signs, by Best Manufacturing Sign Systems, Inc.
   2. Blast Etched Fiberglass Exterior Signs by Visigraph Corporation.
   3. Or equal.

B. Material: Provide surface-etched lettering and pictograms, sandblasted on an opaque three-ply laminate of 1/4-inch thick flat three-ply glass-reinforced resin sheet with non-glare surface and contrasting color core suitable for continuous operating temperatures of 190 degrees F.

C. Alphabet and Graphics: Provide four-inch high helvetica alphabet; upper and lower case letters and matching arrow type face. Confirm font with Owner and Studio.

D. Provide opaque white letters on opaque black background with concealed, flush-mounted fasteners at each corner. Provide one signs each 15 inches by 15 inches with 1/8-inch radiused corners. Confirm colors with Owner and Studio.

E. Quantity:
   1. Provide two signs that read as follows:
      a. TRILITH WATER TOWER PUMP HOUSE
      b. BUILDING 13
   2. Coordinate with Owner and Studio for exact wording and possibility of combining into one sign.

2.10 AUXILIARY MATERIALS

A. Very-High-Bond High-Performance Bonding Tape:
   1. Provide all surface-mounted signage with very-high-bond foam tape backing except where specified as requiring mechanical fasteners.
   2. Products and Manufacturers: Provide one of the following:
      a. Scotch Brand (Very-High-Bond) 4942 VHB Double Coated Acrylic Foam Tape and No. 94 Acrylic Primer, by 3M Industrial Tape and Specialties Division.
      b. Or equal.
   3. Provide a very-high-bonding pressure sensitive joining system consisting of double-coated conformable acrylic foam tape and release liners.
   4. Thickness: 0.045-inch.
   5. Tape Width: 1.5 inches.
   6. Color: Dark gray.
   7. Bonding Adhesive: Acrylic; very-high-bond, solvent and shear resistance.
   8. Primer: High-performance tape manufacturers recommended acrylic primer.

B. Fasteners: Provide fasteners of non-magnetic stainless steel of size and type required and recommended by the associated individual signage manufacturer.

C. Anchors and Inserts: Provide nonferrous metal or hot-dipped galvanized anchors and inserts. Provide toothed stainless steel or lead expansion bolts for drilled-in-place anchors.

D. Mounting Brackets:
   1. Provide manufacturer's standard mounting brackets for each of the following sign types: hanging, projected, double-sided.
   2. Provide inserts, and mechanical and adhesive anchoring devices as specified in this Article for installation of signage.

2.11 FABRICATION

A. Shop Assembly:
   1. Fabricate and preassemble items in the shop to the greatest extent possible.
   2. Disassemble units only to extent necessary for shipping and handling limitations.
   3. Clearly mark units for reassembly and coordinated installation.

2.12 SOURCE QUALITY CONTROL

A. Fabrication Tolerances:
   1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within tolerance of plus or minus 1/16-inch measured diagonally across each sign.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine substrates and conditions under which signage will be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:
   1. Location:
      a. Install signage and appurtenances at the locations shown or indicated. When locations are not shown or indicated, install signage at locations directed by ENGINEER.
      b. Provide exit signs at locations shown or indicated. Surface-mount signs above each point of egress, unless otherwise shown or indicated.
      c. Lightly mark and locate position of each sign. Obtain ENGINEER's acceptance of marked locations before mounting.
   2. Installation – General:
      a. Install signs level, plumb, and at proper height.
      b. Signage shall be securely mounted with concealed, very-high-bond acrylic foam tape, specified adhesives, or mechanical fasteners where specified. Attach signs to surfaces in accordance with sign manufacturer's instructions, unless otherwise shown or indicated.
      c. Provide very-high-bond acrylic foam tape on back of signage using a full perimeter of specified tape. Leave no gaps in tape perimeter at back of signage; peel off second release liner and press onto surfaces.
   3. Repair or replace damaged units.

B. Panel Signs – Room Identification, Directional, and Information Signs:
   1. Where permanent identification is provided for rooms and spaces, install signs on the wall adjacent to the latch side of the door.
   2. Where there is no wall space on the latch side of the door, including at double leaf doors, install signs on the nearest adjacent wall.
   3. Mounting height shall be in accordance with ADA-ABA Accessibility Guidelines in areas accessible to disabled people. For other areas install signs with five feethes from the finished floor to centerline of sign. Mount such signage so that a person may approach within three inches of the sign without encountering protruding objects or, when reading sign, be forced to stand within the swing of a door.

C. Pipe Markers, Equipment Nameplates, and Pipe and Valve Tags:
   1. Location of Pipe Markers and Pipe Tags:

a. Provide pipe markers with text (pipeline contents or service) and adjacent arrow indicating the direction of flow of pipeline contents on each piping system provided under the Project and other piping systems shown or indicated as to receive pipe markers.
b. Locations: Provide pipe markers at each of the following locations:
    1) At intervals of not more than 30 linear feet apart
    2) Directly adjacent to each side of each penetration by the pipeline of the following: wall, floor, ceiling, roof.
    3) Adjacent to each change in flow direction.
    4) On each branch where pipes connect together including but not limited to tees, wyes, and crosses.
    5) Adjacent to each side of each valve (including but not limited to check valves, isolation valves, control valves, and other valves), strainer cleanouts, and each equipment item along the pipeline.
    6) Comply with ASME A13.1.
c. Provide flow-direction arrows at intervals not greater than 15 linear feet. Where flow may be bi-directional, provide arrows adjacent to each other to indicate both directions.
d. Pipe marker locations will be determined by ENGINEER, but in general place pipe markers where personnel view of label is unobstructed. When pipeline is overhead, install label on the two lower quarters of the pipe or pipe covering. Pipe markers shall be clearly visible from personnel operating positions, especially operating positions adjacent to valves and equipment.
e. Provide pipe tags, where specified, at locations as specified for pipe markers.

2. Location of Valve Tags and Valve Nameplates:
    a. Valve nampeplates and valve signs for large valves shall be located on or adjacent to the valve.
    b. For smaller valves, attach tags to valve bonnet or valve flange bolts.
    c. For valves to receive equipment nameplates, as specified in this Section, install nameplate as requied for other equipment nameplates.
    d. Do not attach tags, nameplates, or signs to valve handwheels or other valve actuators.
3. Equipment Nameplates:
    a. Locate nameplates on equipment bases and on structures at readily-visible elevation in such positions relative to the equipment and structures as to prevent damage to nameplate.
    b. Position nameplace for ease of reading by operations and maintenance personnel.

D. Panel Signs – Right-To-Know Signs, Labels, and Tags:
1. Locate tags at intervals of not more than 20 feet center-to-center along chemical pipelines and fill pipelines and on each side of locations where pipelines emerge from penetrations with other materials.

2. Install tank signs on each tank shown or indicated to receive signage at quarter-points on tank circumference, five feet above finished floor.

3.3 PROTECTION AND CLEANING

A. After installation, clean soiled signage surfaces in accordance with manufacturer's written instructions.

B. Protect signage from damage until completion of the Work.

+ + END OF SECTION + +

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all fire protection specialties Work.
   2. Extent of fire protection specialties Work is shown and specified.
   3. Types of fire protection specialties Work required includes:
      a. Dry chemical extinguishers.
      b. Carbon dioxide extinguishers.
      c. Mounting accessories and miscellaneous fasteners.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate installation of items that must be installed with or before fire protection specialties.

C. Related Sections:
   1. Section 10 14 00, Signage.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASTM E814, Test Method for Fire Tests of Penetration Firestop Systems.
   2. FM Global, FM Approval Guide.
   3. NFPA 10, Portable Fire Extinguishers.
   4. UL Fire Classification Rating.
   5. U.S. Architectural & Transportation Barriers Compliance Board's Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities.

1.3 QUALITY ASSURANCE

A. Component Supply and Compatibility:
   1. Provide fire protection specialties products from one manufacturer.

B. Certifications: Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FM Global.
   2. Provide fire extinguishers approved, listed, and labeled to comply with ASTM

E814.

C. Regulatory Requirements:
   1. Provide fire protection specialties approved and labeled by UL.
   2. Provide fire protection specialties conforming to NFPA 10 requirements.
   3. Provide fire protection specialties conforming to ADA-ABA Accessibility Guidelines.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data: Submit the following:
      a. Manufacturer's technical data, certification of UL rating, and installation instructions for fire protection specialties.
      b. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
      c. Product Schedule: For fire extinguishers and fire protection cabinets. Coordinate final fire extinguisher and fire protection cabinet schedule to ensure proper fit and function.

B. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
   2. Warranty: Sample of special warranty.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. General: Provide manufacturer's standard mounting brackets for portable fire extinguishers size as specified.

B. Multi-Purpose Dry Chemical Fire Extinguishers:
   1. Ten-pound capacity, enameled steel container with pressure-indicating gauge, for Class A, Class B, Class C fires, UL rating 4A-60 B:C.
   2. Products and Manufacturers: Provide one of the following:
      a. Cosmic Model 10E by J.L. Industries, a division of Activar Construction Products Group.
      b. MP 10 Series by Larsen's Manufacturing Company.
      c. Or equal.

C. Carbon Dioxide Fire Extinguishers:
   1. Ten-pound enameled steel container capacity UL rating 10 B:C.
   2. Products and Manufacturers: Provide one of the following:
      a. Sentinel Model 10 by J.L. Industries, a division of Activar Construction Products Group.
      b. CD 10 Series by Larsen's Manufacturing Company.
      c. Or equal.

D. Identification: Refer to Section 10 14 00, Signage.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrates and conditions under which fire protection specialties will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to ENGINEER.

3.2 INSTALLATION OF FIRE EXTINGUISHERS

A. When exact locations of fire protection specialties are not shown on Drawings, locate as directed by ENGINEER.

B. Securely fasten products to structure, square and plumb, per Supplier's instructions. Mounting heights shall be:
   1. Install fire extinguishers with gross weight greater than 40 pounds with top of fire extinguisher no more than 3.5 feet above finished floor.
   2. Install fire extinguishers with gross weight less than 40 pounds with top of fire extinguisher no more than 4.0 feet above finished floor.
   3. Clearance between bottom of fire extinguisher and finished floor shall be at least four inches.

C. Identification Devices: Refer to Section 10 14 00, Signage.

D. Recharge fire extinguishers provided under this Contract so that most recent inspection date coincides as nearly as possible with date of Substantial Completion. Inform OWNER in writing of next required inspection and recharging date.

3.3 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.4 FIRE EXTINGUISHER SCHEDULE

A. Type A – Dry chemical, wall mounted.

B. Type B – Carbon dioxide, wall mounted.

+ + END OF SECTION + +

DIVISION 13 – SPECIAL CONSTRUCTION

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SECTION 13 34 19

METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, tools, equipment, and incidentals as shown, specified and required to design, furnish and install all metal building systems. The Work also includes:
      a. Building into metal building systems required items and providing openings, closures, and escutcheons for metal building systems to accommodate the Work under this and other Sections and attaching to the metal building systems all items such as sleeves, hoods, supports, fasteners, and all items required, for which provision is not specifically included under other Sections.
   2. Extent of metal building systems is shown.
   3. Types of products required include the following:
      a. Multi-bay clear span structural system of low rigid frame type.
      b. Insulated metal roof panel system.
      c. Insulated metal wall panel system.
      d. Personnel doors and trim.
      e. All auxiliary system components and miscellaneous accessories, fasteners, trim, framed openings, flashing closures, base moldings, gutters, downspouts, vapor retarders and all other items not specified under this or other Sections, but required to provide a completely watertight and functioning building.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or before, the metal building systems.
   2. Coordinate the locations of equipment, piping, heating and ventilating ductwork, electrical conduit, and similar items in order to provide required clearances and supports for such items without modification of metal building system components at the Site.

C. Related Sections:
   1. Section 03 00 05, Concrete.
   1. Section 07 92 00, Calking and Sealants.
   2. Section 08 11 13, Hollow Metal Doors and Frames.
   3. Section 08 71 00, Finish Hardware.
   4. Section 08 90 00, Louvers.

5. Section 09 91 00, Painting.
6. Section 26 05 26, Grounding and Bonding for Electrical Systems.
7. Section 26 41 13, Lightning Protection for Structures.

1.2 REFERENCE STANDARDS

A. Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified:
   1. ASTM A36, Carbon Structural Steel, Standard Specification for.
   2. ASTM A53, Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless, Standard Specification for.
   3. ASTM A153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware, Standard Specification for.
   4. ASTM A307, Carbon Steel Bolts and Studs, 60,000psi Tensile Strength, Standard Specification for.
   5. ASTM A325, High-Strength Bolts for Structural Steel Joints, Standard Specification for.
   6. ASTM A366, Commercial Steel (CS) Sheet, Carbon, (0.15 Maximum Percent) Cold-Rolled, Standard Specification for.
   7. ASTM A463, Steel Sheet, Aluminum-Coated, by the Hot-Dip Process, Standard Specification for.
   8. ASTM A475, Zinc-Coated Steel Wire Strand, Standard Specification for.
   9. ASTM A490, Heat-Treated Steel Structural Bolts, 150ksi Minimum Tensile Strength, Standard Specification for.
   10. ASTM A500, Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes, Standard Specification for.
   11. ASTM A501, Hot-Formed Welded and Seamless Carbon Steel Structural Tubing, Standard Specification for.
   12. ASTM A529, High-Strength Carbon-Manganese Steel of Structural Quality, Standard Specification for.
   13. ASTM A568, Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for, Standard Specification for.
   14. ASTM A569, Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality, Standard Specification for.
   15. ASTM A570, Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality, Standard Specification for.
   16. ASTM A572, High-Strength Low-Alloy Columbium-Vanadium Structural Steel, Standard Specification for.
   17. ASTM A611, Structural Steel (SS), Sheet, Carbon, Cold-Rolled, Standard Specification for.
   18. ASTM A653, Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, Standard Specification for.
   19. ASTM A687, High-Strength Nonheaded Steel Bolts and Studs, Standard Specification for.

20. ASTM A755, Sheet Steel, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products, Standard Specification for.
21. ASTM A792, Sheet Steel, 55 Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, Standard Specification for.
22. ASTM B695, Coatings of Zinc Mechanically Deposited on Iron and Steel, Standard Specification for.
23. ASTM C36, Gypsum Wallboard, Standard Specification for.
24. ASTM C423, Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method, Standard Test Method for.
25. ASTM C442, Gypsum Backing Board and Coreboard, Standard Specification for.
26. ASTM C578, Rigid, Cellular Polystyrene Thermal Insulation, Standard Specification for.
27. ASTM C665, Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing, Standard Specification for.
28. ASTM C920, Elastomeric Joint Sealants, Standard Specification for.
29. ASTM C991, Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings, Standard Specification for.
30. ASTM C1107, Packaged Dry, Hydraulic-Cement Grout (nonshrink), Standard Specification for.
31. ASTM C1136, Flexible, Low Permeance Vapor Retarders for Thermal Insulation, Standard Specification for.
32. ASTM D523, Specular Gloss, Standard Test Method for.
33. ASTM D1494, Diffuse Light Transmission Factor of Reinforced Plastics Panels, Standard Specification for.
34. ASTM D3841, Glass-Fiber-Reinforced Polyester Plastic Panels, Standard Specification for.
35. ASTM D4214, Evaluating Degree of Chalking of Exterior Paint Films, Standard Test Method for.
36. ASTM E84, Surface Burning Characteristics of Building Materials, Standard Test Method for.
37. ASTM E94, Radiographic Testing, Standard Guide for.
38. ASTM E96, Water Vapor Transmission of Materials, Standard Test Methods for.
39. ASTM E119, Fire Tests of Building Construction and Materials, Standard Test Methods for.
40. ASTM E136, Behavior of Materials in a Vertical Tube Furnace at 750^0 C, Standard Test Method for.
41. ASTM E142, Controlling Quality of Radiographic Testing, Standard Method for.
42. ASTM E164, Ultrasonic Contact Examination of Weldments, Standard Practice for.
43. ASTM E165, Liquid Penetrant Examination, Standard Test Method for.

44. ASTM E283, Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen, Standard Test Method for.
45. ASTM E329, Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction, Standard Specification for.
46. ASTM E331, Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference, Standard Test Method for.
47. ASTM E548, General Criteria Used for Evaluating Laboratory Competence, Standard Guide for.
48. ASTM E709, Magnetic Particle Examination, Standard Guide for.
49. ASTM E1646, Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference, Standard Test Method for.
50. ASTM E1680, Rate of Air Leakage Through Exterior Metal Roof Panel Systems, Standard Test Method for.
51. ASTM F959, Compressible-Washer Type Direct Tension Indicators for Use with Structural Fasteners, Standard Specification for.
52. Metal Building Manufacturers Association (MBMA), Low Rise Building Systems Manual.
53. American Institute of Steel Construction (AISC), S303 - Code of Standard Practice for Steel Buildings and Bridges.
54. American Institute of Steel Construction (AISC), S335 - Specification for Structural Steel Buildings, Allowable Stress Design, Plastic Design.
55. American Iron and Steel Institute (AISI), SG-671 - Specification for the Design of Cold-Formed Steel Structural Members.
56. American Iron and Steel Institute (AISI), SG-911 - Load and Resistance Facet Design Specification for Steel Structural Members.
57. American Society of Civil Engineers, ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
58. Architectural Metal Products Division of The National Association of Architectural Metal Manufacturers (NAAMM), Metal Finishes Manual for Architectural and Metal Products.
59. American Welding Society (AWS), D1.1 - Structural Welding Code - Steel.
60. American Welding Society (AWS), D1.3 - Structural Welding Code - Sheet Steel.
61. Sheet Metal and Air Conditioning Contractors National Association, Incorporated, SMACNA, Architectural Sheet Metal Manual.
62. Steel Door Institute, SDI 122, Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
63. Factory Mutual Engineering Corporation, FM 1-7 - Wind Forces on Buildings and Other Structures.
64. National Fire Protection Association, NFPA 80, Standard for Fire Doors and Fire Windows.
65. National Fire Protection Association NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
66. Research Council on Structural Connections, (RCSC), Specification for Structural Joints Using ASTM A325 and ASTM A490 Bolts.

67. Steel Joist Institute (SJI), Standard Specifications and Load Tables.
68. Steel Structures Painting Council (SSPC), Steel Structures Painting Manual Vol. 2.
69. Underwriters' Laboratories Incorporated (U.L.), Standard for Safety - UL 580 - Tests for Uplift Resistance of Roof Assemblies.

1.3 DEFINITIONS

A. Terminology used in this Specification shall comply with MBMA's, "Low Rise Building Systems Manual" for definitions of terms for metal building systems construction, and the following:
   1. The term "bay spacing" shall mean the dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured perpendicular to end wall (outside face of end-wall girt).
   2. The term "building length" shall mean the dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).
   3. The term "building width" shall mean the dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).
   4. The term "clear span" shall mean the distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame, or knee).
   5. The term "eave height" shall mean the vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).
   6. The term "clear height under structure" shall mean the vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.

1.4 SYSTEM DESCRIPTION

A. Metal building systems include complete, integrated sets of mutually dependent components and assemblies, capable of withstanding structural and other loadings, thermally induced movements, and exposure to weather in the area of the Site, without failure or infiltration of water into the building interior. The system includes primary and secondary framing, roof and wall panels, auxiliary system components and all associated trim, complying with requirements shown and specified, all requirements of the metal building systems manufacturer, and governing authorities having jurisdiction at the Site.

B. Metal building systems also include all internal reinforcements and supports, fasteners, closure plates, flashing, fascias, and all other components necessary to complete the Work in a manner that provides a completely functioning system

supportive of, and integrated with, all building service equipment in compliance with the requirements of governing authorities having jurisdiction at the Site.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Engage a manufacturer specializing in the production of the types and quality of products specified and with a documented record of successful in-service metal building system performance.
   2. Manufacturer shall be a member of MBMA and be certified by AISC as a manufacturer that designs and produces metal building systems in a AISC-Certified Facility.
   3. Engage a manufacturer who will provide complete technical services including preparation and review of Shop Drawings, including installation methods and detailing for metal building system components. Where the manufacturer requires additions, or changes to the Contract Documents in order to facilitate its design and fabrication of system components, these shall be made at no cost to OWNER and only as acceptable to ENGINEER.
   4. Materials and fabrication procedures shall be subject to inspection and tests in the mill, shop, and at the Site, conducted by a qualified inspection agency. Such inspections and tests shall not relieve CONTRACTOR of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

B. Erector Qualifications:
   1. Engage a single erector skilled, trained and with successful and documented experience in the installation of metal building systems who is acceptable to the metal building system manufacturer, and with specific skill and successful experience in the erection of the types of components required; and who agrees to employ only tradesmen with specific skill and successful experience in this type of Work. Submit names and qualification to ENGINEER along with the following information on a minimum of three successful projects:
      a. Names and telephone numbers of owner, architects or engineers responsible for projects.
      b. Approximate contract cost of the metal building system.
      c. Amount of area installed.

C. Professional Engineer:
   1. Engage a registered professional engineer legally qualified to practice in the jurisdiction where the Project is located and experienced in providing engineering services of the kind indicated.
   2. Responsibilities include, but are not necessarily limited to, the following:
      a. Carefully reviewing system performance and design criteria stated in the Contract Documents.

b. Preparing written requests for clarification or interpretation of performance or design criteria for submittal to ENGINEER by CONTRACTOR.
c. Preparing, or supervising the preparation of design calculations, and reviewing and approving related Shop Drawings prepared by the metal building system manufacturer prior to submission to ENGINEER; testing plan development, and test-result interpretations; and providing comprehensive engineering analyses verifying compliance of the system with the requirements of the Contract Documents.
d. Signing and sealing all calculations and engineering analyses.
e. Certifying that:
    1) it has performed the design of the system in accordance with the performance and design criteria stated in the Contract Documents, and
    2) the said design conforms to all applicable local, state and federal codes, rules and regulations and to the prevailing standards of practice.

D. Testing Agency Qualifications: To qualify for approval, an independent testing agency shall demonstrate to ENGINEER's satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated, in accordance with ASTM E329 and as documented according to ASTM E548, without delaying the Work.

E. Erection and Location Tolerances:
1. Comply with MBMA's "Low Rise Building Systems Manual," Chapter IV, Section 9, "Fabrication and Erection Tolerances."
2. Structural-Steel Erection Tolerances: Comply with erection tolerance limits of AISC S303, "Code of Standard Practice for Steel Buildings and Bridges."
3. Roof Panel Installation Tolerances: Shim and align units within installed tolerance as follows:
    a. Slope and Location: 1/4 inch in 20 feet on lines as indicated, and within 1/8-inch offset of adjoining faces and alignment of matching profiles.
4. Wall Panel Installation Tolerances: Shim and align units within installed tolerances as follows:
    a. Level and Plumb: 1/4 inch in 20 feet on location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
5. Door Installation Tolerances: Fit doors in frames within clearances specified in SDI 122.

F. Source Quality Control:
1. Obtain all metal building system components through a single source and from a single manufacturer.
2. In some cases incidental accessories necessary to the proper functioning of the specified system or component may not be mentioned in the Specifications.

CONTRACTOR shall follow the recommendations of the specified metal building system manufacturer and provide systems and components with all required incidental accessories and component items necessary for the proper functioning of the metal building or other building systems, at no additional expense to OWNER. Provide materials matching the specified material and finish of similar items.

3. Do not change material gages, system components or construction details after approval of Shop Drawing by ENGINEER.
4. Contract Documents establish requirements for metal buildings aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignments, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.
5. Provide specified material gages, or heavier gages, if calculations based on performance criteria indicates the need for heavier gage material. All such modifications shall be at no additional expense to OWNER. Where compliance with performance criteria indicates that materials of lesser gage, or size, may be adequate, provide specified gages and sizes as minimum acceptable standard.
6. Welding:
   a. Qualify procedures and personnel according to AWS D1.1 and AWS D1.3.2.
   b. Provide certification that all welders employed on the fabrication of the metal building systems have satisfactorily passed AWS qualification tests within the previous twelve months. Manufacturer shall ensure that all certifications are kept current.
7. Structural Steel: Comply with AISC S335 for design requirements and allowable stresses.
8. Cold-Formed Steel: Comply with AISC SG-671 and AISC SG-911 for design requirements and allowable stresses.
9. OWNER will employ an independent testing agency to perform source quality control testing and special inspections, and to prepare test reports.
   a. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
   b. Allow OWNER's testing agency access to places where structural framing is being fabricated or produced. Cooperate with OWNER's testing agency and provide samples of materials as may be requested for additional testing and evaluation.
10. Correct deficiencies in, or remove and replace structural framing that inspections and test reports indicate do not comply with requirements.
11. Additional testing, at CONTRACTOR's expense, will be performed to determine compliance of corrected Work with requirements.
12. Shop-bolted connections will be tested and inspected according to RCSC's specifications for ASTM A325 and ASTM A490 bolts.

a. Direct-tension indicator gaps will be verified for compliance with ASTM F959, Table 2.

13. In addition to visual inspection, shop welding will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option:
    a. Liquid-Penetrant Inspection: ASTM E165.
    b. Magnetic-Particle Inspection: ASTM E709, performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    c. Radiographic Inspection: ASTM E94 and ASTM E142, minimum quality level 2-2T.
    d. Ultrasonic Inspection: ASTM E164.
14. In addition to visual inspection, shop-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:
    a. Perform bend tests when visual inspections reveal either less than a continuous 360-degree flash, or welding repairs to any shear connector.
    b. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.
15. Testing agency will report test results promptly and in writing to CONTRACTOR and ENGINEER.

G. Requirements of Regulatory Agencies:
1. Fabricate and label structural framing to comply with special inspection requirements at point of fabrication for welding and other connections required by governing authorities having jurisdiction at the Site.

H. Mock-Ups:
1. Before installing wall panels, build mock-ups for each required form of construction and finish to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.
2. Build mock-ups of the types and of the sizes shown.
    a. Include wall panel assembly with window, window opening framed with metal trim, and insulation with vapor retarder.
    b. Include all sealants at perimeter of window and joints of wall.
3. Incorporate materials and methods of fabrication and installation that are identical with Project requirements.
4. Obtain ENGINEER's acceptance of visual qualities, color, erection tolerances and workmanship demonstrated on the mock-ups before start of metal building systm Work. Retain and protect mock-ups during construction as a standard for judging completed metal building system Work. Do not alter mock-up after approval by ENGINEER.
5. Build as many mock-ups as necessary to achieve ENGINEER's acceptance of the metal building systems. Disassemble rejected mock-ups and remove all components from Site. Do not incorporate rejected mock-up components

into the Work. Accepted mock-ups may be incorporated into the finished Work.

6. Metal building systems that do not meet the standard of workmanship approved on the approved sample areas shall be removed and replaced with new material.

1.6 SUBMITTALS

A. Qualifications Data: Submit qualifications data for the following:
   1. Manufacturer.
   2. Erector.
   3. Professional engineer.
   4. Test agency.

B. Samples: Submit the following:
   1. Manufacturer's full selection of standard and custom colors showing the full range of colors available for each type of product included in the metal building system, that incorporates a factory-applied color finish, for initial selection by ENGINEER.
   2. 12-inch long by actual width of roof and wall panels, with required finishes. Include all auxiliary system components such as clips, caps, battens, fasteners, closures, and other exposed panel accessories.
   3. 6-inch square sample of vapor-retarders.
   4. 12-inch long actual profile of corner section of aluminum window frame specified in Section 08520, glazed with glass specified in Section 08800, including all glazing shims, sealants, wedges and other glazing accessories. Insulating glass need not be hermetically sealed, but intermediate films and requirements for special interstitial gas fills shall be included and identified on the sample, if specified.
   5. Each fastener proposed for use in erection of metal building system, tagged as to location and use in the Work.
   6. ENGINEER’s review will be for color and profile, only. Compliance with all other requirements is the responsibility of CONTRACTOR.

C. Shop Drawings: Submit the following:
   1. Completely dimensioned plans, elevations and cross-sections of the metal building system completely coordinated with all required equipment and building service clearances. Accurately locate, show, and dimension the following:
      a. Structural framing system including the center lines of the bottom of all columns. Show complete fabrication of primary and secondary framing. Indicate welds and bolted connections, distinguishing between shop and Site applications. Include transverse cross-sections.
      b. Complete erection drawings showing locations of sidewall, endwall, and roof framing, covering and trim details, and accessory installation

details to clearly indicate the proper assembly of building components. Include plans, elevations, details, and attachments to other Work.

c. Show layouts of wall, roof and liner panels on support framing, details of edge conditions, joints, panel profiles, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and Site-assembled Work.
d. Insulations.
e. Vapor-retarders.
f. Trim and closures.
g. Furnish schedule of doors and frames including finish hardware sets, using the same reference numbers as shown. Include details of reinforcement and installation requirements for finish hardware.
h. Windows.
i. Louvers.
j. All required wall and roof penetrations.
k. All roof mounted equipment and curbs, service-way walkways and flashings.
l. Auxiliary and accessory components. Include details of ventilators, louvers, gutters and downspouts and similar auxiliary and accessory system components.
m. All details shall be drawn at a scale of not less than 1-1/2 inches equal to 12 inches.

2. Manufacturer's complete product information, specifications and installation instructions for metal building components and accessories. Include material descriptions, dimensions and profiles of individual system components.
3. Hard copy print-outs of structural analysis calculations required to show compliance with loading requirements, deflection requirements, other anticipated movements in the metal building system, and other system performance criteria specified prepared, signed and stamped with the seal of a registered professional engineer, as specified. All calculations and assumptions shall be presented so that ENGINEER can easily follow the progress and logic of registered professional's structural analysis.
4. Foundations Loads and Anchor-Bolt Plans:

a. Drawing showing all vertical and horizontal reactions on foundations. Include direction and location of each load application.
b. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.

4. Copies of special warranties, as specified.

D. Certificates: Submit the following:

1. Letter of Design Certification: Registered professional engineer who prepares, signs and stamps its seal shall provide a written statement confirming responsibility for the design and attesting that the design prepared meets the preformance criteria required by the Contract Documents, the requirements

of governing authorities having jurisdiction at the Site, and conforms to prevailing standards of practice. Include the following:

a. Name and location of Project.
b. Order number.
c. Name of manufacturer.
d. Name of CONTRACTOR.
e. Building dimensions, including width, length, height, and roof slope.
f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
g. Governing building code and year of edition.
h. Design Loads: Include dead load, roof live load, collateral loads, impact loads, roof snow load, deflection, wind loads/speeds and exposure, seismic zone or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads, such as loading superimposed on the system by erection equipment.
i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing authorities having jurisdiction.
j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
k. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

2. Welding Certificates: Copies of certificates for welding procedures and personnel, as specified.

E. Test Reports: Submit the following:

1. Material Test Reports: From a qualified testing agency indicating and interpreting test results of steel for compliance with requirements specified.
2. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating the following current products comply with requirements:
   a. Insulation and Vapor-Retarders: Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver components to the Site in manufacturer's original, unopened and undamaged packages, legibly labeled and accurately representing contents, indicating materials and components submitted on approved Shop Drawings.
2. Package roof and wall panels for protection during transportation and handling.
3. Clearly identify manufacturer, brand name, contents, color stock number, and order number on each package.

4. Metal building system components that are damaged during delivery or while being unloaded shall not be stored on Site. Remove such products from Site and replace with new, undamaged material.
5. Inspect materials, account for the presence of all hardware, auxiliary items and other accessories required for the Work, and reject components differing from approved Samples and Shop Drawings. Immediately remove rejected components from the Site.
6. Do not open packages or remove markings until packages are inspected and accepted. Packages showing indications of damage that may affect condition of contents will not be acceptable. Packages with illegible or removed labels will be rejected for use in the Work.

B. Storage of Materials:
1. Store roof and wall panels in a manner that will protect strippable coating from exposure to sun and condensation; with good air circulation around each piece.
2. Stack metal building system components on platforms or pallets, covered with tarpaulins or other suitable weathertight and ventilated covering. Do not store pallet crates directly on the ground. Provide sufficient clearance between enclosure and system components for air circulation and for protection from wind blown rain.
3. Store metal sheets and panels so that water accumulations will drain freely. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage, in an area protected from dirt, weather and from all construction activities. Do not store outside or allow components to become wet or soiled in any way while on Site.
4. If crated system components become wet, remove all system components from the pallet crate immediately, separate and allow to dry under protective cover meeting the requirements of this Specification.

C. Handling of Materials:
1. Unload, store, and erect roof and wall panels and other metal building system components in a manner that prevents bending, warping, twisting, and surface damage.
2. Do not subject preformed metal siding and accessory materials to bending or stress. Do not carry or transport panels in the horizontal (flat) position. Hold panels upright on edge when handling.
3. Do not erect components that become dented, scratched or damaged in any way. Remove such panels from Site and replace with new, undamaged material at no additional expense to OWNER.
4. Panels that are damaged during erection shall be removed from Site and replaced with new, undamaged material. Damaged panels erected into the finished Work shall be removed immediately.

1.8 PROJECT CONDITIONS

A. Environmental Conditions:
   1. Weather Limitations: Proceed with erection only when weather conditions permit roof and wall panel installation to be performed according to manufacturer's written instructions and warranty requirements.

B. Site-Measurements:
   1. Verify dimensions in areas of erection by taking measurements at the Site before fabrication. Indicate dimensions on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delay.
   2. Where Site-measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating components without Site-measurements. Coordinate supports, adjacent construction, equipment and locations of openings to ensure actual dimensions correspond to dimensions established for metal building system Work.

C. Protection:
   1. Provide continuous protection of materials against damage primarily by storing materials under cover and above ground and away from other construction traffic.
   2. Do not expose plastic insulation to sunlight, except to extent necessary for period of installation and concealment.
   3. Protect plastic insulation against ignition at all times. Do not deliver plastic insulation materials to Site before it is required to be built into the Work.

D. Scheduling:
   1. Schedule the arrival of metal building system components, auxiliary items and accessories to minimize the time they are stored at the Site before erection.
   2. Do not proceed with the erection of metal building systems until CONTRACTOR can provide finished Work complying with all requirements of the Specifications.
   3. Where metal building systems require the building-in of plates, inserts, anchors and other items, furnish required inserts to avoid delay in the Work of other trades. Provide setting drawings, templates, and directions for installation of plates, inserts and anchors, required by the Work of this Section but installed under other Sections.
   4. Coordinate with other Work by furnishing Shop Drawings, inserts and similar items at the appropriate times for proper sequencing of construction without delays.
   5. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

E. Preinstallation Conference:
   1. Prior to erection of metal building system components and associated Work, CONTRACTOR shall schedule and meet at the Site with the metal building

system erector, the installer of each component of associated Work, the installers of substrate construction to receive the metal building systems Work, the installers of other Work in and around metal building system that follows the metal building system Work, including mechanical Work, ENGINEER and other representatives directly concerned with performance of the Work. Review foreseeable methods and procedures related to the metal building system Work, including but not necessarily limited to, the following:

a. Review Project requirements and the Contract Documents.
b. Review required submittals, both completed and yet to be completed.
c. Review status of mock-ups.
d. Review status of foundation work, including approval of surface preparations, structural loading limitations and similar considerations.
e. Review construction schedule and availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
f. Review environmental conditions, other Project conditions, and procedures for coping with unfavorable conditions.
g. Review regulations concerning code compliance, environmental protection, health, safety, fire and similar considerations.
h. Review procedures needed for protection of metal building systems during the remainder of the construction period.
i. Review availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
j. Review required inspection, testing, and certifying procedures.

2. Record the discussions of the conference and the decisions and agreements or disagreements reached, and furnish a copy of the record to each party attending.
3. Record all revisions or changes agreed upon, reasons therefor, and parties agreeing or disagreeing with them.
4. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.

1.9 WARRANTY

A. General Warranty: The special warranties specified in this Article shall not deprive OWNER of other rights or remedies OWNER may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by CONTRACTOR under the Contract Documents.

B. Special Warranties:
1. Coating Wear Warranty: Furnish a written warranty, signed by the manufacturer and running to benefit of OWNER, agreeing to replace, for a period of ten years from the date of Substantial Completion, wall, roof and auxiliary system components and accessories finish that shows excessive wear, as specified, and stating that the coil and spray coated polyvinylidene fluoride based coating specified complies with the following:

a. Coating will not blister, peel, flake, check nor chip; and shall also be warranted against excessive color change, chalking and cracking, spalling, crazing, or from otherwise losing adhesion for a period of twenty years from the date of installation, to the extent that such shall create unsightly conditions, impair the intended architectural qualities of the building or otherwise fail to meet performance criteria specified, when viewed from a distance of 5 feet from the item.

b. In the event that the coil coated polyvinylidene fluoride based coating fails to meet the specified standards the manufacturer shall, at his own expense, replace or field paint, at the discretion of OWNER, all areas affected by the failure. In the event that repainting is selected, it shall be done at mutually agreeable intervals throughout the term of the warranty.

c. The warranty does not apply where any failure is caused by accidents, or any external conditions or forces beyond the control of the manufacturer.

2. Material and Workmanship Warranty: Furnish a written warranty, signed by the manufacturer and running to benefit of OWNER, agreeing to replace metal building system components that fail in material or workmanship within three years of the date of Substantial Completion. Failure of materials or workmanship shall include, but is not limited to, leakage or air infiltration, deflections, or deterioration of metal in excess of normal weathering, and in excess of performance criteria specified; and defects in, and improper arrangement of, the various parts, accessories, weatherstripping, and other components of the system.

3. Standing Seam Roof Panel Weathertightness: Furnish a full coverage no-dollar-limit written warranty on material and workmanship guarantying to pay for all materials and all labor reasonably required to repair the roofing system and to return it to a watertight condition if leaks occur due to ordinary wear and tear, secured by a recognized surety company and executed by an authorized representative of the manufacturer, running to the benefit of OWNER, agreeing to replace, for a period of 20 years from the date of Substantial Completion, standing seam metal roof panel assemblies and flashing that fail to remain water- and weather-tight. CONTRACTOR shall obtain all approvals and inspections as may be required by the manufacturer for warranty coverage.

1.10 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials from the same manufactured lot as the materials installed.
2. Provide a minimum of five percent excess over the required amount of metal wall panels, metal roof panel, roof insulation, gutters, downspouts, metal trim, flashing, nuts, bolts, screws, washers, and other required fasteners for building. Pack in cartons and store on the site where directed.

B. Do not provide partial containers or packages of materials. Round-up quantities to furnish only complete, unopened and undamaged containers and packages; with legible labels accurately representing contents of container or package indicating compliance with approved Samples and Shop Drawings, and matching materials actually installed.
   1. Submit quantities of each system component required for the Work, based on actual purchase order to manufacturer for materials to be used for this Project, with calculations establishing quantity of extra materials to be furnished to OWNER.

C. Do not furnish materials whose remaining shelf-life will be less than six months, at the time of Substantial Completion. Furnish only materials that are accompanied by a documented record of proof of being continuously stored and handled according to manufacturer's recommended storage and temperature limitations.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Performance Criteria:
   1. General:
      a. Standards: Comply with applicable standards, recommendations and specified publications of MBMA, AISC, ASCE 7 and FM 1-7, except to the extent more stringent requirements are specified or required by governing authorities having jurisdiction at the Site.
      b. Modifications: The metal building system requirements shown are based on the specific system shown. Other manufacturer's systems with equal performance characteristics may be considered. Within these limitations CONTRACTOR shall be responsible for the structural adequacy, detailing and fabrication of the entire metal building system, including anchorage, and to make whatever modifications of, and additions to, the details as may be required to fulfill the performance requirements as acceptable to ENGINEER. Maintain the visual design concept as shown, including member sizes, profiles, support locations and alignment of components, as judged solely by ENGINEER. Clearly identify, in a manner that is highlighted to ENGINEER, all proposed substitutions, modifications, variations, unspecified features and "or equal" products. Provide complete comparative data, with specified products, at time of Shop Drawing submission.
      c. Professional engineer, to whom design of the metal building system is delegated, shall prepare written requests for clarification of system performance criteria and for clarification of other requirements of the Contract Documents for CONTRACTOR to submit to ENGINEER.
   2. Metal Building System Design: Provide size, spacing, and spans shown, and as follows:

a. Primary Frame Type: Provide the following:
    1) Rigid Clear Span: Solid-member structural framing system without interior columns.
b. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, as follows:
    1) Provide load-bearing end-wall and corner columns, and rafters.
c. Secondary Frame Type: Manufacturer's standard rafters and the following girts:
    1) Exterior-framed (bypass) girts.
d. Eave Height: Manufacturer's standard height, as indicated by nominal height shown.
e. Bay Spacing: As shown on drawings and as determined by manufacturer.
f. Roof Slope: As shown on drawings. Manufacturer's standard for frame type required.
g. Roof System: Insulated metal roof panels. Refer to Section 07 41 13, Metal Roof Panels.
h. Exterior Wall System: Insulated metal wall panels. Refer to Section 07 42 13, Metal Wall Panels.
j. Structural Performance: Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
    1) Live Loads: Include vertical loads induced by the building occupancy. Include loads induced by personnel, materials, and equipment for roof live loads.
        a) Building Occupancy: As shown.
    2) Roof Snow Loads: Include vertical loads induced by the weight of snow, as determined by 50-year mean-recurrence-interval ground snow load at Site. Allow for unbalanced and drift loads.
    3) Wind Loads: Include horizontal loads induced by a basic wind speed corresponding to a 10-year mean-recurrence interval at Site.
    4) Collateral Loads: Include additional dead loads for items such as sprinklers, mechanical systems, electrical systems, material conveying systems and ceilings.
    5) Auxiliary and Impact Loads: Include dynamic live loads, such as those generated by cranes and material conveying equipment.
    6) Load Combinations: Design metal building systems to withstand the most critical effects of load factors and load combinations.
k. Deflection Limits: Design component assemblies to withstand design loads with deflections no greater than the following:
    1) Purlins and Rafters: Vertical deflection of L/240 of the span.
    2) Girts: Horizontal deflection of L/240 of the span.
    3) Roof Panels: Vertical deflection L/240 of the span.
    4) Wall Panels: Horizontal deflection of L/240 of the span.
l. Drift: Lateral deflection of the building frame at the roof line in relationship to the position of the floor or slab-on-grade shall be limited to metal building system manufacturer’s maximum for type of warrantied

construction specified, or not greater than allowed by MBMA, whichever is less.

m. Design secondary framing system to accommodate deflection of primary structure, construction tolerances, and to maintain clearances at openings.

n. Seismic Performance: Design metal building systems capable of resisting the effects of earthquake motions determined according to governing authorities having jurisdiction at the Site or ASCE 7, whichever is more stringent.

o. Thermal Movements: Provide metal building roof and wall panel systems designed for thermal movements. Employ detailing and fabrication techniques that prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects resulting from the following maximum change (range) in ambient and surface temperatures. Base design calculation on surface temperatures of materials caused by both solar heat gain and nighttime-sky heat loss.

1) Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

p. Wind-Uplift Resistance: Provide roof panel assemblies that meet requirements of UL 580 for the following wind-uplift resistance:

1) Class 90.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alliance Steel, Incorporated.
2. American Buildings Company.
3. American Steel Building Company, Incorporated.
4. Butler Manufacturing Company.
5. Ceco Building Systems.
6. Star Building Systems.
7. Steelox Systems Incorporated.
8. Varco-Pruden Buildings; a United Dominion Company.

2.3 STRUCTURAL FRAMING MATERIALS

A. Hot Rolled Structural Shapes and Plates: ASTM A36 or A529 Grade 50.

B. Steel Tubing or Pipe: ASTM A53, Grade B.

C. Steel Plate, Bar or Strip: ASTM A36 or A529 Grade 50.

D. W Shapes; ASTM A992

E. Structural Channels, ASTM A572, GRADE 50.

F. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, structural quality, Grade 50, with G60 coating designation; mill-phosphatized.

G. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755 and the following requirements:
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, G90 coating designation; structural quality.

H. Steel Joists: Provide joists, complying with SJI's requirements, manufactured with steel-angle top and bottom chord members, to produce joist types, end arrangements, and top chord arrangements indicated and required for secondary framing.

I. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy, hex-head structural steel bolts, heavy hex carbon steel nuts, and hardened carbon steel washers.
   1. Finish: Hot-dip zinc coating, ASTM A153, Class C.
   2. Direct-Tension Indicators: ASTM F959, Type 325 or Type 490.
      a. Finish: Hot-dip zinc coating, ASTM A153, Class C.

J. Anchor Rods, Bolts, Nuts, and Washers:
   1. Headed Bolts: ASTM A325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
   2. Washers: ASTM A36.

K. Primers: As selected by manufacturer for compatibility with finish paint systems specified in Section 09 91 00, Painting and capable of providing a sound substrate for Site-applied topcoats, despite prolonged exposure without topcoat protection.

2.4 PANEL MATERIALS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755, and the following:
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, G90 coating designation; structural quality.
   2. Surface: Smooth, flat, mill finish.

B. Panel Sealants: Provide the following:
   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape ½-inch wide and 1/8-inch thick.

2. Joint Sealant: ASTM C920; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant; of type, grade, class, and use classifications required to seal joints in panels and remain weathertight; and as recommended by metal building system manufacturer.

2.5 INSULATION MATERIALS

A. Fire-Test-Response Characteristics for Insulation: Provide insulation with the fire-test-response characteristics indicated, as determined by testing identical products in compliance with test methods specified below by a testing and inspecting agency acceptable to governing authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E84.

B. Mineral-Fiber-Blanket Insulation: Thermal insulation combining glass or slag/rock-wool fibers with thermosetting resins, complying with ASTM C665 and as follows:
   1. Type I: Unfaced.

C. Vapor-Retarder Facing: Complying with ASTM C1136, with permeance not greater than the following when tested according to ASTM E96, Desiccant Method:
   1. Composition: Polypropylene-faced, scrim-reinforced foil, with permeance not greater than 0.02 perm.
   2. Manufacturers: Provide products by one of the following manufacturers:
      a. CGI Silvercote, Incorporated.
      b. Lamtec Corporation.
      c. Owens-Corning Fiberglas Corporation.

2.6 DOOR AND FRAME MATERIALS

A. Refer to section 08 11 13, Hollow Metal Doors and Frames.

2.7 AUXILIARY AND ACCESSORY MATERIALS

A. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound, free of asbestos fibers, sulfur components, and other deleterious impurities.

B. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, 21ortland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, of consistency suitable for application, and with a 30-minute working time.

C. Shop Primer and Finish Painting: As specified in Section 09 91 00, Painting.

2.8 FABRICATION, GENERAL

A. Shop-fabricate bearing plates, and other plates as required for building erection, to the required sizes, sections, and profiles, complete with base plates welded in place, and with all required holes for anchoring or connections shop-drilled, or punched, to template dimensions.
   1. Shop Connections: Riveted, bolted, or welded.
   2. Site Connections: Bolted.

B. Fabricate components, and necessary field connections required for erection, to permit easy assembly and disassembly. Fabricate components such that once assembled they may be disassembled, repackaged, and reassembled with a minimum amount of labor and maximum salvageability.

C. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

D. Fabricate components in a manner that once assembled in the shop, they may be disassembled, repackaged, and reassembled at the Site.

E. Fabricate framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Cold-formed members shall be free of cracks, tears, and ruptures.

F. Primary Framing:
   1. Shop-fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted Site-assembly.
   2. Make shop connections by welding or by using high-strength bolts.
   3. Join flanges to webs of built-up members by a continuous submerged arc-welding process.
   4. Brace compression flange of primary framing by angles connected between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
   5. Weld clips to frames for attaching secondary framing members.

G. Secondary Framing:
   1. Shop-fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place.
   2. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
   3. Make shop-connections by welding or by using non-high-strength bolts.

   H. Shop-Painting: Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease, and other matter that might interfere with paint bond. Follow procedures

and substrate preparation recommendations of the painting manufacturers for the paint systems specified in Section 09900, Painting.

I. Factory-Priming for Site-Painted Finish: Where Site-painting after installation is shown or specified, apply the specified primer immediately after cleaning and pretreating.

2.9 STRUCTURAL FRAMING FABRICATION

A. Primary Framing:
   1. Provide metal building system manufacturer's standard structural primary framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
      a. Provide frames with attachment plates, bearing plates, and splice members. Factory drill for Site-bolted assembly. Provide frame span and spacing indicated.
      b. Slight variations in span and spacing may be acceptable if necessary to meet manufacturer's standard, as approved by ENGINEER.
   2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural steel shapes.
   3. Frame Configuration: Single gable.
   4. Exterior Column Type: Tapered.
   5. Rafter Type: Tapered.

B. Secondary Framing:
   1. Provide metal building system manufacturer's standard structural secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural steel sheet or roll-formed, metallic-coated steel sheet prepainted with coil coating, unless otherwise shown or specified.
   2. Purlins: Steel joists of depths indicated.
   3. Girts: C- or Z-shaped sections; fabricated from minimum 0.0598-inch thick steel sheet, built-up steel plates, or structural steel shapes. Form ends of Z-sections with stiffening lips angled 45 to 50 degrees to flange and with minimum 2-1/2-inch wide flanges.
      a. Depth: As shown.
   4. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 0.0598-inch thick steel sheet, built-up steel plates, or structural steel shapes; to provide adequate backup for both roof and wall panels.
   5. Flange and Sag Bracing: Minimum 1-5/8-inch by 1-5/8-inch structural steel angles, with a minimum thickness of 0.0598-inch, to stiffen primary frame flanges.
   6. Base or Sill Angles: Minimum 3-inch by-2-inch by 0.0747-inch thick, zinc-coated (galvanized) steel sheet.

7. Purlin and Girt Clips: Minimum 0.0747-inch thick, zinc-coated (galvanized) steel sheet.
8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0747-inch thick, zinc-coated (galvanized) steel sheet.
9. Framing for Openings: Channel shapes; fabricated from minimum 0.0598-inch thick, cold-formed, structural steel sheet or structural steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

C. End-Wall Framing:
1. Provide metal building system manufacturer's standard primary end-wall framing fabricated for Site-bolted assembly.
2. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural steel sheet; with minimum thickness of 0.0747-inch.
3. End-Wall Rafters: C-shaped, cold-formed, structural steel sheet; with minimum thickness of 0.0598-inch.

D. Bracing: Provide adjustable wind bracing as follows:
1. Rods: ASTM A36; ASTM A572, Grade D; or ASTM A529, Grade 50; 1/2-inch diameter steel; threaded full length or threaded a minimum of 12 inches at each end.
2. Angles: Fabricated from structural steel shapes to match primary framing, of size required to withstand design loads.
3. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural steel shapes to match primary framing; of size required to withstand design loads.
4. Fixed-Base Columns: Fabricate from shop-welded, built-up steel plates or structural steel shapes to match primary framing; of size required to withstand design loads.
5. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.

E. Bolts: Provide shop-painted bolts, unless structural framing components are in direct contact with roof and wall panels. Provide galvanized bolts when structural framing components are in direct contact with roof and wall panels.

2.10 ROOF PANEL FABRICATION

A. Refer to Section 07 41 13, Metal Roof Panels.

2.11 WALL PANEL FABRICATION

A. Refer to Section 07 42 13, Metal Wall Panels.

2.12 FASCIA AND SOFFIT PANEL FABRICATION

A. Fascia Panels: Manufacturer's standard panels complying with the following:
   1. Match roof panel profile and material.
      a. Material: Zinc-coated (galvanized) steel.
      b. Yield Strength: 50-ksi.
      c. Metal Thickness: 0.0299-inch.
      d. Joint Type: As standard with manufacturer.
      e. Clip System: Floating to accommodate thermal movement.

B. Soffit Panels: Manufacturer's standard panels complying with the following:
   1. Flat Panels: Fabricate from 50-ksi steel sheets, factory-formed to provide flat panel with 16-inch coverage. Panel shall be 1-inch deep. Design side laps for mechanical attachment to structure by interlocking panel edges and securing panels with concealed fasteners. Factory-apply sealant at each interlocking joint. Comply with the following:
      a. Material: Zinc-coated (galvanized) steel.
      b. Metal Thickness: 0.0299-inch.

C. Finishes: Finish panel surfaces to match adjacent panels as follows:
   1. Fascia Panels: Match finish and color of roof panels.
   2. Soffit Panels: Match finish and color of roof panels.

2.13 DOOR AND FRAME FABRICATION

A. Refer to Section 08 11 13, Hollow Metal Doors and Frames.
   1. Finish Hardware: As specified in Section 08 71 00, Door Hardware.

2.14 AUXILIARY SYSTEM COMPONENTS AND MISCELLANEOUS ACCESSORIES

A. Accessories shall be as specified in Section 8 of the Recommended Guide Specifications in the MBMA Manual, including gutters and downspouts.
   1. Provide sheet metal accessories of same material and in same finish as roof and wall panels, unless otherwise specified.

B. Gutters and Downspouts: Refer to Section 07 71 00, Roof Specialties.

C. Contour Eave and Gable Trim: Provide the following:
   1. Gable and eave trim shall be contour type fabricated from 26-gage galvanized steel, ASTM A525, G90 coating.
   2. Gable and eave trim shall have a factory applied paint finish.
   3. Install preformed corner closures to match the configuration of the gable and eave trim.

4. Install preformed rubber weatherseals to completely fill the roof panel corrugation voids prior to installation of eave trim.
5. Install preformed wall closures to completely fill the wall panel corrugation voids prior to installation of eave and gable trim. Wall closures shall be 26-gage galvanized steel factory painted in slate black.

D. Flashing and Trim:

1. Trim and wall panel transitions and other wall accessories for doors and windows and other openings through the metal panels shall be as required to coordinate with doors, window walls and other components specified in other Sections and Contracts.
2. Provide manufacturer's standard profiles to the extent possible. Custom fabricate profiles where required, or shown, and to accommodate the Work of other Sections and Contracts. Provide extruded aluminum trim with polyurethane thermal break for all window wall openings.
3. Form flashing and trim from 0.0179-inch thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil-coating.
4. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent roof or wall panels.
5. Door Head and Jamb Opening Trim: Minimum 0.028-inch thick steel sheet. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
6. Base Molding Trim: Provide continuous interior base moldings in all perimeter wall areas except toilet rooms, fabricated from 22-gage galvanized steel. Finish shall be slat black. Provide base molding 3-7/8-inches high by 3/4-inch wide with a sloping top.
7. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

E. Personnel, Louver and Overhead Door Openings: Provide galvanized steel headers, posts, drip gutters and door post flashing and trim all coordinated with selected metal wall panel system for type and location.

F. Fasteners:

1. Sheet Panel Fasteners: Manufacturer's standard system of self- tapping screws, bolts and nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.
2. Provide metal-backed neoprene washers under heads of fasteners bearing on weather side of panels.
3. Locate and space fastenings for true vertical and horizontal alignment. Use appropriate fastening tools to obtain controlled uniform compression, for positive seal without rupture of neoprene washer.
4. Provide fasteners with heads matching color of roofing or siding sheets by means of plastic caps or factory-applied coating. Provide self-tapping screws, bolts,

nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Comply with the following:

a. Fasteners for Roof and Wall Panels: Refer to Section 07 41 13, Metal Roof Panels, and Refer to Section 07 42 13, Metal Wall Panels..

5. Fasteners for Flashing and Trim: Blind stainless steel rivets or stainless steel self-drilling screws with hex washer head.

G. Closures: Closed-cell, laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match roof and wall panel profile. Provide closure strips where shown or as required to provide weathertight construction.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the areas and conditions under which the metal building systems are to be erected and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

A. Clean substrates of all substances, including grease, oil, rolling compounds, incompatible primers, and loose mill scale, that may impair bond of materials.

B. Clean and prepare items to be finished with Site-applied coatings in compliance with Section 09 91 00, Painting.

3.3 ERECTION

A. Place and secure metal building systems in accordance with approved Shop Drawings, and the Contract Documents.

B. Do not field cut, drill, or alter structural members without written approval from ENGINEER.

C. Set structural framing in locations and to elevations indicated and according to AISC specifications. Maintain structural stability of frame during erection.

D. Baseplates, Leveling Plates and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces before setting baseplates and bearing plates. Clean bottom surface of baseplates and bearing plates.

1. Set baseplates and bearing plates for structural members on wedges, shims, or setting nuts.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of baseplate or bearing plate before packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
    a. Comply with manufacturer's written instructions for proprietary grout materials.

E. Align and adjust framing members before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Make adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

F. Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts. Tighten bolts by turn-of-the-nut method.

G. Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts. Hold rigidly to a straight line by sag rods.
1. Provide rake or gable purlins with tight-fitting closure channels and fascia.
2. Locate and space wall girts coordinated with door and window arrangements and heights.
3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where shown. Tighten rod and cable bracing to avoid sag.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to building structural frame.

3.4 ROOF PANEL INSTALLATION

A. Refer to Section 07 41 13, Metal Roof Panels.

3.5 WALL PANEL INSTALLATION

A. Refer to Section 07 42 13, Metal Wall Panels.

3.6 FASCIA AND SOFFIT PANEL INSTALLATION

A. General: Provide panels full width of fascia and soffits. Install panels perpendicular to support framing.
   1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Install panels with vertical edges plumb. Lap ribbed or fluted panels one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
   2. Site-cutting of fascia and soffit panels with a torch is not permitted.
   3. Fasten flashing and trim around openings and similar elements with self-tapping screws.
   4. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
   5. Use stainless steel fasteners for exterior applications and galvanized fasteners for interior applications.
   6. Locate and space fastenings in true vertical and horizontal alignment.

B. Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fascia meet soffits, along lower panel edges, and at perimeter of all openings.

C. Soffit Panels: Flash and seal panels with weather closures where soffit meets walls and at perimeter of all openings.

3.7 INSULATION INSTALLATION

A. General: Install insulation concurrently with panel installation, according to manufacturer's written instructions and as follows:

3.8 DOOR AND FRAME INSTALLATION

A. General: Comply with manufacturer's written instructions for installing doors, hardware, operators, and other door components. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant as specified in Section 07 92 00.

B. Personnel Doors and Frames: Install doors and frames straight, level, and plumb. Securely anchor frames to building structure. Set units with maximum 1/8-inch clearance between door and frame at jambs and head and maximum 3/4-inch clearance between door and floor.

C. Finish Hardware: Install finish hardware as specified in Section 08 71 00.

3.9 AUXILIARY SYSTEM COMPONENTS AND ACCESSORY INSTALLATION

A. General: Install gutters, downspouts, ventilators, louvers, and other accessories according to manufacturer's written instructions, with positive anchorage to building and weathertight mounting. Coordinate installation with flashings and other components.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
   3. Pipe Flashing: Form flashing around pipe penetration and roof panels. Fasten and seal to roof panel as recommended by manufacturer.
   4. Dissimilar Materials: Separate metal from incompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet on centers using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on centers in between.
   1. Tie downspouts to underground drainage system indicated.

3.10 SITE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency to perform Site quality control testing.

B. Extent and Testing Methodology: Testing and verification procedures will be required of high-strength bolted connections.
   1. Bolted connections will be visually inspected.
   2. Field-bolted connections will be tested and verified according to procedures in RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A325 or A490 Bolts."

C. Testing agency will report test results promptly and in writing to CONTRACTOR and ENGINEER.

3.11 ADJUSTING, CLEANING AND PROTECTION

A. Doors: After completing installation, lubricate, test, and adjust doors to operate easily, free from warp, twist, or distortion.

B. Touchup Painting: Immediately after erection, clean, prepare, and prime or reprime welds, bolted connections, and abraded surfaces of prime-painted primary and secondary framing, accessories, and bearing plates, as specified in Section 09 91 00, Painting.

C. Roof and Wall Panels: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.
   1. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

++ END OF SECTION ++

DIVISION 23 – HEATING, VENTILATION, AND AIR CONDITIONING

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SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC DUCTWORK, PIPING, AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install hangers and supports complete with required appurtenances for HVAC ductwork, piping, and equipment.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the hangers and supports for HVAC ductwork, piping, and equipment Work.

C. Related Sections:
   1. Section 03 60 00, Grouting.
   2. Section 05 05 33, Anchor Systems.
   3. Section 05 12 00, Structural Steel Framing.
   4. Section 05 50 13, Miscellaneous Metal Fabrications.

1.2 REFERENCES

A. American National Standards Institute (ANSI).
   1. ANSI B1.1 – Unified Inch Screw Threads (ASME B1.1).

B. American Society of Civil Engineers (ASCE).
   1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures.

C. American Society for Testing and Materials (ASTM).
   1. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
   2. ASTM A47/A47M – Standard Specification for Ferritic Malleable Iron Castings.
   3. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   6. ASTM A575 – Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.

7. ASTM A668/A688M – Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.

D. American Welding Society (AWS).
   1. AWS B2.1 – Specification for Welding Procedure and Performance Qualification.

E. Federal Specifications (FS).
   1. FS WW-H-171 – Hangers and Supports, Pipe.

F. Manufacturers Standardization Society (MSS).
   1. MSS SP 58 – Pipe Hangers and Supports-Materials, Design and Manufacture.
   2. MSS SP 69 – Pipe Hangers and Supports - Selection and Application.

G. National Fire Protection Association (NFPA).
   1. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.

H. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
   1. HVAC Duct Construction Standards – Metal and Flexible.
   2. Seismic Restraint Manual: Guidelines for Mechanical Systems.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Minimum of five years of experience producing substantially similar equipment and able to show evidence of at least five installations in satisfactory operation for at least five years in the continental United States.
      b. Equipment shall be manufactured in the United States.
   2. Installer:
      a. Engage an experienced installer to perform the work of this Section who has specialized in installing hangers and supports for HVAC ductwork, piping, and equipment similar to that required for this Project and who is acceptable to manufacturer.
      b. Submit name and qualifications to Engineer along with the following information on a minimum of three successful projects:
         1) Names and telephone numbers of owners, architects or engineers responsible for projects.
         2) Approximate contract cost of the hangers and supports for HVAC ductwork, piping, and equipment.
         3) Amount of area installed.
   3. Welding:
      a. Qualify processes and operators in accordance with AWS B2.1 as appropriate for material to be welded.

b. Provide certification that operators employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within previous 12 months. Ensure that all certifications are current.

B. Component Supply and Compatibility:
1. Obtain all equipment included in this Section regardless of the component manufacturer from a single hangers and supports for HVAC ductwork, piping, and equipment manufacturer.
2. Require the hangers and supports for HVAC ductwork, piping, and equipment manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall equipment assembly by the hangers and supports for HVAC ductwork, piping, and equipment manufacturer.
4. Hangers and supports shall be coordinated with and compatible with metal building manufacturer's requirements and recommendations.

C. Regulatory Requirements:
1. International Building Code (IBC).
2. National Fire Protection Association (NFPA).
3. Local and State Building Codes and Ordinances.
4. Permits: Contractor shall obtain and pay for all required permits, fees and inspections.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
1. Shop Drawings:
a. Drawings showing fabrication methods, assembly, accessories, and installation details.
b. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
c. Drawings showing floor supported components and installation arrangement.
2. Product Data:
a. Manufacturer's literature, illustrations, specifications, weight, dimensions, required clearances, materials of construction, and performance data for all equipment.
b. Complete component list.
c. Detailed description of each component.
d. Catalog cut sheets for each component.
e. Deviations from Contract Documents. Any exceptions to the Contract Documents must be clearly defined. Contractor shall be responsible for any additional expenses that may occur due to any exception made.
f. Other technical data related to specified material and equipment as requested by Engineer.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Independent certification reports.
   2. Manufacturer Instructions:
      a. Instructions and recommendations for handling, storing, protecting the equipment.
      b. Installation Data.
   3. Source Quality Control Submittals:
      a. Factory test reports.
   4. Qualifications Statements:
      a. Manufacturer, when requested by Engineer.
      b. Installer, when requested by Engineer.
      c. Welding, when requested by Engineer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
   1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
   2. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to prevent delay of that Work.
   3. Comply with manufacturer's recommendations for rigging of equipment.

B. Storage and Protection:
   1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
   2. Store all equipment in covered storage off the ground and prevent condensation and in accordance with the manufacturer's recommendations for long-term storage.

C. Acceptance at Site:
   1. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Engineer, in writing, if any loss or damage exists to equipment or components. Replace lost equipment or components and repair damage to new condition, in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design Criteria:
   1. Seismic Requirements:
      a. All HVAC ductwork, piping, and equipment shall be provided with seismic restraints in accordance with the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, latest edition.

b. Seismic restraints shall be designed in accordance with the seismic provisions of the International Building Code (IBC) and ASCE 7 in conjunction with the current Georgia amendments to the International Building Code to the extent that the most stringent provisions are utilized in developing the design seismic forces.
c. Refer to the Structural Drawings for site and structure specific seismic design criteria.

2. Designs generally accepted as exemplifying good engineering practice and using stock or production parts shall be utilized wherever possible.
3. Accurate weight balance calculations shall be made to determine the required force at each hanger and support location and the weight load at each force concentration point.
4. Hangers and supports shall be capable of supporting and restraining HVAC ductwork, piping, and equipment in all conditions of operation. They shall allow free expansion and contraction, and prevent excessive stress resulting from transferred weight being induced into the HVAC ductwork, piping, and equipment.
5. Hangers and supports shall be designed so that they cannot become disengaged by movements of the supported HVAC ductwork, piping, and equipment.
6. Rod length shall be limited to a maximum length of eight linear feet.
7. HVAC ductwork, piping, and equipment that cannot be hung by rod and hanger arrangement shall be floor or wall supported.
8. All structural components shall be designed based on static and dynamic loads imposed by the supported HVAC ductwork, piping, and equipment and shall include a safety factor of 2 for the yield strength. Minimum angle sizes shall be 2-inch x 2-inch x1/4-inch.
9. Load ratings, materials and installation shall be consistent with the recommendations from the latest edition of MSS SP 58, MSS SP 69, and FS WW-H-171.

2.2 MANUFACTURERS

A. Manufacturer: Provide product of one of the following:
   1. Erico International Corporation.
   2. Anvil International.
   3. Or equal.

2.3 DETAILS OF CONSTRUCTION

A. Materials:
   1. Hangers, supports, restraints, and appurtenances located in corrosive areas shall be hot dipped galvanized steel in accordance with ASTM A123/A123M and ASTM A153/A153M.
   2. Hangers, supports, restraints, and appurtenances located in non-corrosive or dusty areas shall be hot dipped galvanized steel in accordance with ASTM A123/A123M and ASTM A153/A153M.

3. Hangers, supports, restraints, and appurtenances located outdoors shall be hot dipped galvanized steel.
4. Steel used for the support of uninsulated copper piping or plastic piping shall be PVC coated.
5. Refer to the Corrosive and Non-Corrosive Area Designation Table shown on the Drawings for a list of these areas.

B. Components of hangers and supports shall conform to the following:
1. Bolts: ASTM A307, Grade A, unless otherwise specified below.
2. Forgings: ASTM A668/A688M.
3. Malleable Iron: ASTM A47/A47M.
4. Rods and Bars: ASTM A575.
5. Threads: Unified Screw Threads, Class 2A and 2B, ANSI B1.1.
6. Structural Steel: ASTM A36/A36M.

C. Hanger Attachments: The following types of attachments shall be considered acceptable:
1. Adjustable Steel Clevis: FS WW-H-171E, Type 1.
2. Steel Double Bolt Pipe Clamp: FS WW-H-171E, Type 3.
3. Steel Pipe Clamp: FS WW-H-171E, Type 4.
4. Adjustable Swivel Pipe Ring: FS WW-H-171E, Type 6.
5. Adjustable Steel Band Hanger: FS WW-H-171E, Type 7.
6. Riser Clamp: FS WW-H-171E, Type 8.
7. Light-Duty Clevis Hanger: FS WW-H-171E, Type 12.
8. Long Clips: FS WW-H-171E, Type 26.
9. Offset J-Hooks: FS WW-H-171E, Type 27.
10. Steel Pipe Covering Protection Saddle: FS WW-H-171E, Type 40A.
11. Insulation Protection Shield: FS WW-H-171E, Type 41.
12. Pipe Saddle Support: FS WW-H-171E, Type 37.
13. Pipe Stanchion Saddle: FS WW-H-171E, Type 38.
14. Pipe Saddle Support with Base: FS WW-H-171E, Type 36.
15. Adjustable Roller Hanger: FS WW-H-171E, Type 42.

D. Structural Attachments: The following types of attachments shall be considered acceptable:
1. Side Beam Clamp: FS WW-H-171E, Type 20.
2. Center I-Beam Clamp: FS WW-H-171E, Type 21.
3. Welded Steel Bracket: FS WW-H-171E, Types 32 and 33.
4. Side Beam Bracket: FS WW-H-171E, Type 35.

E. Hanger Rod Attachments: Use as required to complete assembly:
1. Forged Steel Clevis: FS WW-H-171E, Type 14.
2. Adjustable Turnbuckle: FS WW-H-171E, Type 15.
3. Forged Steel Welders Eye Nut: FS WW-H-171E, Type 17.

F. Concrete anchorage shall be provided in accordance with Section 05 05 33, Anchor Systems.

G. Structural steel shall be provided in accordance with Section 05 12 00, Structural Steel Framing.

H. Miscellaneous metal fabrications shall be provided in accordance with Section 05 50 13, Miscellaneous Metal Fabrications.

2.4 SOURCE QUALITY CONTROL

A. Shop Tests:
   1. Equipment shall be completely manufactured and pre-assembled in accordance with Reference Standards. Perform the following tests and inspections at factory before shipment:
      a. Tested and inspected for approval as a unit by Underwriters Laboratories Inc., UL Label or equal.
      b. Factory test equipment to ensure that the entire package has been properly fabricated and assembled, that the package meets the specified performance requirements including manufacturer's data report.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials and equipment will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Take field measurements where required prior to installation to ensure proper fitting of Work.

3.2 INSTALLATION

A. General:
   1. Install the equipment in accordance with the Contract Documents and by manufacturer's instructions and recommendations. Obtain written interpretation from Engineer in the event of conflict between manufacturer's instructions and recommendations and the Contract Documents.
   2. Install in accordance with Laws and Regulations.
   3. Do not modify structures to facilitate installation of equipment, unless approved in writing by Engineer.
   4. Installation to conform to requirements of all local and state codes.

3.3 CLEANING

A. Thoroughly clean all equipment and accessories prior to installation.

B. Remove all dirt, rust, dust, etc. from equipment and accessories after installation.

C. Remove and dispose of all debris and waste from the Site resulting from installation.

3.4 SCHEDULES

A. Hangers and Supports for HVAC Equipment:
   1. Provide spacing and hanger rod sizes in accordance with equipment manufacturer's installation instructions.

+ + END OF SECTION + +

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified, and required to perform the testing, adjusting and balancing for HVAC as specified herein.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before the testing, adjusting and balancing for HVAC Work.

C. Related Sections:
   1. Section 09 91 00, Painting.

1.2 QUALITY ASSURANCE

A. Balancer's Qualifications:
   1. Balancer shall have a minimum of five years of experience of testing, adjusting and balancing substantially similar equipment, and shall be able to show evidence of at least five adjustments in satisfactory operation for at least five years.
   2. Submit biographical information on employee proposed to directly supervise the testing, adjusting and balancing for HVAC Work.
   3. Submit proof of certification by National Environmental Balancing Bureau (NEBB) and/or Association Air Balance Council (AABC).

B. Regulatory Requirements: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. Associated Air Balance Council, (AABC).
   2. Air Moving and Conditioning Association, (AMCA).
   3. American National Standards Institute, (ANSI).
   4. American Refrigeration Institute, (ARI).
   5. Institute of Electrical and Electronic Engineers, (IEEE).
   6. National Electrical Code, (NEC).
   7. National Electrical Manufacturers' Association, (NEMA).
   8. National Environmental Balancing Bureau, (NEBB).
   9. National Fire Protection Association, (NFPA).

10. Sheet Metal and Air Conditioning Contractors' National Association, (SMACNA).
11. Underwriters' Laboratories, Incorporated, (UL).
12. Local and State Building Codes and Ordinances.
13. Permits: Contractor shall obtain and pay for all required permits, fees and inspections.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Submit samples of data sheets on each item of equipment.
      b. Submit data sheets on each item of testing equipment required.
      c. Include name of devices, manufacturer's name, model number, latest date of calibration and correction factors.

B. Informational Submittals: Submit the following:
   1. Site Quality Control Submittals:
      a. Submit specimen copies of report forms for Engineer's review.
      b. Forms shall be 8-1/2 by 11-inch paper for loose-leaf binding, with blanks for listing all required testing ratings and certification of report.
      c. Reports shall be on the organizations approved forms imprinted with the company's name.
      d. Certified report, outlining procedure used to balance the system and the types of measuring devices used.
      e. Submit test results on approved forms in typed format.
      f. Submit a minimum of three certified copies of required test reports to the Engineer for review.
   2. Qualifications Statements:
      a. Submit balancer's qualifications

C. Closeout Submittals: Submit the following
   1. Operations and Maintenance Manuals:
      a. Submit complete Installation, Operation and Maintenance Manuals, including, test reports, maintenance data and schedules, description of operation, and spare parts information.
      b. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01 78 23, Operations and Maintenance Data.

1.4 OPERATING INSTRUCTIONS

A. Written startup and field test reports must be submitted to Engineer and Owner for approval prior to Owner's acceptance for responsibility.

1.5 CORRECTIVE ADJUSTMENTS

A. Should corrective measures caused by faulty installation require re-testing, adjusting and balancing, such Work shall be at no additional cost to the Owner.

B. Inspections:
   1. Inspect all equipment for proper operation prior to testing, adjusting and balancing.
   2. Fan Belt Deflection: Not less than 1/4-inch or more than 1/2-inch.

PART 2 – PRODUCTS

2.1 GENERAL

A. Contractor shall provide all necessary instrumentation, tools, ladders, etc. to complete all air and hydronic balancing tests and adjustments.

B. Instrumentation shall be in accordance with NEBB, AABC, or SMACNA requirements and shall be calibrated to the accuracy standards demanded by these organizations.

C. Flow-measuring hoods (manufactured, not fabricated) shall be acceptable for measurement of ceiling diffuser performance only.

D. Contractor shall assume full responsibility for safe keeping of all instrumentation during the course of the Work.

2.2 AIR BALANCE INSTRUMENTS

A. Provide all velometers, anemometers, pitot tubes, differential air pressure gages, manometers, hook gages, static pressure probe units, etc. as may be required to perform all air balance tests of HVAC equipment, ducts, registers, grilles, etc.

2.4 SYSTEM PERFORMANCE MEASURING INSTRUMENTS

A. Provide insertion thermometers, sling psychrometers, tachometers, revolution counters, clamp-on volt-ammeter recorders, and other instruments as required to measure all facets of the complete HVAC system performance.

PART 3 – EXECUTION

3.1 GENERAL

A. All testing, adjusting, and balancing of air systems shall be performed in compliance with the standard procedure manual published by the testing, adjusting, and balancing organization affiliated with Contractor. Contractor shall

submit one copy of the standard procedure manual to the Engineer for their records.

B. Contractor shall be solely responsible for the protection and safeguarding of the Work and shall provide every protection against accidents, injury, and damage to persons and property.

C. Contractor shall keep dust, dirt, and debris to an absolute minimum and reinstall all removed ceiling components to their original positions at the end of each day's Work.

D. Contractor shall be fully responsible for removal and reinstallation of ceiling system and replacement of any component damaged.

E. Contractor shall install additional access panels at no extra cost to the Owner, as is required to gain access to equipment concealed above ceilings, behind walls, or any other concealed space.

F. Air systems shall be tested, adjusted, and balanced with clean filters.

3.2 JOB CONDITIONS

A. Heating, ventilating and air conditioning equipment shall be completely installed and in continuous operation, as required, to accomplish the testing, adjusting and balancing Work specified.

B. Testing, adjusting and balancing shall be performed when outside ambient conditions are approximate to the design conditions for all heating and cooling functions.

D. Test, adjust and balance all air systems, ductwork, etc. and their control systems.

3.3 INSPECTION

A. Pre-Startup Inspection:
   1. Verify proper equipment mounting and setting.
   2. Verify that control, interlock and power wiring is complete.
   3. Verify alignment of motors and drives.
   4. Verify proper piping connections and accessories.
   5. Verify that lubrication is completed.

B. First Run Observations:
   1. Verify direction of rotation.
   2. Verify setting of safety controls.
   3. Monitor heat build-up in bearings.
   4. Check motor loads against nameplate data.

C. Equipment Check:
   1. Verify proper overload heater sizes.
   2. Verify function of safety and operating controls.
   3. Verify proper operation of equipment.
   4. Report on inspection, observation and checking procedures.

3.4 AIR SYSTEMS

A Test, adjust and balance systems in accord with the AABC “National Standards for Field Measurements, Total System Balance, Air Distribution, Hydronics Systems”, Volume One, Number 81266, or SMACNA's “Air Handling” Specification.

B. Preliminary:
   1. Identify and list size, type and manufacturer of all equipment to be tested, including air terminals.

C. Central Systems:
   1. Test rpm for all equipment, including adjusting of each fan, air handling unit, and air conditioning unit to design requirements within the limits of mechanical equipment provided.
   2. Test and record motor voltages and running amperes including motor nameplate data, and starter heater ratings for each unit as listed above.
   3. Make pitot tube traverse of main supply, exhaust and return ducts, determine cfm at all fans and units and adjust fans and units to within five percent of design requirements.
   4. Test and record system static pressure, suction and discharge.
   5. Test and adjust system for design outside air, (cfm).
   6. Test and adjust system for design recirculated air, (cfm).
   7. Test and record heating apparatus entering air temperatures, (dry bulb).
   8. Test and record cooling apparatus entering air temperatures, (dry bulb and wet bulb).
   9. Test and record heating apparatus leaving air temperatures, (dry bulb).
   10. Test and record cooling apparatus leaving air temperatures, (dry bulb and wet bulb).
   11. Record all fan and air handling unit speeds.
   12. Record air quantity delivered by each fan and air-handling unit.

D. Distribution:
   1. Adjust volume dampers, control dampers, splitter dampers, etc., to proper design CFM in main ducts, branch ducts, and zones.

E. Air Terminals:
   1. Identify each air terminal as to location and determine required flow reading.

2. Test and adjust each air terminal to within tolerance of design requirements as listed below.
    a. Diffusers and Supply Registers: 0 percent to +10 percent.
    b. Return Registers: 0 percent to -10 percent.
    c. Exhaust Registers: 0 percent to -10 percent.
3. Test procedure on air terminals shall include recording comparison of required cfm and observed cfm, adjustment of terminal, and recording of final cfm.
4. Adjust flow patterns from air terminal units to minimize drafts to the extent that the design and equipment permits.

F. Verification:
1. Prepare summation of readings of observed cfm for each system, compare with required cfm, and verify that duct losses are within specified allowable range.
2. Verify design cfm at fans as described above.
3. If the air systems are not properly balanced, Contractor shall rebalance and recheck all data in the presence of the Engineer and as accepted by the Engineer.

3.6 AUTOMATIC CONTROL SYSTEM

A. In cooperation with the control manufacturer's representative, set and adjust automatically operated devices to achieve required sequence of operations.

B. Testing organization shall verify all controls for proper calibration and list those controls requiring adjustment by control system installer.

3.7 MAINTENANCE AND REPAIR

A. Maintenance and Repair:
1. Provide all labor, tools and equipment to provide a Preventive Maintenance Program and make repairs for all equipment and controls during the one-year correction period after the Final Acceptance by Owner. Contractor shall provide the following services for the same period of one year:
    a. Receive calls for all problems and take steps to immediately correct deficiencies, which may exist.
    b. Provide a monthly inspection of all equipment, and record the findings on a checklist hereinafter specified.
    c. Provide a Preventive Maintenance Schedule for the principle items of equipment.
    d. Respond to Owner and make repairs for all equipment and controls within 24-hours of notification by Owner.

B. Check List:
1. Provide a checklist and post a copy of it, where directed by the Owner.

2. Include each piece of equipment specified or shown.
3. Provide four columns for required quarterly inspections.
4. Provide columns for the following:
    a. Equipment condition.
    b. Equipment operation.
    c. Equipment lubrication.
    d. Preventive maintenance.
5. Preventive maintenance shall be performed in accordance with the manufacturer’s recommendations and accepted practice.

3.8 MANUFACTURER'S SERVICES

A. A factory trained representative shall be provided for installation supervision, start-up and test services and operation and maintenance personnel training services. The representative shall make a minimum of 2 visits, minimum 4 hours on-Site for each visit, to the Site. The first visit shall be for assistance in the installation of equipment. Subsequent visit shall be for checking the completed installation, start-up of the system. Manufacturer's representative shall test operate the system in the presence of the Engineer and verify that the equipment conforms to the requirements. Representative shall revisit the Site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

B. All costs, including travel, lodging, meals and incidentals, for additional visits shall be at no additional cost to the Owner.

+ + END OF SECTION + +

SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install instrumentation and control for HVAC complete and operational with accessories.
   2. The Work also includes:
      a. ATC panels.
      b. Space thermostats.
      c. Control actuators including linkage kits as required.
      d. Control panels and enclosures with all associated electrical wiring and components including all power supplies and accessories located in and on the control panels.
      e. Control relays, selector switches, push buttons, pilot lights, indicating lights, Hand-Off-Auto switches, High/Low selector switches and all accessories located in and on the ATC panels.
      f. Selector switches, push buttons, and indicating lights.
      g. Strobes and horns.
      h. 24 or 120 VAC power, control, and status wiring and conduit, unless otherwise indicated or shown on Electrical Drawings, from ATC panel to all remote devices, panels, equipment and 120 VAC fans (including but not limited to thermostats, occupancy sensors, motorized damper actuators, remote panels, interface panels, HV units, HVAC units, ACU units, fans, ceiling fans, etc). Each system shall include all conduit and wire for a complete and functional system.
      i. 120 VAC or 24 VAC power and control wiring and conduit between ATC panels and HVAC equipment unless otherwise indicated or shown on the Electrical Drawings. Each system shall include all conduit and wire for a complete and functional system.
      j. Motor starters where specified or required.
      k. Power disconnect switches where specified or required.
      l. Power transformers where specified or required.
      m. All wiring, conduit, equipment and devices to provide sequences of operation herein for complete and workable systems.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the instrumentation and control for HVAC Work.

C. Related Sections:
   1. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.
   2. Section 23 34 05, Metallic HVAC Fans.
   3. Section 26 05 05, General Provisions for Electrical Systems.
   4. Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables.
   5. Section 26 05 29, Hangers and Supports for Electrical Systems.
   6. Section 26 05 33.13, Rigid Conduits.
   7. Section 26 05 33.33, Pull Junction and Terminal Boxes.
   8. Section 26 05 53, Identification for Electrical Systems.
   9. Section 40 78 00, Panel Mounted Instruments and Devices.
   10. Other Division 23 Sections for general reference.

D. Products Furnished and Installed By Others:
   1. 120 VAC, 208 VAC, 230 VAC, 240 VAC and 480 VAC power and signal wiring and conduit where shown on the Electrical Drawings.
   2. Motor starters and disconnects except where specified under Division 23 are included under Division 26, Electrical.
   3. Miscellaneous other necessary controls and appurtenances that are required to be incorporated into the Work are provided by other Div 23 Sections. Contractor to review and coordinate for a complete system.

1.2 REFERENCES

A. Air-Conditioning, Heating, and Refrigeration Institute (AHRI).
   1. AHRI 880 – Performance Rating of Air Terminals.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
   1. ASHRAE Standard 62.1 – Ventilation for Acceptable Indoor Air Quality.

C. Institute of Electrical and Electronic Engineers (IEEE).
   1. IEEE 315 – Graphic Symbols for Electrical and Electronics Diagrams.

D. National Electrical Code (NEC).

E. National Electrical Manufacturers Association (NEMA).

F. National Fire Protection Association (NFPA).
   1. NFPA 79 – Electrical Standard for Industrial Machinery.
   2. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.

G. Underwriters Laboratories Inc. (UL).
   1. UL 94 – Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing.
   2. UL 181 – Factory-Made Air Ducts and Air Connectors.
   3. UL 508A – Industrial Control Panels.
   4. UL 873 - Temperature-Indicating and -Regulating Equipment.

5. UL 1449 – Surge Protective Devices.
6. UL 1995 – Heating and Cooling Equipment.

1.3 QUALITY ASSURANCE

A. General Requirements:
   1. The automatic temperature control system shall be furnished by a single supplier who shall assume unit responsibility for providing a complete and integrated system.
   2. All equipment, components and materials required shall be furnished by the single supplier who shall assume the responsibility for adequacy, performance and configuration of all items.
   3. All materials, equipment and installation shall be in strict accordance with requirements of Division 26, Electrical.

B. Qualifications:
   1. Supplier Qualifications:
      a. Minimum of five years of experience supplying substantially similar equipment and able to show evidence of at least five installations in satisfactory operation for at least five years in the continental United States.

C. Component Supply and Compatibility:
   1. Obtain all equipment included in this Section regardless of the component manufacturer from a single Supplier.
   2. Require the Supplier to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall equipment assembly by the Supplier.

D. Regulatory Requirements:
   1. National Electrical Code (NEC).
   2. National Fire Protection Association (NFPA).
   3. Underwriters Laboratories Inc. (UL).
   4. Local and State Building Codes and Ordinances.
   5. Permits: Contractor shall obtain and pay for all required permits, fees and inspections.

E. Certifications:
   1. ATC panels shall bear an approved label with all the necessary identification marks, electrical data, and any necessary cautions as required by the National Electric Code.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:

a. Drawings showing fabrication methods, assembly, accessories, installation details, and wiring diagrams.
b. Control schematics conforming to IEEE 315 standards. Complete control schematic and point to point internal and external wiring diagrams. Separate control schematics shall be provided for each panel.
c. Detailed drawings of control panel layout with graphics and plans showing interior and exterior equipment layout.
d. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.

2. Product Data:
   a. Manufacturer's literature, illustrations, specifications, weight, dimensions, required clearances, materials of construction, and performance data for all equipment.
   b. Complete component list.
   c. Detailed description of each component.
   d. Catalog cut sheets for each component.
   e. Sequence of operations description.
   f. Written confirmation that instrumentation and control for HVAC system will be fully compatible and interface properly with all equipment, control components and software furnished under this Section and other Sections.
   g. Deviations from Contract Documents. Any exceptions to the Contract Documents must be clearly defined. Contractor shall be responsible for any additional expenses that may occur due to any exception made.
   h. Other technical data related to specified material and equipment as requested by Engineer.
3. Testing Plans, Procedures, and Testing Limitations:
   a. Plan for performing required shop testing.
   b. Plan for performing required field testing.

B. Informational Submittals: Submit the following:
1. Written confirmation that control systems will be fully compatible and interface properly with all equipment, control components and software furnished under this Section and other Sections.
2. Supplier Instructions:
   a. Instructions and recommendations for handling, storing, protecting the equipment.
   b. Installation Data.
   c. Instructions for handling, start-up, and troubleshooting.
3. Source Quality Control Submittals:
   a. Written report presenting results of required shop testing.
   b. Factory test reports.
4. Field Quality Control Submittals:
   a. Written report presenting results of required field testing.
5. Supplier Reports:
   a. Submit written report of results of each visit to Site by Supplier's service personnel, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.

6. Qualifications Statements:
    a. Supplier, when requested by Engineer.

C. Closeout Submittals: Submit the following:
    1. Operations and Maintenance Data:
        a. Submit complete Installation, Operation and Maintenance Manuals, including, test reports, maintenance data and schedules, description of operation, and spare parts information.
        b. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01 78 23, Operations and Maintenance Data.
    2. Record Documentation:
        a. Contractor and supplier shall revise all instrumentation and control for HVAC system working drawings, submittals, and software documentation to reflect as-built conditions in accordance with requirements of the Contractor Documents.
        b. Provide half-size color coded line prints of wiring diagrams and any program or configuration printouts applicable to each automatic temperature control panel placed inside a clear plastic envelope and stored in the print pocket of each automatic temperature control panel.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
    1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
    2. Automatic temperature control system equipment shall be packaged at the factory prior to shipment to protect each item from damage during shipment and storage. Containers shall be protected against impact, abrasion, corrosion, discoloration and/or other damages.
    3. Clearly label contents of each container and provide information on the required storage conditions necessary for the equipment.

B. Storage and Protection:
    1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect metal enclosures and parts and other material from corrosion and deterioration.
    2. Store all equipment in covered storage off the ground and prevent condensation and in accordance with the manufacturer's recommendations for long-term storage.

C. Acceptance at Site:
    1. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Engineer, in writing, if any loss or damage exists to equipment or components. Replace lost equipment or components and repair damage to new condition, in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. System Description:
   1. Descriptions contained hereinafter are for guidance and to show the functions desired. They do not describe or specify all components required to interface with and control all equipment. All parts and equipment necessary to meet functional requirements shall be provided.
   2. Contractor shall be completely responsible for the proper operation and installation of all control systems herein specified. Contractor shall be responsible for coordination of all interfaces with other equipment, contractors, and work specified in other Sections and Divisions to achieve the required control operations.

B. Design Criteria:
   1. All instrumentation and automatic temperature control system components shall be heavy duty types, designed for continuous service in a water treatment plant environment.
   2. All sensing bulbs, capillaries and immersion sensors shall either be constructed of a non-copper corrosion resistant material or be installed in a separable stainless steel well, including all outdoor ambient sensor locations.
   3. Sensors, transmitters, and control devices located in corrosive areas shall be industrial grade, corrosion resistant, heavy-duty type. Refer to the Corrosive and Non-corrosive Area Designation Table found on the Drawings.
   4. The automatic temperature control system is to contain products from a single manufacturer, when possible, and to consist of equipment models, which are currently in production. All equipment provided is to be of modular construction and to be capable of field expansion.
   5. Design all logic and control loops to fail safe.
   6. All instrumentation and automatic temperature control system components shall be designed to return automatically to accurate measurement with 15 seconds upon power restoration after a power failure or when transferred to standby power supply.
   7. Surge protection shall be provided for all instruments and all other control system components, which could be damaged by electrical surges.
   8. All relays with interconnections to field devices shall be wired through terminal blocks.
   9. All panel mounted instruments, switches, and other devices shall be selected and grouped for functionality and arranged to present a coordinated appearance.
   10. All components furnished, including field and panel instruments, shall be tagged with the item number and nomenclature indicated on the Contract Documents and/or approved Shop Drawings.

C. Performance Criteria:

1. Provide all materials, equipment, sensors and control devices required to provide the Sequence of Operations described under Article 3.3, constructed and rated for the location in which they are installed.
2. Contractor shall refer to Section 23 05 05, General Provisions for Electrical Systems, and the Electrical Drawings for area classifications and ratings.
3. Hangers and Supports shall comply with applicable provisions of Section 26 05 29, Hangers and Supports For Electrical Systems.
4. All sensing bulbs, capillaries and immersion sensors shall either be constructed of a non-copper corrosion resistant material or be installed in a separable stainless steel well, including all outdoor ambient sensor locations.

2.2 SUPPLIERS

A. The instrumentation and control for HVAC systems shall be furnished by a single Supplier who shall assume responsibility for providing a complete and integrated system. The following suppliers are acceptable provided they meet the requirements of the Contract Documents:
    1. Johnson Controls Inc.
    2. Honeywell Automation and Control Solutions.
    3. Siemens.
    4. Trane.
    5. Or equal.

2.3 DETAILS OF EQUIPMENT

A. Line Voltage Space Thermostats (Non-Corrosive and Corrosive Environments):
    1. Product and Manufacturer: Provide one of the following:
        a. Model WCRT-100, as manufactured by Chromalox.
        b. Or equal.
    2. Sealed Noryl case.
    3. Shielded nickel-plated sensing bulb attached directly to thermostat enclosure.
    4. Thermostat Setpoint Range: 40 degrees F to 100 degrees F, with 2.5-degree F differential.
    5. Adjustable setpoints through dial on face.
    6. 120 VAC, 125 VA rating.
    7. Contacts shall have proper ampere rating for intended use.
    8. NEMA 4X rated.

B. Motorized Control Damper Actuators:
    1. Product and Manufacturer: Provide one of the following:
        a. Model AF Series, as manufactured by Belimo.
        b. Or equal.
    2. Electric direct coupled proportional and two position actuators.
    3. Proportional and two position as indicated in the Sequence of Operations.
    4. Spring return where specified.
    5. V-bolt and V-shaped cradle shaft attachment.

6. Electronic overload or digital rotation sensing circuitry to prevent damage to actuator throughout the rotation of actuator.
7. Spring return actuators shall be capable of either clockwise or counterclockwise spring return operation by changing mounting orientation.
8. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA DC control input and provide a 2 to 10 VDC or 4 to 20 mA DC operating range. Proportional control through a pulse width modulating signal is acceptable. Proportional control through floating (Tri-state) control is not acceptable. Actuators shall be capable of providing 2 to 10 VDC position feedback signals.
9. 24 VAC/VDC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC or more than 8 watts for DC applications. Actuators operating on 120 VAC power shall not require more than 10 VA.
10. Modulating actuators shall have an external, built in switch to allow the reversing of direction of rotation.
11. External manual gear release with manual crank to allow manual positioning of shaft.
12. Factory-mounted electrical cable and conduit fitting for connection to junction box.
13. Conforming to UL 873.
14. Actuator shall be provided with sufficient torque to open and close the device. Provide a minimum torque of 180-in-lb.
15. 120 VAC or 24 VDC.
16. NEMA Type 2 housing.
17. Accessories:
    a. Linkage kit.
    b. Mounting bracket.
    c. Auxiliary switches.
    d. Limit switches.
    e. Provide polycarbonate weather shield enclosure in all non-corrosive atmospheres and where specified on the Equipment Schedule.
    f. Provide NEMA 4X enclosure in all corrosive atmospheres, outdoors and where specified on the Equipment Schedule.

C. Control Panels and Enclosures:
    1. General Construction Requirements:
        a. Contractor shall provide all electrical components and devices, support hardware, fasteners, and interconnecting wiring required to make the control panels and/or enclosures complete and operational.
        b. Contractor shall locate and install all devices and components so that connections can be easily made and that there is ample room for servicing each item.
        c. Components for installation on panel exterior shall be submitted for approval.
        d. Contractor shall adequately support and restrain all devices and components mounted on or within the panel to prevent any movement.

e. All wiring to panel connections from field instruments, devices, and other panels shall be terminated at master numbered terminal strips, unless otherwise specified.
f. Contractor shall provide copper grounding studs for all panel equipment.
g. Contractor shall provide the following convenience accessories inside of each control panel:
    1) One 120 VAC, 20A duplex, grounding type receptacle.
h. No device shall be mounted less than 36-inches above the operating floor level, unless otherwise specified.
i. Panels shall be built in accordance with the NEC Article 409, Industrial Control Panels.

2. Identification:
    a. Contractor shall provide laminated plastic nameplates for identification of panels and components mounted thereon as follows:
        1) Nameplates shall be of 3/32-inch thick laminated phenolic type with white matte finish surface and black letter engraving.
        2) Panel identification nameplates to have 1/2-inch high letter engravings.
        3) Panel mounted component (e.g., control devices, indicating lights, selector switches, etc.) identification nameplates to have 1/4-inch high letter engravings.
        4) Nameplates shall be attached to the panel face with two stainless steel self-tapping screws.
        5) Nameplate engravings shall include the instrument or equipment tag number and descriptive title.
        6) Tag all internally mounted instruments in accordance with the following requirements:
            a) The identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.
            b) Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch diameter stainless steel wire rope.
            c) Identification tag shall be installed so that the numbers are easily visible to service personnel.
            d) Front of panel mounted instruments shall have the tag attached to rear of device.
        7) Tagging of the following items shall be accomplished with the use of adhesive plastic Brady USA, Inc. labels, or equal.
            a) Tag all electrical devices (e.g., relays, timers, power supplies) mounted within control panels and enclosures.
            b) Numerically tag all terminal blocks.
            c) Color code and numerically tag wiring at each end.
        8) Match Owner's existing wiring color code. Where no such code exists, color code and/or numerically code wiring as required by

applicable standards. All wiring not de-energized by the panel disconnect or circuit breaker shall be orange colored wire.

9) For all panels containing wiring not de-energized by the panel disconnect or circuit breaker, provide a warning nameplate on the front of the panel stating "WARNING ORANGE WIRING NOT DE-ENERGIZED BY PANEL DISCONNECT". The nameplate shall be orange with black 1/4-inch high letter engravings and shall be attached to the panel face with stainless steel screws and adhesive.

3. Panels and Enclosures:
   a. General:
      1) Panels and enclosures shall meet the NEMA requirements for the location that they are to be installed. Refer to Division 26 Specification Sections.
      2) Panels and enclosures shall meet the NEMA requirements for the type specified.
      3) Sizes shown are estimates. Contractor shall furnish panels and enclosures amply sized to house all equipment, instruments, front panel mounted devices, power supplies, power distribution panels, wiring, and other components installed within.
   b. General Construction Features:
      1) Fabricate enclosures using minimum 14-gauge steel for wall-mounted enclosures. Steel shall be free of pitting and surface blemishes.
      2) Contractor shall continuously weld all exterior seams and grind smooth. Also, surface grind complete removal of corrosion, burrs, sharp edges and mill scale.
      3) Reinforce sheet steel with steel angles where necessary to adequately support equipment and ensure rigidity and to preclude resonant vibrations.
      4) Panel shall be flat within 1/16-inch over a 24-inch by 24-inch area, or flat within 1/8-inch for a larger surface. Flatness shall be checked by using a 72-inch long straight edge. Out-of-flatness shall be gradual, in one direction only, and shall not consist of obvious depressions or a series of wavy sections.
      5) Panel shall use pan type construction for doors.
      6) Doors shall be mounted with full length heavy-duty piano hinges with stainless steel hinge pins.
      7) Contractor shall provide oil-resistant gasket completely around each door or opening.
      8) Contractor shall provide handle-operated, oil-tight, key-lockable three point stainless steel latching system with rollers on latch-rods for easy door closing.
      9) Contractor shall use stainless steel fasteners throughout.
      10) Contractor shall provide steel print pocket with white enamel finish.
      11) Contractor shall provide enclosure mounting supports as required for wall mounting.

12) Contractor shall provide all holes and cutouts for installation of conduit and equipment. All conduit and piping openings and all conduits shall be sealed watertight.
13) Contractor shall completely clean all interior and exterior surfaces so they are free of corrosive residue, oil, grease and dirt. Zinc phosphatize for corrosion protection.
14) One coat of primer shall be applied to all interior and exterior surfaces immediately after corrosion protection has been applied. Exterior surfaces shall then be given sufficient coats of primer surfacer, applied with sanding and cleaning between coats, until a Grade 1 finish can be produced on the finish coat.
15) All interior surfaces shall be painted with two coats of semi-gloss white polyurethane enamel.
16) All exterior surfaces shall be painted with a minimum of three finish coats of polyurethane enamel to ultimately produce a Grade 1 finish (super smooth; completely free of imperfections). Color to be selected by Engineer from complete selection of standard and custom color charts furnished by the manufacturer.
17) Primer and finish paint shall be compatible and shall be a low VOC, high solids polyurethane enamel, Hi-Solids Polyurethane B65 W300 Series as manufactured by Sherwin-Williams, Inc. or equal.
18) Provide one extra quart of touch-up paint for each exterior finish color.

c. Electrical Systems:
   1) Control of Environment:
      a) Panels shall be furnished with adequately sized, automatically controlled 120 VAC strip heaters to maintain temperature 10 degrees F above ambient for condensation prevention inside panels.
      b) Panels shall be provided with automatically controlled closed loop ventilation fans or closed loop air conditioners with filtered air louvers if required to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the enclosure.
   2) Internal Power Distribution:
      a) Panels shall be provided with an internal 120 VAC power distribution panel with number of circuits and separate circuit breakers sized as required to distribute power to the panel components. Distribution panel shall contain two spare breakers minimum.
   3) Wiring:
      a) Internal wiring shall be Type MTW stranded copper wire with thermoplastic insulation rated for 600 V at 85 degrees C for single conductors, color coded and labeled with wire identification.
      b) For DC panel signal wiring, use No. 18 minimum AWG shielded.
      c) For AC power wiring, use No. 12 minimum AWG. For AC signal and control wiring, use No. 16 minimum AWG. For wiring

carrying more than 15 A, use sizes required by NEC and NFPA 79 Standards.

d) Low voltage signal wiring and shielded wiring shall be separated from power and control wiring by a minimum of 6-inches.
e) Parallel runs of wire shall be grouped or bundled using covered troughs. Maximum bundle size to be 1-inch. Troughs shall have 40 percent spare capacity.
f) Wire troughs along horizontal or vertical routes shall be installed to present a neat appearance. Angled runs are not acceptable.
g) Contractor shall adequately support and restrain all wiring runs to prevent sagging or other movement.
h) Contractor shall terminate all field wiring using forked, insulated, crimp-on connectors (soldered type not acceptable) at 600 V rated barrier type terminal strips with screwed connections and permanently affixed numeric identifiers beside each connection. Identifiers to be self-stick plastic tape strips with permanent type, machine printed numbers. For DC field signal wiring, terminal strips shall be capable of handling No. 12 wiring (minimum).

D. Manufacturer: Provide product of one of the following:
   1. Phoenix Contact.
   2. Entrelec Swartwout.
   3. Allen Bradley.
   4. Or equal.
      a. All wiring shall be installed such that if wires are removed from any one device, power will not be disrupted to any other device.
      b. For internal component to component wiring only, compression type terminal blocks are acceptable.
      c. Contractor shall provide spare terminals equal in number to 20 percent of the terminals used for each type of wiring (e.g., DC signal and AC power).
      d. Contractor shall provide a separate terminal for grounding each shielded cable.
      e. Contractor shall use separate 5/16-inch diameter copper grounding studs for instrument signal cable shields and AC power.
      f. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.
      g. When DC power and/or low voltage AC power is required, provide and install the necessary power supplies and transformers in the panel.
      h. Contractor shall provide circuit breakers to protect each circuit, with no more than six instruments on a single circuit.
      i. Contractor shall provide complete wiring diagram showing “as-built” circuitry. Diagram shall be enclosed in transparent plastic and placed in easily accessible pocket built into panel door.

E. Surge Protection:
   1. General: Surge protection shall be provided to protect the electronic instrumentation system from surges propagating along the signal and power

supply lines. The protection systems shall be such that the protection level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level, and be maintenance free and self-restoring. Instruments shall be housed in suitable metallic cases, properly grounded. Ground wires for all surge protectors shall be connected to a good earth ground and where practical each ground wire run individually and insulated from each other. These protectors shall be mounted within the instrument enclosure or a separate junction box (compatible with the area designation) coupled to the enclosure.

2. UL 1449 listed.
3. Manufacturer: Provide product of one of the following:
   a. DITEK Corporation.
   b. Joslyn.
   c. Or equal.

F. Common, push-to-test circuitry shall be provided for each panel to simultaneously test all indicating lights, horn, and strobe on the panel using a single pushbutton.

G. Indicating Lights:
   1. Provide motor overload indication for all 3-phase motors.
   2. Provide power indication light for all panels.
   3. Provide other indicating lights as required by the sequences of operations below in paragraph 3.3.

H. Provide silence pushbutton for all panel alarms.

I. Each panel shall contain provisions for remote monitoring consisting of dry contact outputs rated 5A at 120 VAC for the following:
   1. Common malfunction alarm, one from each panel. Common malfunction alarm to include where required, but is not limited to:
      a. Fan failure.
      b. Motor overload.
      c. Specific equipment alarms as specified and/or shown.

J. Each panel shall contain provisions to accept a dry contact signal from a fire alarm control panel or smoke detector. Upon receiving a signal from the fire alarm control panel or smoke detector, each controlled system (whether specifically required in the sequence of operation description for that system or not) within the panel shall be shut down in an orderly manner. Manual pushbutton reset inside each panel shall be required for the ATC system to restart. Label affixed to the exterior of the panel shall indicate that the manual reset is located within the panel. For systems without fire alarm service, “FUTURE” shall be indicated.

K. Control Relays:
   1. Manufacturer: Provide product of one of the following:
      a. Allen-Bradley.
      b. IDEC.
      c. Or equal.

2. Provide general purpose, plug-in type rated for continuous duty.
    a. Coil Voltages: 24 VDC and 120 VAC as required.
    b. Contacts:
        1) Silver cadmium oxide rated not less than five amperes resistive at 120 VAC or 28 VDC continuous.
        2) For switching low energy circuits (less than 200mA DC) fine silver, gold flashed contacts rated not less than three amperes resistive at 120 VAC or 28 VDC continuous shall be provided.
    c. Relays to have clear plastic dust cover.
    d. Relays to be UL recognized.

L. Selector Switches, Pushbuttons, and Indicating Lights:
1. Product and Manufacturer: Provide one of the following:
    a. Model 800 Series, as manufactured by Allen-Bradley.
    b. Or equal.
2. General:
    a. Selector switches, pushbuttons and indicating lights shall be provided by one manufacturer and is of the same series or model type.
    b. Type: Heavy-duty, oil-tight.
    c. Provide legend plate for indication of switch, pushbutton or light function (e.g. “HIGH/LOW”, “HAND/OFF/AUTOMATIC”).
    d. Mounting: Flush mounted on control panel front, unless otherwise noted.
    e. NEMA rated to match panel in which mounted.
    f. Full size 30.5 mm devices.
3. Selector Switches:
    a. Provide selector switches with number of positions as required to perform intended functions as shown and specified.
    b. Switches shall have standard black knob.
    c. Contacts:
        1) Provide number and arrangement of contacts as required to perform intended functions specified but not less than one single pole, double throw contact.
        2) Type: Double break, silver contacts with movable contact blade providing scrubbing action.
        3) Rating: Compatible with AC or DC current with devices simultaneously operated by the switch contacts, but not less than ten amperes resistive at 120 VAC or DC continuous.
4. Pushbuttons:
    a. Provide momentary, dual type pushbuttons as required to perform intended functions specified and shown.
    b. Provide extended head pushbutton for all stop functions and flush head pushbuttons for all other functions.
    c. Contacts: Comply with the requirements specified for selector switches.
5. Indicating Lights:
    a. Type: Full voltage LED.

b. Indicating lights shall be provided with labeled escutcheon plates identifying the light function. (e.g. “RUN”, “STOP”, “ALARM”, “POWER”)

6. Button and Lens Colors:
   a. Refer to Paragraph 3.3. below.
7. Strobes and Horns:
   a. Product and Manufacturer: Provide one of the following:
      1) Model 400 ST with Model 350, as manufactured by Federal Signal.
      2) Or equal.
   b. General: Strobe light with horn shall be a pulsating, illuminating, multi-tone audible device used to indicate alarm at automatic temperature control panels.
   c. Service:
      1) Non-Corrosive Areas: NEMA 12 construction.
   d. Required Features:
      1) Power Required: 120 VAC, 60 Hz.
      2) Strobe Light: Minimum 400 Effective Candela; 360 degree pattern.
      3) Flashing Mechanism: Minimum 75 flashes per minute.
      4) Polycarbonate Dome.
      5) Color: Red.
      6) Base Materials of Construction: Aluminum
      7) Panel Mounting: Provide appropriate brackets and appurtenances.
      8) Decibel Output: 100 at ten feet minimum with manual volume control.

2.4 ACCESSORIES

A. Conduit and Wire:
   1. Provide wire in conformance with Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables.
   2. Provide hangers and supports, conduit, boxes and accessories in conformance with Section 26 05 29, Hangers and Supports for Electrical Systems; Section 26 05 33.13, Rigid Conduits; and Section 26 05 33.33, Pull Junction and Terminal Boxes.

B. Miscellaneous:
   1. Provide any additional controls and appurtenances as required to provide proper equipment control as specified in Article 3.3 below.
   2. Provide all mounting accessories, as required.
   3. Tubing, static pressure tips, mounting hardware, fasteners, and appurtenances shall be constructed of Type 316 stainless steel.

2.5 IDENTIFICATION

A. All equipment and component identification shall be provided in accordance with Section 26 05 53, Identification For Electrical Systems.

2.6 INTERFACE WITH MOTOR STARTERS

A. Refer to the ATC and control schematics as shown on the HVAC and Electrical Drawings for interface requirements.

2.7 SOURCE QUALITY CONTROL

A. Shop Tests:
   1. Equipment shall be completely manufactured and pre-assembled in accordance with Reference Standards. Perform the following tests and inspections at factory before shipment:
      a. Tested and inspected for approval as a unit by Underwriters Laboratories Inc., UL Label or equal.
      b. Factory test equipment to ensure that the entire package has been properly fabricated and assembled, that all the controls function as specified herein and that the package meets the specified performance requirements including manufacturer's data report.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials and equipment will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Take field measurements where required prior to installation to ensure proper fitting of Work.

3.2 INSTALLATION

A. General:
   1. Install the equipment in accordance with the Contract Documents and by manufacturer's instructions and recommendations. Obtain written interpretation from Engineer in the event of conflict between manufacturer's instructions and recommendations and the Contract Documents.
   2. Install in accordance with Laws and Regulations.
   3. Do not modify structures to facilitate installation of equipment, unless approved in writing by Engineer.
   4. Installation to conform to requirements of all local and state codes.

B. Wall mounted space sensors and thermostats shall be installed 5-feet above finished floor. Wall plates, face plates, and mounting hardware shall be provided as required for a complete installation.

C. Where wall mounted space sensors and thermostats must be located on exterior walls, provide an insulating mounting panel. Provide sunshield for outdoor located thermostats and temperature sensors.

D. Furnish and install all mounting accessories junction boxes, wall boxes wall plates as required for installation of all thermostats and sensors.

E. Provide fire-stopping material or fire rated mechanical link seals for each penetration through fire rated walls. Each penetration shall meet or exceed the fire rating of the walls. Refer to Drawings for locations of fire rated walls.

F. Where motorized control dampers are shown on the Drawings, furnish sufficient quantity of actuators to operate the motorized control damper as described in Article 3.3 below or as shown on the Drawings.

3.3 SEQUENCE OF OPERATIONS

A. General Requirements:
   1. Safety devices, fire alarm control, and smoke control shall be hardwired, interlocked to operate in "ON", "AUTO", "HAND" and "AUTOMATIC" positions.
   2. Fire alarm, smoke control and life safety sequences shall override other automatic control sequences, including hardwired safety devices.
   3. Reset schedules and setpoints shown in Sequence of Operations are for initial programming and start-up, during system check out the reset schedules and setpoints shall be fine-tuned to obtain desired comfort and energy savings results. The Engineer reserves the right to make setpoint changes based on installed operating conditions, at no additional cost to the Owner.
   4. Automatic control functions that switch equipment on and off (e.g., fans) must be programmed with dead bands or time delays to prevent short cycling of equipment.
   5. The strobe and horn provided at the ATC panel shall be energized whenever the equipment is in alarm condition.
   6. All controllers, relays, interlock wiring, and other devices required to provide the Sequence of Operations shall be housed within the ATC panel, except where otherwise noted.
   7. Remote and local control panels shall be provided with panel mounted switches, pilot lights, and other control devices to provide automatic and manual control from the panel.
   8. HAND/OFF/AUTOMATIC" (HOA) selector switch shall start the unit when in the "HAND" position, stop the unit when in the "OFF" position, and perform a specified operation when in the "AUTOMATIC" position.
   9. Running equipment and open dampers shall be shown in GREEN. Stopped equipment and closed dampers shall be shown in RED. Alarms shall be shown in AMBER.
   10. All relays and other devices required to provide the Sequence of Operations shall be housed within control panels, except where otherwise noted.
   11. All remote panels shall be provided with the following pilot lights:
      a. Panel Power.
   12. All remote panels shall be provided with the following buttons:
      a. Push to Test Circuitry.

13. The following shall annunciate status at remote panels:
    a. Equipment status (e.g. running, off, etc.).
14. The following shall communicate alarms to the local plant PLC:
    a. Equipment Failure:
        1) Common Alarm.

B. ATC-1: (Booster Pump Station):
1. The exhaust fan shall operate through a HAND/OFF/AUTO switch with run indicating and fan off lights located on the front of the local control station ATC panel.
    a. In the HAND position, the exhaust fan shall energize to run once the motorized dampers EF-1-MD1 and EF-1-MD2 are 100% open.
    b. In the AUTO position, the exhaust fan shall be interlocked to operate with the room thermostat.
        1) When indoor temperature rises above the room thermostat's setpoint (adjustable) of 80°F, the exhaust fan shall energize to run once the motorized dampers EF-1-MD1 and EF-1-MD2 are 100% open.
    c. In the OFF position the fan shall be off.
2. Outside air dampers EF-1-MD1 and EF-1-MD2 shall spring return to the normally closed position upon shut down of the exhaust fan, and/or when the motorized damper actuators are de-energized.
3. The exhaust fan shall normally run intermittently through the wall mounted thermostat with the exhaust fan in the AUTO position.

C. Electric Unit Heaters (EUH):
1. Electric unit heaters shall be cycled by integral thermostat set at 55 degrees F (adjustable).

3.4 FIELD QUALITY CONTROL

A. Field Tests:
1. After equipment installation is complete, Contractor and a qualified field service representative of unit/system supplier shall perform an operating test of each unit and associated controls, in presence of Engineer. Equipment will pass the test when each unit and its controls are demonstrated to function correctly.
2. Running Tests:
    a. Field-test each equipment and system together with its controls and appurtenances. Tests shall demonstrate to Engineer that each part and all parts together function in accordance with the Contract Documents. Provide all necessary testing equipment, labor, and appurtenances.
    b. Verify that equipment operates at design point as intended, that vibration limits are not excessive and beyond manufacturer's recommendations, and that equipment operates smoothly without excessive noise, temperature rise, or other defects, across entire range of operating curve.
    c. Verify that all controls work as intended in both manual and automatic mode. Successfully test-operate each piece of equipment or system for at least 4 hours.

d. If equipment or system does not comply with the Contract Documents and does not pass the tests, Contractor shall adjust, modify, and retest as often as necessary until tests are successfully passed.

B. Manufacturer's Services:
   1. Provide a qualified, factory-trained service person to perform the following:
      a. Instruct Contractor in installing equipment.
      b. After installation, inspect and adjust equipment, verify proper operation, and assist with field testing.
      c. Instruct operations and maintenance personnel in operation and maintenance of the equipment.
   2. Manufacturer's service person shall make visits to the Site as follows:
      a. First visit shall be for instructing Contractor in proper equipment installation, and assisting in installing equipment. Minimum number of hours on-Site: 8 hours.
      b. Second visit shall be for checking completed installation, start-up of system; and performing field testing. Minimum number of hours on-Site: 8 hours.
      c. Third visit shall be to instruct operations and maintenance personnel.
         1) Furnish services of manufacturer's qualified, factory-trained specialists to instruct operations and maintenance personnel in recommended operation and maintenance of equipment.
         2) Training requirements, duration of instruction, and qualifications shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.
         3) Number of hours on-Site shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.
      d. Technician shall revisit the Site as often as necessary until installation is acceptable.
   3. All costs, including expenses for travel, lodging, meals and incidentals, and cost of travel time, for visits to the Site shall be included in the Contract Price.

C. Supplier's Installation Report:
   1. Prepare supplier's installation reports and submit within 30 days after completion of field testing and operation instruction. The reports shall be prepared in accordance with the requirements of Section 01 78 23, Operations and Maintenance Data, and shall include the following:
      a. Field testing reports.
      b. Description of testing and installation deficiencies not resolved to the Owner's satisfaction.
      c. Description of problems or potential problems.
      d. Names of Owner personnel who attended the operations and maintenance training sessions.
      e. Record copy of materials used for the training sessions including an outline summary of the course.

3.5 ADJUSTING

A. Adjust all controls for proper settings.

B. While system is operable, balance all equipment to achieve design conditions. Coordinate with Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

3.6 CLEANING

A. Thoroughly clean all equipment and accessories prior to installation.

B. Remove all dirt, rust, dust, etc. from equipment after installation.

C. Remove and dispose of all debris and waste from the Site resulting from installation.

++ END OF SECTION ++

SECTION 23 31 13

METAL DUCTWORK

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install metal ductwork complete and operational with accessories.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the metal ductwork Work.

C. Related Sections:
   1. Section 10 14 00, Signage.
   2. Section 23 05 29, Hangers and Supports for HVAC Ductwork, Piping, and Equipment.
   3. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.
   4. Section 23 09 00, Instrumentation and Control for HVAC.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc. (AMCA).
   1. AMCA Standard 500-D – Laboratory Methods of Testing Dampers for Rating.
   2. AMCA Publication 511 – Certified Ratings Program - Product Rating Manual for Air Control Devices.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
   1. ASHRAE Standard 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

C. American Society for Testing and Materials (ASTM).
   1. ASTM E84 – Standard Test Method for Burning Characteristics of Building Materials.

D. American Welding Society (AWS).
   1. AWS B2.1 – Specification for Welding Procedure and Performance Qualification.
   2. AWS D1.1 – Structural Welding Code – Steel.
   3. AWS D1.2 – Structural Welding Code – Aluminum.
   4. AWS D1.3 – Structural Welding Code – Sheet Steel.
   5. AWS D1.6 – Structural Welding Code – Stainless Steel.

E. National Bureau of Standard’s Voluntary Product Standard.

1. NBS PS 15-69 – Standard for Contact-Molded Reinforced Polyester Chemical Resistant Process Equipment.

F. National Fire Protection Association (NFPA).
   1. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.
   2. NFPA 90B – Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
   3. NFPA 701 – Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

G. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
   1. HVAC Duct Construction Standards – Metal and Flexible.
   2. Rectangular Industrial Duct Construction Standards.

H. Underwriters Laboratories Inc. (UL).
   1. UL 181 – Factory-Made Air Ducts and Air Connectors.
   2. UL 181A – Closure Systems for Use With Rigid Air Ducts.
   3. UL 181B – Closure Systems for Use With Flexible Air Ducts and Air Connectors.
   4. UL 555 – Fire Dampers.
   5. UL 555S – Smoke Dampers.
   6. UL 900 – Air Filter Units.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Minimum of five years of experience producing substantially similar equipment and able to show evidence of at least five installations in satisfactory operation for at least five years in the continental United States.
      b. Equipment shall be manufactured in the United States.
   2. Installer:
      a. Engage an experienced installer to perform the work of this Section who has specialized in installing metal ductwork similar to that required for this Project and who is acceptable to manufacturer.
      b. Submit name and qualifications to Engineer along with the following information on a minimum of three successful projects:
         1) Names and telephone numbers of owners, architects or engineers responsible for projects.
         2) Approximate contract cost of the metal ductwork.
         3) Amount of area installed.
   3. Welding:
      a. Qualify processes and operators in accordance with AWS B2.1 as appropriate for material to be welded.

b. Provide certification that operators employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within previous 12 months. Ensure that all certifications are current.

B. Regulatory Requirements:
1. National Electrical Code (NEC).
2. National Fire Protection Association (NFPA).
3. Underwriters Laboratories Inc. (UL).
4. Local and State Building Codes and Ordinances.
5. Permits: Contractor shall obtain and pay for all required permits, fees and inspections.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
1. Shop Drawings:
a. Drawings showing fabrication methods, assembly, accessories, and installation details.
b. 1/4-inch scale duct layouts, dimensioned to show length of runs, sizes, support spacing and expansion provisions.
c. Detailed installation drawing of each individual component showing:
1) Mounting requirements.
2) Locations.
d. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
2. Product Data:
a. Manufacturer's literature, illustrations, specifications, weight, wall thicknesses, design pressures, dimensions, required clearances, materials of construction, and performance data for all equipment.
b. Complete component list.
c. Detailed description of each component.
d. Catalog cut sheets for each component.
e. Deviations from Contract Documents. Any exceptions to the Contract Documents must be clearly defined. Contractor shall be responsible for any additional expenses that may occur due to any exception made.
f. Other technical data related to specified material and equipment as requested by Engineer.

B. Informational Submittals: Submit the following:
1. Certificates:
a. Certification that all stainless steel ductwork, accessories, and hardware are of the Type specified.
2. Manufacturer Instructions:
a. Instructions and recommendations for handling, storing, protecting the equipment.
b. Installation Data.
3. Source Quality Control Submittals:
a. Factory test reports.

4. Field Quality Control Submittals:
    a. Written report presenting results of required field testing.
5. Supplier Reports:
    a. Submit written report of results of each visit to Site by Supplier's service personnel, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
6. Qualifications Statements:
    a. Manufacturer, when requested by Engineer.
    b. Installer, when requested by Engineer.
    c. Welding, when requested by Engineer.

C. Closeout Submittals: Submit the following:
1. Record Documentation:
    a. During progress of the Work keep an up-to-date set of the Drawings showing field and Shop Drawing modifications. Immediately upon completion of the Work, submit "pdf" of CADD drawings showing the actual in place installation of all ductwork and equipment installed under this Section at a scale satisfactory to the Owner. The drawings shall show all ductwork on plans and in sections, with all reference dimensions and elevations required for complete Record Drawings of the systems. Two paper prints shall also be furnished. The prints and electronic copies of the CADD files shall be furnished no later than 30 days after completion of the Contract and prior to final payment.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
2. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to prevent delay of that Work.
3. Comply with manufacturer's recommendations for rigging of equipment.

B. Storage and Protection:
1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
2. Store all equipment in covered storage off the ground and prevent condensation and in accordance with the manufacturer's recommendations for long-term storage.

C. Acceptance at Site:
1. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Engineer, in writing, if any loss or damage exists to equipment or components. Replace lost equipment or components and repair damage to new condition, in accordance with manufacturer's instructions.

1.6 SITE CONDITIONS

A. Existing Conditions:
   1. The Contract Documents show the general arrangement and extent of the Work to be done. The exact location and arrangement of all parts shall be determined as the Work progresses. The exact location of all parts of the Work is governed by the general building plans and the actual building conditions.
   2. The Drawings are intended as an indication of the arrangement of equipment and ductwork and is as nearly correct as can be determined in advance of the actual construction of the Work. Equipment, ductwork, and appurtenances found to interfere with the construction of the building, plumbing apparatus and piping, electrical wiring or other obstructions, etc., shall be changed in location to clear obstructions.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. System Description:
   1. The Drawings show the general arrangement of all systems. Should local conditions necessitate rearrangement of the systems, Contractor, before proceeding with the Work, shall prepare and submit complete drawings showing all details of the proposed rearrangement for written approval.
   2. The connections shown to the various units are intended as an indication only. The actual connections at the time of installation to be made and arranged to suit the requirements of each case and adequately provide for expansion and minimize the amount of space required for the same.
   3. The Drawings do not show all offsets, fittings, accessories and details, which may be required. Contractor shall carefully examine all of the General Construction, Electrical, Mechanical, Structural and other Drawings and the respective Specifications for conditions which may affect the installation of the Work, and shall arrange the Work accordingly, furnishing all required items to meet such conditions which are not specified as work “by others,” to complete the systems to the true extent of the Contract Documents.

B. Design Criteria:
   1. All sheet metal construction shall be in accordance with the construction details and installation details in the latest edition of the SMACNA HVAC Duct Construction Standards. This Standard is hereinafter referred to as HVAC DS.
   2. Sheet metal construction shall conform to the following minimum pressure classification (positive and negative pressure), unless otherwise shown or specified:
      a. Ductwork serving process spaces: 2-inch W.G.

2.2 DETAILS OF MATERIALS

A. Material Type:
   1. Aluminum ductwork shall be Alloy 3003 - H-14.
      a. All accessories for aluminum ductwork shall be aluminum, unless noted otherwise.

B. Duct construction alternatives (duct gauge in relation to reinforcement spacing) selected by Contractor from HVAC DS Tables shall be identified by duct system and shall be submitted in schedule form to the Engineer prior to beginning installation of ductwork. Contractor shall construct ductwork to meet the requirements of the HVAC DS Tables in conjunction with the minimum duct thickness schedules in Article 3.7 below.

C. Thickness of aluminum ductwork and size and thickness of aluminum supports shall be appropriately converted using the aluminum conversion tables in the HVAC DS.

D. Rectangular ductwork longitudinal seams shall be Pittsburgh Lock type with permanently elastomeric sealant applied continuously within the seam.

E. Duct reinforcement shall be made using external stiffener angles. Tie rods shall not be acceptable. Stiffener angles shall be constructed of the same material as the ductwork.

F. Transverse Joints:
   1. Manufacturer: Provide product of one of the following:
      a. Ductmate Industries, Inc.
      b. Elgen Manufacturing Company, Inc.
      c. Or equal.
   2. Ductwork shall be connected by a mechanical joining system, except where otherwise noted.
   3. Manufacturer's installation instructions will be followed, except where otherwise noted.
   4. SMACNA T-24 and other flange type connectors formed from the duct edge will NOT be allowed.
   5. All connectors shall meet or exceed the functional criteria outlined in the HVAC DS and shall be constructed of the same material as the ductwork.

G. Transitions and Offsets:
   1. Reference: HVAC DS.
   2. Material: Same material as ductwork.

H. Seal Class:
   1. Class A – Ductwork constructed with a minimum pressure classification (positive and negative pressure) of 4-inch W.G. and up.
   2. Class B – Ductwork constructed with a minimum pressure classification (positive and negative pressure) less than 4-inch W.G.

I. Leakage:

1. Not to exceed five percent.

J. Flexible duct or duct constructed of fiberglass duct board shall not be permitted, except where specifically shown or indicated.

2.3 ACCESSORIES

A. Hangers and Supports:
   1. Hangers and supports shall be provided in accordance with Section 23 05 29, Hangers and Supports for HVAC Ductwork, Piping, and Equipment.

B. Motorized Control Dampers (for Rectangular Ductwork):
   1. Commercial Type Dampers for Aluminum Ductwork:
      a. Design and Performance Criteria (based on 48-inch damper width):
         1) Dampers shall be performance rated and certified in accordance with AMCA Standard 500-D and AMCA Publication 511.
         2) Maximum Design Total Static Pressure: 5.2-inch W.G.
         3) Damper Leakage: Class 1 Leakage Rated – Not more than 8 cfm per square foot at 4-inch W.G. with blade seals.
         4) Certification: Manufacturer shall submit certified test data.
      b. Product and Manufacturer: Provide one of the following:
         1) Model CD50, as manufactured by Ruskin.
         2) Or equal.
      c. Details of Construction:
         1) Material: 6063-T5 aluminum.
         2) Frame: 0.125-inch thick hat channel with mounting flanges.
         3) Single Section Sizes:
            a) Minimum: 6-inch wide by 9-inch high.
            b) Maximum: 60-inch wide by 72-inch high.
         4) Blades:
            a) 6-inch wide.
            b) Opposed blades.
            c) Airfoil shape with heavy gauge 6063-T5 aluminum double skin construction.
            d) EPDM edge seals for motorized control dampers only.
         5) Linkage: Concealed in frame outside the air stream.
         6) Axles: 1/2-inch plated steel hex.
         7) Bearings: Molded synthetic.
         8) Jamb Seals: Flexible metal compressible type.
         9) Provide Type 304 stainless steel outside handle, quadrant with 2-inch standoff and approved position indicator with locking device for all volume dampers.

C. Gravity Backdraft Dampers (GBD):
   1. Commercial Type GBD for Galvanized Steel and Aluminum Ductwork:
      a. Provide gravity backdraft damper where specified on the Equipment Schedule or shown on the Drawings.
      b. Design and Performance Criteria (based on 48-inch damper width):

1) Dampers shall be performance rated and certified in accordance with AMCA Standard 500-D and AMCA Publication 511.
2) Maximum Design Back Pressure: 4.0-inch W.G.
3) Damper Leakage: Not more than 15 cfm per square foot at 1-inch W.G.
4) Blades shall begin to open at approximately 0.12-inch W.G and shall be kept fully open at 0.20-inch W.G.
5) Certification: Manufacturer shall submit certified test data.

c. Product and Manufacturer: Provide one of the following:
1) Model BD6, as manufactured by Ruskin.
2) Or equal.

d. Details of Construction:
1) Material: 6063-T5 aluminum.
2) Frame: Minimum 0.125-inch thick extruded aluminum frame.
3) Single Section Sizes:
a) Minimum: 6-inch wide by 6-inch high.
b) Maximum: 48-inch wide by 52-inch high.
4) Blades:
a) Extruded 0.070-inch thick 6063-T5 aluminum construction.
b) Extruded vinyl blade edge seals mechanically locked into extruded blade slots. Adhesive tape seals are not acceptable.
5) Linkage: 1/2-inch tie bars with stainless steel pivot pins.
6) Bearings: Molded synthetic.
7) Provide a field-adjustable static pressure controller (SPC) to maintain static pressures in the ranges up to 0.25-inch W.G. for dampers up to 17.3 ft^2 and up to 0.75-inch W.G. for dampers up to 6 ft^2.

D. Miscellaneous Duct Fittings:
1. Reference: HVAC DS.
2. Material: Same material as ductwork.

E. Sleeves:
1. Material: Same material as ductwork passing through opening.
2. Thickness: Minimum 24-gauge.
3. Calk airtight with fire resistant sealant between sleeve and ductwork.

F. Duct Gaskets:
1. Product and Manufacturer: Provide one of the following:
a. Model 440 Gasket Tape, as manufactured by Ductmate Industries, Inc.
b. Or equal.
2. Material: Non-hardening butyl.
3. Service Temperatures: -65 degrees F to 220 degrees F.
4. Service Life: 20 years minimum.
5. Gaskets shall have the following Fire Hazard Classifications in accordance with ASTM E84:
a. Flame Spread: 10 maximum.
b. Smoke Developed: 10 maximum.

G. Hardware and Fasteners:
   1. All hardware and fasteners for aluminum ductwork shall be Type 316 stainless steel, unless noted otherwise.

H. Grilles and Diffusers:
   1. General:
      a. Grilles and diffusers mounted in hung ceilings shall have a baked enamel white finish.
      b. Aluminum grilles and diffusers not mounted in hung ceilings shall have a clear anodized finish.
      c. Stainless steel grilles and diffusers shall have a satin polish [mill] finish except where white polyvinylidene fluoride (PVDF) coating is specified on the Equipment Schedule.
      d. Where registers are shown to be provided in lieu of grilles, include an integral opposed blade damper of the same construction as the grille.
   2. Grid Core Grilles (GCG):
      a. Product and Manufacturer: Provide one of the following:
         1) Aluminum construction:
            a) Model CRE1000, as manufactured by Tuttle & Bailey.
            b) Model 50F, as manufactured by Titus.
            c) Or equal.
      b. 1-inch by 1-inch by 1-inch extruded grid core.
      c. 0-degree deflection.
      d. For surface mounting as shown or indicated on Drawings.

I. Drip Pans:
   1. Provide 16-gauge Type 304 stainless steel drip pans under all ductwork installed over electrical equipment and motors.
   2. Route drainage to nearest approved floor drain, gutter, or other drainage system with 3/4-inch pipe. All construction shall be liquid tight. Pitch the drain pan uniformly toward the drainpipe at a slope not less than 1/8-inch per lineal foot.

2.4 IDENTIFICATION

A. All equipment and component identification shall be provided in accordance with Section 10 14 00, Signage.

2.5 SOURCE QUALITY CONTROL

A. Shop Tests:
   1. Equipment shall be completely manufactured and pre-assembled in accordance with Reference Standards. Perform the following tests and inspections at factory before shipment:
      a. Tested and inspected for approval as a unit by Underwriters Laboratories Inc., UL Label or equal.
      b. Factory test equipment to ensure that the entire package has been properly fabricated and assembled, that all the controls function as specified herein

and that the package meets the specified performance requirements including manufacturer's data report.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials and equipment will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Take field measurements where required prior to installation to ensure proper fitting of Work.

3.2 PREPARATION

A. Protection of Surrounding Areas/Surfaces:
   1. Openings and penetrations shall be capped to protect the building from outside conditions.
   2. Properly cap the open ends of all ductwork at the end of each day's Work or other stopping point throughout the construction. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical damage.

3.3 INSTALLATION

A. General:
   1. Install the equipment in accordance with the Contract Documents and by manufacturer's instructions and recommendations. Obtain written interpretation from Engineer in the event of conflict between manufacturer's instructions and recommendations and the Contract Documents.
   2. Install in accordance with Laws and Regulations.
   3. Do not modify structures to facilitate installation of equipment, unless approved in writing by Engineer.
   4. Installation to conform to requirements of all local and state codes.

B. All ductwork shall conform accurately to the dimensions shown, the ducts shall be straight and smooth inside with joints neatly finished. Ductwork shall be installed so as to preclude the possibility of vibration under all operating conditions.

C. Tape and seal all joints in accordance with HVAC DS. Tape shall not be used as the primary means of sealing. Tape used in sealing metallic ductwork shall be listed and labeled in accordance with UL 181A and shall be marked "181 A-P" for pressure-sensitive tape, "181 A-M" for mastic or "181 A-H" for heat-sensitive tape. Tape used in sealing flexible ductwork and connectors shall be listed and labeled in accordance with UL 181B and shall be marked "181 B-FX" for pressure-sensitive tape or "181 B-M" for mastic.

D. Fire dampers shall be provided and installed where indicated and where required by UL and authorities having jurisdiction, and shall be approved by local building codes and in accordance with the requirements of the NFPA.

E. Install all ductwork and accessories to provide a system free from buckling, warping, bellowing, or vibration.

F. All ducts at flexible connections with fans shall be supported at free end within 12-inches of flexible connection.

G. Provisions shall be made for supporting all ductwork, dampers, and other ductwork accessories, where necessary.

H. Coordinate all air outlets for compatibility with ceiling system.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Services:
   1. Provide a qualified, factory-trained service person to perform the following:
      a. Instruct Contractor in installing equipment.
      b. After installation, inspect and adjust equipment, verify proper operation, and assist with field testing.
      c. Instruct operations and maintenance personnel in operation and maintenance of the equipment.
   2. Manufacturer's service person shall make visits to the Site as follows:
      a. First visit shall be for instructing Contractor in proper equipment installation, and assisting in installing equipment. Minimum number of hours on-Site: 4 hours.
      b. Second visit shall be for checking completed installation, start-up of system; and performing field testing. Minimum number of hours on-Site: 2 hours.
      c. Technician shall revisit the Site as often as necessary until installation is acceptable.
   3. All costs, including expenses for travel, lodging, meals and incidentals, and cost of travel time, for visits to the Site shall be included in the Contract Price.

3.5 ADJUSTING

A. All duct systems shall be tested, adjusted, and balanced per Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

B. Test openings shall be installed in the ductwork as directed by the testing, adjusting, and balancing Contractor. Test openings shall be sealed by a screw cap and gasket.

3.6 CLEANING

A. Thoroughly clean all ductwork and accessories prior to installation.

B. Remove all dirt, rust, dust, etc. from ductwork and accessories after installation.

C. Remove and dispose of all debris and waste from the Site resulting from installation.

3.7 SCHEDULES

A. Minimum Duct Thicknesses:
   1. Ductwork serving process spaces: One gauge thicker than recommended in the HVAC DS for the same pressure classification, reinforcement and support spacing.

B. All ductwork and plenums serving the following equipment shall be aluminum:
   1. Intake plenums and exhaust fan discharge plenum in the Pump Building.

C. Ductwork materials not specified above or on the Drawings shall be constructed of aluminum, unless otherwise directed by Engineer.

+ + END OF SECTION + +

SECTION 23 34 05

METALLIC HVAC FANS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install metallic HVAC fans complete and operational with accessories.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the metallic HVAC fans Work.

C. Related Sections:
   1. Section 10 14 00, Signage.
   2. Section 23 05 29, Hangers and Supports for HVAC Ductwork, Piping, and Equipment.
   3. Section 23 09 00, Instrumentation and Control for HVAC.
   4. Section 26 05 05, General Provisions for Electrical Systems.
   5. Section 26 05 53, Identification For Electrical Systems.
   6. Section 26 28 16.33, Disconnect Switches.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc. (AMCA).
   1. AMCA Standard 99-0401 – Classification for Spark Resistant Construction.
   2. AMCA Standard 99-2408 – Operating Limits for Centrifugal Fans.
   3. AMCA Standard 204 – Balance Quality and Vibration Levels for Fans.
   4. AMCA Standard 210 – Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
   5. AMCA Standard 300 – Reverberant Room Method for Sound Testing of Fans.
   6. AMCA Standard 301 – Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

B. American Bearing Manufacturers Association (ABMA).
   1. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
   2. ABMA 11 – Load Ratings and Fatigue Life for Roller Bearings.

C. American Society for Testing and Materials (ASTM).
   1. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.

D. Institute of Electrical and Electronic Engineers (IEEE).

E. National Electrical Code (NEC).

F. National Fire Protection Association (NFPA).
   1. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.
   2. NFPA 91 – Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids.

G. Underwriters Laboratories Inc. (UL).
   1. UL 705 – Power Ventilators.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Minimum of five years of experience producing substantially similar equipment and able to show evidence of at least five installations in satisfactory operation for at least five years in the continental United States.
      b. Equipment shall be manufactured in the United States.
      c. Manufacturer's facility, where equipment will be manufactured and tested, shall be ISO 9001:2000 certified. Manufacturer shall include a copy of the ISO 9001:2000 certificate with the submittals.

B. Component Supply and Compatibility:
   1. Obtain all equipment included in this Section regardless of the component manufacturer from a single metallic HVAC fan manufacturer.
   2. Require the metallic HVAC fan manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall equipment assembly by the metallic HVAC fan manufacturer.

C. Regulatory Requirements:
   1. National Electrical Code (NEC).
   2. National Fire Protection Association (NFPA).
   3. Underwriters Laboratories Inc. (UL).
   4. Local and State Building Codes and Ordinances.
   5. Permits: Contractor shall obtain and pay for all required permits, fees and inspections.

D. Certifications:
   1. Metallic HVAC fans shall bear an approved label with all the necessary identification marks, electrical data, and any necessary cautions as required by the National Electric Code.
   2. Metallic HVAC fans shall be AMCA certified.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Drawings showing fabrication methods, assembly, accessories, installation details, and wiring diagrams.
      b. Setting drawings, templates, and directions for the installation of roof/equipment curbs, anchor bolts, and other anchorages.
   2. Product Data:
      a. Manufacturer's literature, illustrations, specifications, weight, dimensions, required clearances, materials of construction, and performance data for all equipment.
      b. Complete component list.
      c. Detailed description of each component.
      d. Catalog cut sheets for each component.
      e. Fan performance curves with operating points.
      f. Expected sound power levels in each octave band and A-weighted for unit's inlet and outlet. Submit proposed measures to reduce sound power if expected levels are above 75 dBA.
      g. Standard and custom color selection charts for finishing system.
      h. Lubricant Specification: Furnish lubricant specification for type and grade required for equipment furnished.
      i. Deviations from Contract Documents. Any exceptions to the Contract Documents must be clearly defined. Contractor shall be responsible for any additional expenses that may occur due to any exception made.
      j. Other technical data related to specified material and equipment as requested by Engineer.
   3. Testing Plans, Procedures, and Testing Limitations:
      a. Plan for performing required shop testing.
      b. Plan for performing required field testing.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Certification of painting systems, in accordance with "Finishing" Article in this Section.
      b. Independent certification reports:
         1) UL Label or equal.
         2) AMCA certification.
      c. Copy of manufacturer's ISO 9001:2000 certificate.
   2. Manufacturer Instructions:
      a. Instructions and recommendations for handling, storing, protecting the equipment.
      b. Installation Data.
      c. Instructions for handling, start-up, and troubleshooting.
   3. Source Quality Control Submittals:
      a. Written report presenting results of required shop testing.
      b. Factory test reports.

4. Field Quality Control Submittals:
    a. Written report presenting results of required field testing.
5. Supplier Reports:
    a. Submit written report of results of each visit to Site by Supplier's service personnel, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
6. Qualifications Statements:
    a. Manufacturer, when requested by Engineer.

C. Closeout Submittals: Submit the following:
1. Operations and Maintenance Data:
    a. Submit complete Installation, Operation and Maintenance Manuals, including, test reports, maintenance data and schedules, description of operation, and spare parts information.
    b. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01 78 23, Operations and Maintenance Data.
2. Warranty Documentation:
    a. General warranty.
    b. Special warranties on materials and equipment.

D. Maintenance Material Submittals: Furnish the following:
1. Spare Parts:
    a. Spare parts list and recommended quantities.
    b. One set of bearings for each belt drive fan.
    c. One drive shaft for each belt drive fan.
    d. One set of belts for each belt drive fan.
2. Extra Stock Materials:
    a. Touch up paint for each unit.
3. Tools:
    a. Two sets of special tools, if any, required for normal operation and maintenance.
4. Spare parts, extra stock materials, and tools shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the Owner at the conclusion of the Project.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
2. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to prevent delay of that Work.
3. Comply with manufacturer's recommendations for rigging of equipment.

B. Storage and Protection:

1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
2. Store all equipment in covered storage off the ground and prevent condensation and in accordance with the manufacturer's recommendations for long-term storage.

C. Acceptance at Site:
1. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Engineer, in writing, if any loss or damage exists to equipment or components. Replace lost equipment or components and repair damage to new condition, in accordance with manufacturer's instructions.

1.6 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive Owner of other rights or remedies Owner may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under the Contract Documents. The obligations of Contractor under the Contract Documents shall not be limited in any way by the provisions of the specified special warranty.

B. Special Warranty on Materials and Equipment:
1. Provide manufacturer's written warranty, running to the benefit of Owner, agreeing to correct, or at option of Owner, remove or replace materials or equipment specified in this Section found to be defective during a period of 1 year after the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EQUIPMENT PERFORMANCE

A. Design Criteria:
1. Design conditions shall be as indicated on the Equipment Schedule.
2. Fans shall conform and be certified to UL 705.
3. Fan bearings shall be rated for a minimum L-10 life of 100,000 hours at the fan's maximum operating speed in accordance with ABMA 9 or 11.
4. Fans shall be balanced in accordance with AMCA Standard 204.
5. Spark resistant fan construction shall conform to AMCA Standard 99-0401.

B. Performance Criteria:
1. Minimum performance data for each unit shall be as indicated on the Equipment Schedule. Provided equipment shall not exceed scheduled total power.
2. Fans shall be performance rated in accordance with AMCA Standards 210, 300, and 301.

2.2 DETAILS OF EQUIPMENT

A. Extruded Aluminum Propeller Wall Fans
   1. Product and Manufacturer: Provide one of the following:
      a. Model EWB, as manufactured by Loren Cook Company.
      b. Or equal.
   2. Orifice Ring and Panel:
      a. Minimum 14-gauge steel construction with continuously welded corners and hi-efficiency venturi.
      b. Supply fans shall have an aluminum inlet.
      c. Type 304 stainless steel fasteners.
   3. Propeller:
      a. Extruded aluminum airfoil design with a cast aluminum hub.
      b. Blade pitch shall be factory set and locked using set screws and roll pins.
      c. Hub shall be keyed and locked to the shaft with set screws or a taper lock bushing.
   4. Shaft (Belt Drive Only):
      a. Type 304 stainless steel, turned, ground, and polished.
      b. Sized for a critical speed of at least 125 percent of maximum RPM.
   5. Bearings (Belt Drive Only):
      a. Heavy duty, self-aligning lubricated type for continuous service.
   6. Motor Base (Belt Drive Only):
      a. Minimum 14-gauge welded steel motor plate with adjustable threaded studs.
      b. Fully adjustable platform style.
   7. OSHA inlet guard: Manufacturer's standard.

B. Fan Motors
   1. Motors shall be premium efficiency, totally enclosed fan cooled (TEFC) type. Where TEFC motors are not available from the manufacturer, provide open drip proof (ODP) type with a letter from the manufacturer stating TEFC is not available.
   2. Motors shall have a service factor of 1.15.
   3. Motors shall be normal starting torque, normal slip, squirrel cage induction type. VFD driven motors shall be compatible for variable frequency drive operation and suitable to be applied in speed varying service without overheating.
   4. Motors shall be of sufficient size so that there will be no overload on the motor above rated nameplate horsepower under any condition of operation imposed by the driven equipment.
   5. Motors shall have Class F insulation with Class B temperature rise and be capable of carrying nameplate full load current plus service factor continuously without an injurious temperature rise in an ambient temperature of 40 degrees C.
   6. Motor thrust bearings shall be adequate to carry continuous thrust loads under all conditions of operation imposed by the driven equipment.

7. Motors shall be in accordance with all current applicable standards of NEMA, IEEE, ABMA, NEC, and ANSI.
8. Locked rotor currents shall be as specified in NEMA Standards.
9. Provide lubrication of non-hygroscopic grease or oil type.
10. Provide automatic breather and drain for TEFC motor enclosures.
11. Two speed motors shall be provided with two windings per phase.
12. Provide integral overload protection on all single phase motors.

C. Belts and Drives
   1. Fans shall be belt drive with adjustable sheaves or direct drive as shown on the Equipment Schedule.
   2. Belts shall be oil and heat resistant, non-static type.
   3. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized with a minimum 1.5 service factor of the installed motor horsepower.

2.3 ACCESSORIES

A. Disconnects
   1. Provide lockable, horsepower rated, unfused disconnects for all single phase motors conforming to Section 26 28 16.33, Disconnect Switches.
   2. Disconnects shall be constructed and rated for the location in which they are installed. Refer to Section 26 05 05, General Provisions for Electrical Systems, and the Electrical Drawings for area classifications and ratings.

B. Automatic Belt Tensioners
   1. For all wall mounted belt drive propeller fans.
   2. Maintain constant tension on the belt drive to increase belt life by reducing belt slippage.

C. Mounting Hardware
   1. Provide Type 304 stainless steel hardware for all fan installation.

D. Structural Supports
   1. Contractor shall provide and install all hangers, rods, supports, bolts, nuts, washers, inserts, and appurtenances as required to mount equipment where shown. All hangers, rods, supports, bolts, nuts, washers, inserts, and appurtenances shall conform to Section 23 05 29, Hangers and Supports for HVAC Ductwork, Piping, and Equipment.

2.4 FINISHING

A. All fans shall have an electrostatically applied, baked epoxy powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a 2.5 to 3.5 mil thick baked powder finish. Fans for outdoor

applications shall have an ultraviolet resistant topcoat. Coating shall be capable of withstanding at least 1,000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B117 test procedure.]

B. All surfaces shall be prepared, and coating systems applied and cured in strict accordance with the coating manufacturer's approved procedures. Primer coatings shall be selected for the specific material and application.

C. Primer coat and finish coat dry film thickness shall be applied to the required thickness as recommended by the coating manufacturer to provide maximum corrosion protection.

D. The equipment manufacturer shall furnish a written affidavit that the equipment has been prepared, primed, and coated in strict accordance with the coating manufacturer's procedures and at the coating manufacturer's facility.

E. All gears, bearing surfaces, machined surfaces, and other surfaces that are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. Maintain coating during shipping and storage until equipment is placed into operation.

2.5 CONTROLS

A. Refer to Section 23 09 00, Instrumentation and Control for HVAC, for sequence of operations.

2.6 IDENTIFICATION

A. All equipment and component identification shall be provided in accordance with Section 10 14 00, Signage.

B. All electrical wiring identification shall be provided in accordance with Section 26 05 53, Identification For Electrical Systems.

C. All electrical wiring shall be color-coded and labeled for simplified identification. Power wiring shall be coded per Owner standards.

2.7 SOURCE QUALITY CONTROL

A. Shop Tests:
   1. Fan Tests:
      a. Except as described below or otherwise approved by Engineer, test one fan of each size in accordance with AMCA Standard 210. Tests are not required for standard fans for which data on previously tested units of equal design is available. Curves and other test data from units previously tested shall be submitted with shop test results prior to shipping equipment.

b. Test each fan for minimum three hours run-time, at the manufacturer's plant with the job or test motor. Vibration and temperature measurements shall be taken to determine its mechanical integrity. Vibration level shall be limited to a maximum of 1.25 mils. Temperature of bearing housing near the end of run time shall not exceed 215 degrees F under artificially created ambient temperature of 104 degrees F.
c. Each test shall be witnessed by a registered professional engineer, who may be an employee of fan manufacturer. The professional engineer shall certify that the required tests were performed, and sign and seal the results. Jurisdiction of professional engineer's registration, registration number, and name shall be on the seal. Equipment serial number shall also appear on test data for the fan.

2. Equipment shall be completely manufactured and pre-assembled in accordance with Reference Standards. Perform the following tests and inspections at factory before shipment:
   a. Tested and inspected for approval as a unit by Underwriters Laboratories Inc., UL Label or equal.
   b. Factory test equipment to ensure that the entire package has been properly fabricated and assembled, that all the controls function as specified herein and that the package meets the specified performance requirements including manufacturer's data report.
   c. Fan wheels and shafts shall be statically and dynamically balanced.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials and equipment will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Take field measurements where required prior to installation to ensure proper fitting of Work.

3.2 PREPARATION

A. Protection of Surrounding Areas/Surfaces:
   1. Openings and penetrations shall be capped to protect the building from outside conditions.
   2. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical damage.

3.3 INSTALLATION

A. General:

1. Install the equipment in accordance with the Contract Documents and by manufacturer's instructions and recommendations. Obtain written interpretation from Engineer in the event of conflict between manufacturer's instructions and recommendations and the Contract Documents.
2. Install in accordance with Laws and Regulations.
3. Do not modify structures to facilitate installation of equipment, unless approved in writing by Engineer.
4. Installation to conform to requirements of all local and state codes.
5. Curb mounted fans shall be provided with enough electrical wiring and conduit slack to allow the fan to be removed from the curb without disconnecting the electrical wiring at the fan.

3.4 FIELD QUALITY CONTROL

A. Field Tests:
   1. After equipment installation is complete, Contractor and a qualified field service representative of unit manufacturer shall perform an operating test and a sound test of each unit and associated controls, in presence of Engineer. Equipment will pass the test when each unit and its controls are demonstrated to function correctly, and sound levels do not exceed maximum limits.
   2. Running Tests:
      a. Field-test each equipment together with its controls and appurtenances. Tests shall demonstrate to Engineer that each part and all parts together function in accordance with the Contract Documents. Provide all necessary testing equipment, labor, and appurtenances.
      b. Verify that equipment operates at design point as intended, that vibration limits are not excessive and beyond manufacturer's recommendations, and that equipment operates smoothly without excessive noise, temperature rise, or other defects, across entire range of operating curve. Verify that all controls work as intended in both manual and automatic mode. Successfully test-operate each equipment for at least 8 hours.
      c. If equipment does not comply with the Contract Documents and does not pass the tests, Contractor shall adjust, modify, and retest the equipment as often as necessary until tests are successfully passed.
   3. Sound Tests:
      a. Perform sound power level test as requested by the Engineer. Test results shall be rated in dBA.
      b. Take the overall sound power level at the unit's inlet and outlet openings. Sound level shall not exceed approved sound level performance.
      c. If required, manufacturer shall submit a statement as to the unit's conformance with this Section, whether remedial measures will be required, and if so, what remedial measures he proposes.

B. Manufacturer's Services:
   1. Provide a qualified, factory-trained service person to perform the following:
      a. Instruct Contractor in installing equipment.

b. After installation, inspect and adjust equipment, verify proper operation, and assist with field testing.
c. Instruct operations and maintenance personnel in operation and maintenance of the equipment.

2. Manufacturer's service person shall make visits to the Site as follows:
   a. First visit shall be for instructing Contractor in proper equipment installation, and assisting in installing equipment. Minimum number of hours on-Site: 4 hours.
   b. Second visit shall be for checking completed installation, start-up of system; and performing field testing. Minimum number of hours on-Site: 4 hours.
   c. Third visit shall be to instruct operations and maintenance personnel.
      1) Furnish services of manufacturer's qualified, factory-trained specialists to instruct operations and maintenance personnel in recommended operation and maintenance of equipment.
      2) Training requirements, duration of instruction, and qualifications shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.
      3) Number of hours on-Site shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.
   d. Technician shall revisit the Site as often as necessary until installation is acceptable.
3. All costs, including expenses for travel, lodging, meals and incidentals, and cost of travel time, for visits to the Site shall be included in the Contract Price.

3.5 ADJUSTING

A. Adjust all controls for proper settings.

B. While system is operable, balance all equipment to achieve design conditions.

3.6 CLEANING

A. Thoroughly clean all equipment and accessories prior to installation.

B. Remove all dirt, rust, dust, etc. from equipment and accessories after installation.

C. Remove and dispose of all debris and waste from the Site resulting from installation.

+ + END OF SECTION + +

SECTION 23 82 39.43

ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install electric unit heaters complete and operational with accessories.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the electric unit heaters Work.

C. Related Sections:
   1. Section 10 14 00, Signage.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc. (AMCA).
   1. AMCA Standard 210 – Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

B. Factory Mutual (FM).

C. National Electrical Code (NEC).

D. National Electrical Manufacturers Association (NEMA).

E. Underwriters Laboratories Inc. (UL).
   1. UL 873 – Temperature-Indicating and -Regulating Equipment.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Minimum of five years of experience producing substantially similar equipment and able to show evidence of at least five installations in satisfactory operation for at least five years in the continental United States.
      b. Equipment shall be manufactured in the United States.

c. Manufacturer's facility, where equipment will be manufactured and tested, shall be ISO 9001:2000 certified. Manufacturer shall include a copy of the ISO 9001:2000 certificate with the submittals.

B. Component Supply and Compatibility:
   1. Obtain all equipment included in this Section regardless of the component manufacturer from a single electric unit heater manufacturer.
   2. Require the electric unit heater manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall equipment assembly by the electric unit heater manufacturer.

C. Regulatory Requirements:
   1. Factory Mutual (FM).
   2. National Electrical Code (NEC).
   3. National Fire Protection Association (NFPA).
   4. Underwriters Laboratories Inc. (UL).
   5. Local and State Building Codes and Ordinances.
   6. Permits: Contractor shall obtain and pay for all required permits, fees and inspections.

D. Certifications:
   1. Electric unit heaters shall bear an approved label with all the necessary identification marks, electrical data, and any necessary cautions as required by the National Electric Code.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Drawings showing fabrication methods, assembly, accessories, installation details, and wiring diagrams.
   2. Product Data:
      a. Manufacturer's literature, illustrations, specifications, weight, dimensions, required clearances, materials of construction, and performance data for all equipment.
      b. Complete component list.
      c. Detailed description of each component.
      d. Catalog cut sheets for each component.
      e. Deviations from Contract Documents. Any exceptions to the Contract Documents must be clearly defined. Contractor shall be responsible for any additional expenses that may occur due to any exception made.
      f. Other technical data related to specified material and equipment as requested by Engineer.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Independent certification reports:
         1) UL Label or equal.
      b. Copy of manufacturer's ISO 9001:2000 certificate.
   2. Manufacturer Instructions:
      a. Instructions and recommendations for handling, storing, protecting the equipment.
      b. Installation Data.
      c. Instructions for handling, start-up, and troubleshooting.
   3. Source Quality Control Submittals:
      a. Written report presenting results of required shop testing.
      b. Factory test reports.
   4. Field Quality Control Submittals:
      a. Written report presenting results of required field testing.
   5. Supplier Reports:
      a. Submit written report of results of each visit to Site by Supplier's service personnel, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
   6. Qualifications Statements:
      a. Manufacturer, when requested by Engineer.

C. Closeout Submittals: Submit the following:
   1. Operations and Maintenance Data:
      a. Submit complete Installation, Operation and Maintenance Manuals, including, test reports, maintenance data and schedules, description of operation, and spare parts information.
      b. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01 78 23, Operations and Maintenance Data.

D. Maintenance Material Submittals: Furnish the following:
   1. Spare Parts:
      a. Spare parts list and recommended quantities.
   2. Tools:
      a. Two sets of special tools, if any, required for normal operation and maintenance.
   3. Spare parts and tools shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the Owner at the conclusion of the Project.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
   1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
   2. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to prevent delay of that Work.

3. Comply with manufacturer's recommendations for rigging of equipment.

B. Storage and Protection:
   1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
   2. Store all equipment in covered storage off the ground and prevent condensation and in accordance with the manufacturer's recommendations for long-term storage.

C. Acceptance at Site:
   1. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Engineer, in writing, if any loss or damage exists to equipment or components. Replace lost equipment or components and repair damage to new condition, in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 EQUIPMENT PERFORMANCE

A. Design Criteria:
   1. Design conditions shall be as indicated on the Equipment Schedule.
   2. All electric unit heaters shall be UL Listed.

B. Performance Criteria:
   1. Minimum performance data for each unit shall be as indicated on the Equipment Schedule. Provided equipment shall not exceed scheduled total power.

2.2 DETAILS OF EQUIPMENT

A. Horizontal Unit Heaters (Non-Corrosive Environment)
   1. Product and Manufacturer: Provide one of the following:
      a. Model LUH, as manufactured by Chromalox.
      b. Model Industrial Unit Heater, as manufactured by INDEECO.
      c. Or equal.
   2. Casing:
      a. Minimum 18-gauge die formed steel construction.
      b. Phosphate undercoated and finished with polyester powder coat.
      c. Provided with universal wall swivel bracket and mounting hardware.
   3. Heating Elements:
      a. Corrosion resistant steel fins brazed to tubular element.
   4. Fans:
      a. Aluminum broad blade, axial-flow type design.
      b. Attached with rubber vibration isolators.
   5. Fan Motors:

a. Totally-enclosed-fan-cooled enclosure.
b. Permanently lubricated bearings.
c. Integral thermal cutout.

6. Louvers:
   a. Same material of construction as casing.
   b. Individually adjustable for downward, upward or straight air flow.
7. Controls:
   a. Sub-divided circuits with individual fuse protection for all heaters with a total current draw of 48 A or greater.
   b. Heavy duty magnetic contactors.
   c. Thermal cutout with automatic reset.
   d. Integral 120 VAC control transformer.
   e. Thermostats:
      1) Remote Type:
         a) Refer to Paragraph 2.3 below.

2.3 ACCESSORIES

A. Space Thermostats (Non-Corrosive and Corrosive Environments)
   1. Product and Manufacturer: Provide one of the following:
      a. Model WCRT-100, as manufactured by Chromalox.
      b. Or equal.
   2. Sealed Noryl case.
   3. Shielded nickel-plated sensing bulb attached directly to thermostat enclosure.
   4. Thermostat Setpoint Range: 40 degrees F to 100 degrees F, with 2.5-degree F differential.
   5. Adjustable setpoints through dial on face.
   6. 120 VAC, 125 VA rating.
   7. Contacts shall have proper ampere rating for intended use.
   8. NEMA 4X rated.

2.4 IDENTIFICATION

A. All equipment and component identification shall be provided in accordance with Section 10 14 00, Signage.

2.5 SOURCE QUALITY CONTROL

A. Shop Tests:
   1. Equipment shall be completely manufactured and pre-assembled in accordance with Reference Standards. Perform the following tests and inspections at factory before shipment:
      a. Tested and inspected for approval as a unit by Underwriters Laboratories Inc., UL Label or equal.
      b. Factory test equipment to ensure that the entire package has been properly fabricated and assembled, that all the controls function as specified herein

and that the package meets the specified performance requirements including manufacturer's data report.

c. Fan wheels and shafts shall be statically and dynamically balanced.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials and equipment will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Take field measurements where required prior to installation to ensure proper fitting of Work.

3.2 INSTALLATION

A. General:
   1. Install the equipment in accordance with the Contract Documents and by manufacturer's instructions and recommendations. Obtain written interpretation from Engineer in the event of conflict between manufacturer's instructions and recommendations and the Contract Documents.
   2. Install in accordance with Laws and Regulations.
   3. Do not modify structures to facilitate installation of equipment, unless approved in writing by Engineer.
   4. Installation to conform to requirements of all local and state codes.

3.3 FIELD QUALITY CONTROL

A. Field Tests:
   1. After equipment installation is complete, Contractor and a qualified field service representative of unit manufacturer shall perform an operating test of each unit and associated controls, in presence of Engineer. Equipment will pass the test when each unit and its controls are demonstrated to function correctly.
   2. Running Tests:
      a. Field-test each equipment together with its controls and appurtenances. Tests shall demonstrate to Engineer that each part and all parts together function in accordance with the Contract Documents. Provide all necessary testing equipment, labor, and appurtenances.
      b. Verify that equipment operates at design point as intended, that vibration limits are not excessive and beyond manufacturer's recommendations, and that equipment operates smoothly without excessive noise, temperature rise, or other defects, across entire range of operating curve. Verify that all controls work as intended. Successfully test-operate each equipment for at least 8 hours.

c. If equipment does not comply with the Contract Documents and does not pass the tests, Contractor shall adjust, modify, and retest the equipment as often as necessary until tests are successfully passed.

B. Manufacturer's Services:
   1. Provide a qualified, factory-trained service person to perform the following:
      a. Instruct Contractor in installing equipment.
      b. After installation, inspect and adjust equipment, verify proper operation, and assist with field testing.
      c. Instruct operations and maintenance personnel in operation and maintenance of the equipment.
   2. Manufacturer's service person shall make visits to the Site as follows:
      a. First visit shall be for instructing Contractor in proper equipment installation, and assisting in installing equipment. Minimum number of hours on-Site: 4 hours.
      b. Second visit shall be for checking completed installation, start-up of system; and performing field testing. Minimum number of hours on-Site: 4 hours.
      c. Third visit shall be to instruct operations and maintenance personnel.
         1) Furnish services of manufacturer's qualified, factory-trained specialists to instruct operations and maintenance personnel in recommended operation and maintenance of equipment.
         2) Training requirements, duration of instruction, and qualifications shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.
         3) Number of hours on-Site shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.
      d. Technician shall revisit the Site as often as necessary until installation is acceptable.
   3. All costs, including expenses for travel, lodging, meals and incidentals, and cost of travel time, for visits to the Site shall be included in the Contract Price.

3.4 ADJUSTING

A. Adjust all controls for proper settings.

B. Position unit as shown on the Drawings and adjust outlet louvers and diffusers for maximum throw.

3.5 CLEANING

A. Thoroughly clean all equipment and accessories prior to installation.

B. Remove all dirt, rust, dust, etc. from equipment and accessories after installation.

C. Remove and dispose of all debris and waste from the Site resulting from installation.

+ + END OF SECTION + +

DIVISION 26 - ELECTRICAL

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SECTION 26 05 05

GENERAL PROVISIONS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals shown, specified, and required to complete the electrical Work.
2. Utility Companies:

a. Electric Utility Company: Perform the Work in connection with the electric service and utility metering in accordance with requirements of Coweta-Fayette EMC.

B. Coordination:

1. Review installation procedures and schedules under other Specification Sections and coordinate with other trades the installation of electrical items that will be installed with or within formwork, walls, partitions, ceilings, and panels.

2. Coordination and Intent of Electrical Drawings:

a. Dimensions on Drawings related to equipment are based on equipment of certain manufacturers. Verify the dimensions of equipment furnished to space available at the Site and allocated to the equipment.

b. Drawings show the principal elements of the electrical Work and are not intended as detailed working drawings for the electrical Work. Drawings supplement and complement the Specifications and other Contract Documents relative to principal features of electrical systems.

c. Equipment and devices provided under this Contract shall be properly connected and interconnected with other equipment and devices for successful operation of complete systems, whether or not all connections and interconnections are specifically mentioned or shown in the Contract Documents.

d. Drawings are provided for CONTRACTOR's guidance in fulfilling the intent of the Contract Documents CONTRACTOR shall comply with Laws and Regulations, including safety and electrical codes, and provide materials,

equipment, appurtenances, and specialty items necessary for complete and operable systems.

C. Related Sections:

1. Section 02 41 00, Demolition.
2. Section 03 00 05, Concrete.
3. Section 05 05 33, Anchor Systems.
4. Section 31 20 00, Earth Moving.
5. Section 31 23 16.13, Trenching.
6. Section 40 60 05, Instrumentation and Control for Process Systems.

D. Area Classifications:

1. Wet Locations: Comply with NEC and NEMA requirements for wet locations. Enclosures in wet locations shall comply with NEMA 4 unless specified otherwise.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Electrical Subcontractor:

a. Electrical Subcontractor shall have not less than five years experience installing electrical systems of the types required for the Project.

b. Electrical Subcontractor shall possess a valid electricians' and contractors' license in the jurisdiction where the Site is located.

c. Submit the following information for not less than three successful, completed projects: project name and location; year completed; name and contact information for: prime contractor for whom electrical Subcontractor worked, project owner, and project engineer or architect, including addresses and telephone numbers.

B. Component Supply and Compatibility:

1. Materials and equipment similar to each other shall be from the same manufacturer for uniformity.

C. Regulatory Requirements:

1. Permits: Refer to the General Conditions, Supplementary Conditions, and other parts of the Contract Documents for responsibilities relative to obtaining and paying for permits, licenses, and inspection fees.

2. Codes: Refer to Section 01 42 00, References, for indication of applicable codes.

1.3 SUBMITTALS

A. General:

1. To the extent practical, submit Shop Drawings and other CONTRACTOR submittals for each Specification Section into the smallest number of submittals possible. Do not furnish partial submittals.

2. Review of equipment submittals does not relieve CONTRACTOR of responsibility for providing complete and successfully operating systems.

B. Action Submittals: Submit the following:

1. Shop Drawings:

a. Internal wiring diagram and drawings indicating all connections to components and numbered terminals for external connections.

b. Dimensioned plan, section, elevations, and panel layouts showing means for mounting, conduit connection, and grounding.

c. List of components including manufacturer’s name and catalog number (or part number) for each.

2. Product Data:

a. Manufacturer's name and product designation or catalog number.

b. Electrical ratings.

c. Manufacturer’s technical data and specifications.

d. Manufacturer’s indication of compliance with applicable reference standards.

e. Painting and coating systems proposed.

3. Test Procedures: Proposed testing procedures and testing limitations for source quality control testing and field quality control testing.

C. Informational Submittals: Submit the following:

1. Manufacturer’s Instructions:

a. Installation data and instructions.

b. Instructions for handling, starting up, and troubleshooting.

2. Source Quality Control Submittals: Results for required shop testing.

3. Field Quality Control Submittals: Results for required field testing.

4. Qualifications:

a. Electrical Subcontractor.

D. Closeout Submittals: Submit the following:

1. Record Documentation:

a. System Record Drawings: Include the following:

1) One-line wiring diagram of the electrical distribution system.

2) Actual, in-place conduit and cable layouts with schedule of conduit sizes and number, and size of conductors.

3) Layouts of the power and lighting arrangements and the grounding system.

4) Control schematic diagrams, with terminal numbers and control devices identified, for all equipment.

b. Record documents shall indicate final equipment and field installation information.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Contractor shall comply with requirements specific to all electrical systems work mentioned in Section 01 65 00, Product Delivery Requirements, and Section 01 66 00, Product Storage and Handling Requirements.

PART 2 – PRODUCTS

A. Performance Criteria:

1. Electrical equipment shall be capable of operating successfully at full-rated load, without failure, with ambient outside air temperature of 30 degrees F to 100 degrees F and an elevation of 1100 feet above mean sea level.

2. Unless specified otherwise, electrical equipment shall have ratings based on 75 degrees C terminations.

B. Testing Laboratory Labels: Electrical material and equipment shall bear the label of Underwriters' Laboratories, Inc., or other nationally recognized, independent testing laboratory, where standards have been established and label service applies.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which Work will be performed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:

1. Install materials and equipment in accordance with the Contract Documents, Laws, and Regulations, approved (and accepted, as applicable) Shop Drawings and other CONTRACTOR submittals, and manufacturer's recommendations.

2. Provide tools and equipment required to trace circuits necessary for proper execution of the Work.

3. Define and identify all wiring, circuit terminations, and equipment to be modified to ensure proper interface of components. The Contract Price includes all costs associated with field services specified for a complete and functional system.

3.3 FIELD QUALITY CONTROL

A. Field Quality Control – General:

1. Perform field quality control for electrical Work in accordance with the Contract Documents.

B. Site Tests:

1. Prior to requesting certificate of Substantial Completion, demonstrate to ENGINEER those electrical systems and electrically operated equipment installed or modified under the Contract operates in accordance with the Contract Documents and operates as required.

2. Perform the following operational tests on electrical systems:

a. Operate power circuits to verify proper operation and connection to electrical systems materials and equipment, including mechanical key-interlocks for circuit breakers.

b. Operate control circuits, including pushbuttons, indicating lights, and similar devices, to verify proper connection and function. Operate all devices, such as pressure switches, flow switches, and similar devices, to verify that shutdowns and control sequences operate as required.

c. Operate lighting systems and receptacle devices to verify proper operation and connections.

3. Prepare and submit report on the equipment demonstration and operating field quality control tests. Report shall include complete information on the tests performed, date completed, and results.

C. Manufacturer's Services:

1. Furnish at the Site qualified, factory-trained representative(s) of equipment manufacturers for the services indicated in the Contract Documents.

+ + END OF SECTION + +

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install low-voltage conductors and cabling.
2. Types of cabling required include:
    a. Insulated cable for installation in raceways.

B. Related Sections:

1. Section 26 05 53, Identification for Electrical Systems.
2. Section 31 20 00, Earth Moving.
3. Section 31 23 16.13, Trenching.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
2. ASTM B3, Specification for Soft or Annealed Copper Wire.
3. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
4. UL 44, Thermoset-Insulated Wires and Cables.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:

1. NEC Article 300, Wiring Methods.
2. NEC Article 310, Conductors for General Wiring.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Product Data:

a. Manufacturer's literature, specifications, and engineering data for low volt insulated cable proposed for use.

B. Informational Submittals: Submit the following:

1. Field Quality Control Submittals:

a. Written results of field insulation resistance tests.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Insulated Cable in Raceways:

1. Application: Use for circuits located indoors and outdoors.

2. Manufacturers: Provide products of one of the following:

a. Southwire.

b. The Okonite Company.

c. American Insulated Wire

d. General Cable

e. Or approved equal.

3. Material: Single conductor copper cable complying with ASTM B3 and ASTM B8 with flame-retardant, moisture- and heat-resistant insulation rated for 90 degrees C in dry or wet locations, listed by UL as Type XHHW-2 or RHW-2 complying with UL 44.

4. Wire Sizes: Not smaller than No. 12 AWG for power and lighting and No. 14 AWG for 120-volt control circuits.

5. Stranding: 600-volt cable shall be stranded, except that solid cable, No. 10 and smaller may be used for lighting circuits.

B. Cable Connectors, Solderless Type:

1. Products and Manufacturers: Provide products of one of the following:

a. T&B Sta-Kon.

b. Burndy Hylug.

c. Or approved equal.

2. For wire sizes No. 4 AWG and above, use either compression type or bolted type with silver-plated contact faces.

3. For wire sizes up to and including No. 6 AWG, use compression type. Alarm and control wire shall be terminated using forked type connectors at terminal boards.

4. For wire sizes No. 250 KCMIL and larger, use connectors with at least two cable clamping elements or compression indents and provision for at least two bolts for joining to apparatus terminal.

5. Properly size connectors to fit fastening device and wire size. Connectors shall be rated for 90 degree C, 600 volts.

C. Cable Splices:

1. Products and Manufacturers:

a. Compression-Type Splices: Provide one of the following:

1) Burndy Hylink.

2) T&B Color-Keyed Compression Connectors.

3) Or approved equal.

b. Spring Connectors: Provide one of the following:

1) Buchanan B-Cap.

2) T&B Wire Connector.

3) Or approved equal.

2. For wire sizes No. 8 AWG and larger, splices shall be made up with compression type copper splice fittings. Splices shall be taped and covered with materials recommended by cable manufacturer to provide insulation equal to that on conductors.

3. For wire sizes No. 10 AWG and smaller, splices may be made up with pre-insulated spring connectors.

4. For wet locations, splices shall be waterproof. Compression type splices shall be waterproofed by sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring thermosetting resin into mold that surrounds the joined conductor. Spring connector splices shall be waterproofed with sealant filler.

5. Splices shall be suitably sized for cable, rated 90 degrees C, and 600 volts.

D. Wire and Cable Markers:

1. Provide wire and cable markers in accordance with Section 26 05 53, Identification for Electrical Systems.

2.2 SOURCE QUALITY CONTROL

A. Factory Tests:

1. Factory-test wire and cable in accordance with UL standards

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install cables complete with proper terminations at both ends. Check and correct for proper phase sequence and proper motor rotation.

B. Pulling:

1. Use insulating types of pulling compounds containing no mineral oil.

2. Pulling tension shall be within limits recommended by wire and cable manufacturer.

3. Use dynamometer where mechanical means are used.

4. Cut off section subject to mechanical means.

C. Bending Radius: Limit to minimum of six times cable overall diameter.

D. Slack: Provide maximum slack at all terminal points.

E. Splices:

1. Where possible, install cable continuous, without splice, from termination to termination.

2. Where required, splice as shown and where required for cable installation. Splices below grade, in manholes, handholes, and wet locations shall be waterproof.

3. Splices are not allowed in conduits.

F. Identification:

1. Identify conductors in accordance with Section 26 05 53, Identification for Electrical Systems.

2. Identify power conductors by circuit number and phase at each terminal or splice location.

3. Identify control and status wiring using numeral tagging system.

G. Color-code power cables as follows:

1. No. 8 AWG and Smaller: Provide colored conductors.

2. No. 6 AWG and Larger: Apply general-purpose, flame-retardant tape at each end, wrapped in overlapping turns to cover an area of at least two inches.

3. Colors: Match color scheme in use at the Site. If the Site does not have an existing color scheme, use the following colors:

System	Conductor	Color
All Systems	Equipment Grounding	Green
240/120 Volts Single-Phase, Three-Wire	Grounded Neutral One Hot Leg Other Hot Leg	White Black Red
208Y/120 Volts Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	White Black Red Blue
240/120 Volts Three-Phase, Four-Wire Delta, Center Tap Ground on Single-Phase	Grounded Neutral Phase A High (wild) Leg Phase C	White Black Orange Blue
480Y/277 Volts Three-Phase, Four-Wire	rounded Neutral Phase A Phase B Phase C	Gray Brown Orange Yellow

3.2 FIELD QUALITY CONTROL

A. Site Tests:

1. Test each electrical circuit after permanent cables are in place, to demonstrate that circuit and equipment are connected properly and will perform satisfactorily, free from improper grounds and short circuits.

2. Individually test 600-volt cable mechanical connections after installation and before they are put in service, with calibrated torque wrench. Values shall be in accordance with manufacturer's recommendations.

3. Individually test 600-volt cables for insulation resistance between phases and from each phase to ground. Test after cables are installed and before they are put in service, with Megger for one minute at voltage rating recommended by cable manufacturer or in accordance with ANSI/NETA ATS recommendations.

4. Insulation resistance for each conductor shall not be less than value recommended by cable manufacturer. Cables not meeting recommended value or that fail when tested under full load conditions shall be replaced with a new cable for full length.

+ + END OF SECTION + +

SECTION 26 05 23

INSTRUMENTATION AND COMMUNICATION CABLES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install instrumentation and communication cables.

2. Types of cables include the following:

a. Shielded instrumentation cables.

b. Data communication cables.

B. Related Sections:

1. Section 26 05 33.13, Rigid Conduits.

2. Section 26 05 53, Identification for Electrical Systems.

1.2 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section, have the following meaning:

1. “CPE” means chlorinated polyethylene.

2. “FEP” means fluorinated ethylene-propylene.

3. “XLPE” means cross-linked polyethylene.

1.3 REFERENCES

A. Standards referenced in this Section are:

1. ASTM A510, Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.

2. ASTM B633, Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

3. ANSI/TIA/EIA-568, Commercial Building Telecommunications Cabling (requirements and restrictions of Technical Service Bulletins (TSBs) apply.)

4. UL 13, Power-Limited Circuit Cables.

5. UL 1581, Electrical Wires, Cables, and Flexible Cords.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. NEC 725, Class 1, Class 2, and Class 3 Remote-Control, Signaling and Power-Limited Circuits.

2. NEC 727, Instrumentation Tray Cable.

3. NEC 800, Communications Circuits.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:

1. Product Data: Manufacturer's technical information for instrumentation cables and communications cables proposed.

B. Informational Submittals: Submit the following:

1. Field Quality Control Submittals: Written report of results of field quality control testing specified in this Section.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General:

1. Cables shall bear the UL label.

B. Single Shielded Pair Instrument Cables:

1. Manufacturers: Provide products of one of the following:

a. Belden Company.

b. Okonite Company.

c. Dekoron Wire and Cable Company.

d. Or approved equal.

2. Tinned Copper, XLPE-insulated, stranded conductors, not less than no. 16 AWG, twisted pair, with overall shield, stranded tinned no. 18 AWG copper drain wire and overall PVC or CPE jacket. Rated for not less than 600 volts and complying with UL 1581 or UL 13.

C. Multi-Paired Shielded Instrument Cables:

1. Manufacturers: Provide products of one of the following:

a. Belden Company.

b. Okonite Company.

c. Dekoron Wire and Cable Company.

d. Or approved equal.

2. Tinned Copper, XLPE- insulated stranded conductors, not less than no 16 AWG, stranded tinned no. 18 AWG copper drain wire, with overall 100% foil shield and overall PVC or CPE outer jacket. Rated for not less than 600 volts.

D. Multi-Conductor Shielded Instrument Cables:

1. Manufacturers: Provide products of one of the following:

a. Belden Company.

b. Okonite Company.

c. Dekoron Wire and Cable Company.

d. Or approved equal.

2. Tinned copper, XLPE-insulated stranded conductors, not less than no. 16 AWG, stranded tinned no. 18 AWG copper drain wire, with overall 100 percent foil shield and overall PVC or CPE jacket. Rated for not less than 600 volts.

E. Cable Terminals:

1. Manufacturers: Provide products of one of the following:

a. T&B Sta-Kon.

b. Burndy Insulug.

c. Or approved equal.

2. Fork type copper compression terminals with nylon insulation for termination of cable at terminal blocks.

F. Horizontal Unshielded Twisted Pair (UTP) Cables:

1. Horizontal cabling is cabling between and including the telecommunications outlet/connector and patch panel or termination block.

2. Manufacturers: Provide products of one of the following:

a. Bertek.

b. Belden.

c. Mohawk

d. Or approved equal.

3. Cables shall consist of no. 24 AWG, thermoplastic-insulated, solid conductors formed into four individually twisted pairs and enclosed by thermoplastic jacket.

4. Comply with ANSI/TIA/EIA-568, Part 10.2.

5. Riser-rated where installed in conduit. Other installations shall be plenum-rated.
6. Rated for Category 6 use.

G. Patch Cords:
1. Patch cords are used for connecting patch panel to hub, or wall jack to equipment.
2. Manufacturer: Provide products of one of the following:
   a. Bertek.
   b. Belden.
   c. Mohawk
   d. Or equal.
3. Cables shall consist of no. 24 AWG, thermoplastic-insulated, stranded conductors formed into four individually-twisted pairs and enclosed by thermoplastic jacket.
4. Cables shall be riser-rated.
5. Rated for Category 6 use.
6. Cables shall incorporate integral strain relief into the connector at each end. Connectors shall be RJ45 plugs.
7. Provide the following patch cords:
   a. One 10-foot cable per wall jack installed.
   b. One 3-foot cable per every two wall jacks installed.
   c. One 5 foot cable per every two wall jacks installed.

H. Connecting Hardware for Unshielded Twisted Pair (UTP) Cables:

1. Hardware used to terminate UTP cable shall comply with ANSI/TIA/EIA-568, Part 10.4.
2. Connecting hardware shall be compatible with wiring specified in the Contract Documents.
3. Rated for Category 6 use.
4. Connecting hardware shall utilize 110-type terminal blocks to coordinate with patch panels and termination blocks specified the Contract Documents.
5. Telecommunications Outlets/Connectors:
   a. Manufacturers: Provide products of one of the following:
      1) Hubbell.
      2) Or approved equal.
   b. Outlets and connectors shall utilize RJ45 (eight-pin modular) plug/receptacle configuration.

c. Outlets and connectors shall utilize T568B pin/pair assignments and must be coordinated with wire type (solid or stranded conductor).

d. Outlets shall be flush-mount type or surface-mount type, as indicated on the Drawings.

I. Patch Panels:

1. Manufacturers: Provide products of one of the following:

a. Black Box.

b. Or approved equal.

2. Patch panels shall utilize RJ45 (eight-pin modular) plug/receptacle configuration and utilize T568B pin/pair assignments for receptacles.

3. Coordinate patch panel terminations with wire type (solid or stranded conductor).

4. Patch panels shall be wall-mount type or rack-mount type, as indicated on the Drawings.

5. Listed as Category 6.

6. Provide quantity of ports not less than the quantity of wall jacks installed in the building/area served, plus 50 percent additional as spares.

J. Cable Support Hardware:

1. Conduit:

a. Where conduit is shown or indicated on the Drawings, comply with Section 26 05 33.13, Rigid Conduits.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials and equipment will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:

1. Install cables complete with proper terminations at both ends.

2. Install in conduit separate from power cables, unless shown or indicated otherwise.

3. Ground shield on shielded cables at one end only and as recommended by instrument manufacturer.

4. Identify conductors in accordance with Section 26 05 53, Identification for Electrical Systems.

5. Install and terminate Supplier-furnished cable in accordance with equipment manufacturer requirements and cable manufacturer's recommendations.

6. Install in accordance with Laws and Regulations, including NEC.

3.3 FIELD QUALITY CONTROL

A. Site Tests:

1. Test the shielded instrumentation cable shields with ohmmeter for continuity along full length of cables, and for shield continuity to ground.

2. Connect shielded instrumentation cables to calibrated 4 to 20 mA dc signal transmitter and receiver. Test at 4 and 20 mA transmitter settings.

3. Replace with new cables the full length of cables that fail test.

4. Test equipment shall be provided by the CONTRACTOR.

5. For testing of communications cables, test equipment used shall comply with the following:

a. Equipment shall consist of a "master" and a "remote" unit.

b. Test of all aspects of cables shall be automatic and initiated with a single command. Test over entire frequency range. Test unit shall be capable of accepting cable identification tag for reporting. Test unit shall return "pass/fail" status for cables and, if "fail," shall indicate reason for failure.

c. Test unit shall be capable of storing all test results internally and printing the results later.

d. For unshielded twisted pair cables, test unit shall be specifically designed and manufactured to certify cabling relative to Category 6 compliant.

+ + END OF SECTION + +

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install complete grounding for electrical systems, structures, and equipment.

A. Related Sections:

1. 32 31 00, Fences
2. 26 41 13, Lighting Protection for Structures

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
2. UL 467, Grounding and Bonding Equipment.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements

1. National Electrical Code, (NEC).
   a. NEC Article 250, Grounding and Bonding.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
   a. Listing of grounding connector types identifying where each will be used.
   b. Layouts of each structure’s ground grid.
   c. Test point construction details.
2. Product Data:
   a. Manufacturer’s technical information for grounding materials proposed for use.

3. Testing Plans:
    a. Ground resistance test procedure.

B. Informational Submittals: Submit the following:

1. Field Quality Control Submittals
    a. Results of ground resistance tests at each test point.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Bare Ground Cable:

1. Manufacturers: Provide products of one of the following:
    a. Cablec Corporation.
    b. General Cable Corporation.
    c. Southwire Cable Company.
    d. Or approved equal.
2. Material: Soft-drawn, bare copper stranded cable complying with ASTM B8. No. 4/0 AWG minimum size unless otherwise shown or indicated on the Drawings.

B. Ground Rods:

1. Manufacturers: Provide products of one of the following:
a. Copperweld, Bimetallics Division.
b. ITT Blackburn Company.
c. Or approved equal.
2. Material: Copper-clad rigid steel rods, 3/4-inch diameter, ten feet long.
3. All required ancillary items: As shown in Contract Drawings.

C. Grounding Connectors:

1. Products and Manufacturers: Provide one of the following:
    a. Pressure Connectors:
        1) O.Z./Gedney, Division of General Signal Corporation.
        2) Burndy Corporation.
        3) Or approved equal.
    b. Welded Connections:
        1) Cadweld by Erico Products, Incorporated.

2) Therm-O-Weld by Burndy Corporation.

3) Or approved equal.

2. Material: Pressure connectors shall be copper alloy castings, designed and fabricated specifically for items to be connected and assembled with Durium or silicone bronze bolts, nuts, and washers. Welded connections shall be by exothermic process utilizing molds, cartridges, and hardware designed specifically for connection to be made.

D. Ground Test Well:

1. As shown in Contract Drawings.

E. Ground Bonding Jumpers:

1. Braided copper tape, one inch wide, woven of No.30 gauge bare copper wire, terminated with copper ferrules.

F. Ground system components shall comply with UL 467.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions for the Work and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions are corrected.

3.2 STRUCTURE GROUND SYSTEM

A. Provide ground grids as shown and indicated on the Drawings.

B. Provide No. 4/0 bare copper cable around exterior perimeter of structures at not less than 2.5 feet below grade, unless otherwise shown or indicated on the Contract Documents.

C. For structures with steel columns, provide No. 4/0 ground cable from grid to each column around perimeter of structure. Connect cable to steel with exothermic welds.

D. Connect grids to continuous underground water pipe system, when practical.

E. For new structures with concrete foundation or footings, connect structure's reinforcing steel or other concrete-encased electrode to grounding grid.

F. Provide accessible test points for measuring the ground resistance of each grid.

G. Weld all buried connections except for test points.

3.3 EQUIPMENT GROUNDING

A. Ground electrical equipment in compliance with Laws and Regulations and the Contract Documents.

B. Equipment grounding conductors shall be bare stranded copper cable of adequate size installed in metal conduit where required for mechanical protection. Ground conductors, pulled into conduits with non-grounded conductors, shall be insulated. Insulation shall be green.

C. Control panels grounding conductors shall be bare stranded copper cable of adequate size to ground grid from AC ground bus, and an insulated stranded copper cable of adequate size to ground grid from DC ground bus.

D. Connect ground conductors to conduit with copper clamps, straps, or with grounding bushings.

E. Connect to piping by welding or brazing. Use copper bonding jumpers on gasketed joints.

F. Connect to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding. Do not use hold-down bolts. Where grounding provisions are not included, drill suitable holes in locations recommended by equipment manufacturer or designated by ENGINEER.

G. Connect to motors by bolting directly to motor frames, not to soleplates or supporting structures.

H. Connect to service water piping by means of copper clamps. Use copper bonding jumpers on gasketed joints.

I. Scrape bolted surfaces clean and coat with conductive oxide-resistant compound.

3.4 FIELD QUALITY CONTROL

A. Site Tests:

1. Test completed grounding systems for resistance to ground using an electrical three-terminal ground resistance tester. Test all grounded cables and metal parts for continuity of connection. ENGINEER and OWNER will witness the testing.

2. Grounding system maximum resistance shall not exceed five ohms under normally dry conditions when measured by resistance tester. Resistance values above five ohms shall be brought to ENGINEER’s attention. Provide additional ground rods as required to attain a resistance to ground of less than five ohms for each ground grid. Add grounding additive installing additional ground rods to increase their effectiveness.

+ + END OF SECTION + +

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install hangers and supports for electrical systems.

2. Area Classifications: Materials shall by suitable for the area classification(s) shown or indicated on the Drawings, and specified in Section 26 05 05, General Provisions for Electrical Systems.

B. Related Sections:

1. Section 05 05 33, Anchor Systems.

2. Section 26 05 05, General Provisions for Electrical Systems.

3. Section 26 05 33.13, Rigid Conduits.

1.2 REFERENCES

A. Standards referenced in this section are:

1. ASTM A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Detailed installation drawings showing dimensions and compatibility with proposed layout.

2. Product Data:

a. Manufacturer’s name, product designation, and catalog number of each material item proposed for use.

b. Manufacturer’s specifications including material, dimensional and weight data, and load capacity for each supporting system component proposed for use.

c. Pictorial views and corresponding identifying text of each component proposed for installation.

d. Documentation that confirms product compatibility with Laws and Regulations.

B. Informational Submittals: Submit the following:

1. Certifications:

a. Submit certifications required under this Section.

2. Manufacturer's Instructions:

a. Manufacturer's installation instructions, including recommended tightening torque values for all nuts and bolts.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide products of one of the following:

1. B-Line.
2. Kindorf.
3. Unistrut
4. Or approved equal.

2.2 MATERIALS

A. Strut, Fittings, and Accessories:

1. General

a. Unless otherwise shown or indicated, strut shall be 1-5/8 inches by 1-5/8 inches. Double struts shall be two pieces of the same strut, welded back-to-back at the factory.

b. Attachment holes, when required, shall be factory-punched on hole centers approximately equal to the cross-sectional width and shall be 9/16-inch diameter.

c. Fittings, braces, brackets, hardware, and accessories shall be Type 316 stainless steel.

d. Strut nuts shall be spring captured Type 316 stainless steel.

e. Square and round washers shall be Type 316 stainless steel.

2. Strut materials shall be suitable for area classifications indicated in Section 26 05 05, General Provisions for Electrical Systems, and shown or indicated on the Drawings.

a. Wet Locations:

1) Strut shall be 12-gage Type 316 stainless steel.

B. Hanger Rods:

1. Material:

a. Dry Locations: All-thread, zinc-coated

b. Wet, Corrosive, or Hazardous Areas: Stainless steel.

2. Size: Not less than 3/8-inch diameter, unless otherwise shown on the Drawings or specified.

C. Beam Clamps for Attaching Threaded Rods or Bolts to Beam Flanges for Hanging Struts or Conduit Hangers:

1. Beam clamps shall be stainless steel equipped with stainless steel square head set screw and shall include threaded hole sized for attaching the all-thread rod or threaded bolt.

D. Miscellaneous Hardware:

1. Bolts, screws, and washers shall be stainless steel.

2. Hex Nuts: Shall be stainless steel and include nylon inserts.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Provide hangers and supports for electrical systems with necessary channels, fittings, brackets, and related hardware for mounting and supporting materials and equipment. Provide anchor systems, concrete inserts, and associated hardware for proper support of electrical systems.

B. Install equipment and devices on hangers and supports as shown on the Drawings, as specified, and as required.

C. Install hangers and supports level, true, free of rack, and parallel and perpendicular to building walls and floors, so that the hangers and supports are installed in a neat, professional, skillful manner.

D. Holes in suspended ceilings for rods for hangers and supports and other equipment shall be provided adjacent to bars, where possible, to facilitate removal of ceiling panels.

E. Coordinate installation of hangers and supports with equipment, cabinets, consoles, panels, enclosures, boxes, conduit, cable tray, wireway, busway,

cablebus, piping, ductwork, lighting fixtures, and other systems and equipment. Locate hangers and supports clear of interferences and access ways.

F. Anchor Bolts, Expansion Anchors, and Concrete Inserts: Shall be in accordance with Section 05 05 33, Anchor Systems, and requirements of this Section.

G. Mounting of Conduit:

1. Provide space of not less than 1/4-inch between conduit surfaces and abutting or near surfaces except struts, cable trays, steel beams, and columns.

2. Fasten conduit to struts, cable trays, steel beams, and columns using specified clamps and straps as shown, specified, and required.

3. Devices shall be compatible with size of conduit and type of support. Following installation, size identification shall be visible and legible.

4. Install conduit supports and fasteners in accordance with Section, 26 05 33.13, Rigid Conduits.

H. Supports for Cabinets, Consoles, Panels, Enclosures, and Boxes:

1. Freestanding: Unless otherwise specified or shown on the Drawings, provide supports for floor-mounted equipment, cabinets, consoles, panels, enclosures, and boxes. Such supports shall be 3.5-inch-high concrete equipment base with a 45-degree chamfered edge. Base shall extend two inches beyond outside dimensions of equipment on all sides.

2. Wall-Mounted:

a. Provide space not less than 1/4-inch between cabinets, consoles, panels, enclosures, and boxes and the surface on which each is mounted. Provide non-metallic or stainless-steel spacers as required.

b. Do not mount equipment, enclosures, panels, and boxes directly to beams or columns. Mount struts to beams or columns using beam clamps, and mount equipment, enclosures, panels, and boxes to the struts.

3. Floor Stand Rack:

a. Where equipment, cabinets, consoles, panels, enclosures, and boxes cannot be wall-mounted, provide an independent floor stand rack.

b. Floor stand rack shall consist of struts, plates, brackets, connection fittings, braces, accessories, and hardware assembled in a rigid framework suitable for mounting of intended materials and equipment.

c. Equip floor stand racks with brackets and bases for rigidly mounting the framework to the ceiling or floor, as applicable; or equip floor stand racks with beam clamps, angle plates, washers, and bolts for fastening to beam flanges, as applicable.

d. When equipment, cabinets, consoles, panels, enclosures, and boxes weigh more than 100 pounds:

1) Main vertical supports of floor stand rack assemblies shall be back-to-back struts.

2) Bracing, clamping, and anchoring of each floor stand rack shall be sufficient to ensure rigidity of the floor stand rack with the intended equipment, enclosures, conduit, cable tray, busway, cable bus, and wireway installed. Floor stand racks shall not be deflected more than 1/8-inch by a 100-pound force applied at any point on the floor stand rack in any direction.

I. Drilling into beams or columns is not allowed unless authorized by ENGINEER.

J. Tighten nuts and bolts to the manufacturer's recommended torque values.

K. Field Cutting:

1. Cut edges of strut and hanger rod shall have rounded corners, edges beveled, and burrs removed. If field cutting the strut is required, use clean, sharp, dedicated tools. Remove oil, shavings, and other residue of cuttings prior to installation.

2. Coatings: To prevent corrosion:

a. Coat cut edges with epoxy-base touchup paint.

b. Coat cut edges with zinc-rich paint.

+ + END OF SECTION + +

SECTION 26 05 33.13

RIGID CONDUITS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install conduit and fittings to form complete, coordinated, and grounded raceway systems.

2. When specific, detailed conduit routings for various systems within buildings and other areas are not be shown on the Drawings, CONTRACTOR shall establish routings based on single-line, riser, and interconnection diagrams and other information on the Drawings. CONTRACTOR shall provide for the proper installation of conduits in each system.

3. Conduit types and the installation methods shall comply with the following, unless otherwise shown or indicated in the Contract Documents:

a. Use steel conduit (rigid steel or intermediate metallic) for exposed indoor conduit runs in non-corrosive areas.

b. Use PVC-coated rigid steel or aluminum conduit for exposed interior or exterior conduit runs in hazardous, wet, and corrosive locations.

c. Use PVC-coated rigid steel conduit for individual conduits direct-buried in the ground.

d. Use Schedule 40 PVC or steel conduit for concrete-encased duct bank runs.

e. Use steel conduit for plant monitoring and control (PMCS) systems, system control and data acquisition (SCADA) systems, and communication systems, regardless of the installation.

B. Coordination:

1. Conduit runs shown are diagrammatic. Coordinate conduit installation with piping, ductwork, light fixtures, and other systems and equipment and locate to avoid interferences.

2. For conduits to be embedded in concrete slabs, confirm adequate slab thickness and coordinate location of conduits with placement of reinforcing steel, waterstops, expansion joints, and other features of the concrete slab.

C. Related Sections:

1. Section 05 05 33, Anchor Systems.
2. Section 26 05 29, Hangers and Supports for Electrical Systems.
3. Section 26 05 53, Identification for Electrical Systems.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ANSI C80.1, Standard for Rigid Electrical Steel Conduit (ERSC).
2. ANSI/NEMA FB1, Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.
3. NEMA TC2, Electrical Polyvinyl Chloride (PVC) Conduit.
4. NEMA TC3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
5. UL 6, Electrical Rigid Metal Conduit – Steel.
6. UL 514B, Conduit, Tubing, and Cable Fittings.
7. UL 651, Safety Schedule 40 and 80 Rigid PVC Conduit and Fittings.
8. UL 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.
9. UL 1242, Electrical Intermediate Metal Conduit – Steel.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:

1. NEC Article 342, Intermediate Metal Conduit
2. NEC Article 344, Rigid Metal Conduit.
3. NEC Article 352, Rigid Nonmetallic Conduit.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Assembly details of conduit racks and other conduit support systems.

b. Layout drawings showing proposed routing of exposed conduits, conduits embedded in structural concrete, and conduits directly buried in the ground. Shop Drawings shall show locations of pull and junction boxes and penetrations in walls and floors. Shop Drawings of embedded conduits shall include cross-sections showing thickness of concrete slabs and locations of conduits relative to reinforcing steel, waterstops, and other features of the slab.

2. Product Data:

a. Manufacturer's catalog cuts and product data for conduit, fittings, and appurtenances.

B. Informational Submittals: Submit the following:

1. Manufacturer's Instructions:

a. When requested by ENGINEER, provide copies of manufacturer's recommendations for handling and installing products.

2. Site Quality Control Submittals:

a. When requested by ENGINEER, provide copies of results of specified Site quality control testing.

C. Closeout Submittals: Submit the following:

1. Record Drawings:

a. Show actual routing of exposed and concealed conduit runs in record documents in accordance with Section 01 78 39, Project Record Documents.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Rigid Steel Conduit, Elbows, and Couplings:

1. Manufacturers: Provide products of one of the following:

a. Allied Tube and Conduit.

b. Wheatland Tube Company.

c. Western Tube and Conduit Corporation.

d. Or approved equal.

2. Material: Rigid, heavy-wall, mild steel, hot-dip galvanized, smooth interior, tapered threads, and carefully reamed ends; 3/4-inch NPS minimum size.

B. PVC-coated Rigid Steel Conduit, Elbows, and Couplings:

1. Manufacturers: Provide products of one of the following:

a. Robroy Industries.

b. Perma-Cote Industries.

c. OCAL, Inc.

d. Or approved equal.

2. Material: Rigid, heavy-wall, mild steel, hot-dip galvanized, smooth urethane interior coating, tapered threads, carefully reamed ends, 3/4-inch NPS minimum size with factory exterior coating of 40-mil thick PVC.

3. Color: Color of coating shall be the same on all conduit and fittings.

C. Metallic Conduit Fittings, and Outlet Bodies:

1. Manufacturers: Provide products of one of the following:

a. Crouse-Hinds Company.

b. Appleton Electric Company.

c. Or approved equal.

2. Material and Construction: Cast gray iron alloy, cast malleable iron or aluminum bodies, and covers consistent with conduit material. Units shall be threaded type with five full threads. Materials shall comply with ANSI/NEMA FB1 and be listed by UL. Do not use "LB" fittings. Use type "LBD" fittings where use of fittings is unavoidable.

3. Use: Conduits shall be gasketed and watertight in hazardous, wet, and corrosive locations.

D. PVC-coated Conduit Fittings, and Outlet Bodies:

1. Manufacturers: Provide products of one of the following:

a. Robroy Industries.

b. Perma-Cote Industries.

c. OCAL, Inc.

d. Or approved equal.

2. Material and Construction: Cast gray iron alloy, cast malleable iron bodies, and covers with factory coating of 40-mil thick PVC and smooth urethane interior coating. Units shall be threaded type with five full threads. Material shall comply with ANSI/NEMA FB1

and be listed by UL. Do not use "LB" fittings. Use type "LBD" fittings where use of fittings is unavoidable.

3. Use: Provide PVC-coated or aluminum conduit fittings and outlet bodies in hazardous, wet, and corrosive locations. Fitting material shall be consistent with conduit material.

E. Non-metallic Conduit and Fittings:

1. PVC Plastic Conduit:

a. Manufacturers: Provide products of one of the following:

1) Amoco Chemicals Corp.

2) Carlon Electrical Products.

3) Or approved equal.

b. Material: Schedule 40 PVC, rated for 90 degrees C, complying with NEMA TC3 and UL 514B and 651.

c. Fittings: Form elbows, bodies, terminations, expansions, and fasteners of same material and manufacturer as base conduit. Provide cement by same manufacturer as base conduit.

F. Conduit Hubs:

1. Manufacturers: Provide products one of the following.

a. Myers Electrical Products Company.

b. Or approved equal.

2. Material: Threaded conduit hub, vibration-proof, weatherproof, with captive O-ring seal, zinc metal with insulated throat and bonding screw.

3. Use: Provide for all conduit terminations to boxes, cabinets, and other enclosures in areas designated as wet locations.

G. PVC-coated Conduit Hubs:

1. Manufacturers: Provide products one of the following:

a. Robroy Industries.

b. Perma-Cote Industries.

c. OCAL, Inc.

d. Or approved equal.

2. Material: Threaded conduit hub, vibration-proof, weatherproof, with captive O-ring seal, zinc metal with insulated throat and

bonding screw, and factory coating of 40-mil thick PVC and smooth urethane interior coating.

3. Use: Provide for PVC-coated steel or aluminum conduit terminations to boxes, cabinets, and other enclosures in areas designated as corrosive location.

H. Conduit Bushings and Locknuts:

1. Manufacturers: Provide products one of the following:

a. O-Z/Gedney.

b. Appleton Electric Company.

c. Or approved equal.

2. Insulated Bushings: Malleable iron body with plastic liner. Threaded type with steel clamping screw. Provide with bronze grounding lug, as required.

3. Locknuts: Steel for sizes 3/4-inch through two-inch diameter and malleable iron for sizes 2.5-inch through four-inch diameter.

4. Use: Provide for all conduit terminations to boxes, cabinets, and other enclosures except threaded type in areas designated as dusty locations.

I. Thruwall Seals

1. For new construction through exterior subsurface walls and exterior concrete walls.

a. Manufacturer: Provide one of the following:

1) Type WSK and WSCS by O-Z/Gedney.

2) Or approved equal.

2. For new construction passing through concrete floors and floor slabs.

a. Manufacturer: Provide one of the following:

1) Type FSK and FSCS floor seals by O-Z/Gedney.

2) Or approved equal.

3. For conduits passing through new exterior masonry block walls or through core-drilled holes in existing exterior subsurface walls, exterior concrete walls, floor slabs, and roof slabs, and for conduits passing through existing interior concrete walls or floors and interior masonry block walls.

a. Manufacturer: Provide one of the following:

1) Type CSMI sealing bushing at the inside of the structure and Type CSMC sealing bushing at the outside of the structure by O-Z/Gedney.

2) Or approved equal.

2.2 ACCESSORIES

A. Fasteners: To the extent possible, fastener material shall be consistent with conduit material. For PVC-coated rigid steel conduit runs, fasteners shall have factory applied PVC coating or be stainless steel. Fasten raceway systems to supporting structures using the following:

1. To Wood: Wood screws.

2. To Hollow Masonry Units: Toggle bolts, in accordance with Section 05 05 33, Anchor Systems.

3. To Brick Masonry: Expansion bolts by Price, or equal.

4. To Concrete: Anchors in accordance with Section 05 05 33, Anchor Systems.

5. To Steel: Beam clamps in accordance with Section 26 05 29, Hangers and Supports for Electrical Systems.

B. Duct Sealing Compound

1. Soft, fibrous, slightly tacky, non-hardening sealing compound.

2. Remains workable at all temperatures.

3. Manufacturer:

a. Type DUX by O-Z/Gedney.

b. Or approved equal.

2.3 IDENTIFICATION

A. Conduit Labels:

1. Provide conduit labels in accordance with Section 26 05 53, Identification for Electrical Systems.

B. Warning Tape:

1. Provide warning tape in accordance with Section 26 05 53, Identification for Electrical Systems.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install in accordance with Laws and Regulations.

B. Supports:

1. Rigidly support conduits by clamps, hangers, or Unistrut-type channels. Conduit supports and accessories shall be in accordance with Section 26 05 29, Hangers and Supports for Electrical Systems.

2. Support single conduits by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the support surface. Support multiple runs of conduits on trapeze type hangers.

C. Fastenings: Fasten raceway systems rigidly and neatly to supporting structures using specified materials.

D. Exposed Conduit:

1. Install parallel or perpendicular to structural members or walls.

2. Where possible, run-in groups. Provide conduit racks of suitable width, length, and height, arranged to suit field conditions. Provide support every ten feet, minimum.

3. Install on structural members in protected locations.

4. Locate clear of interferences.

5. Provide six inches of clearance from hot fluid lines and ¼-inch from walls.

6. Install vertical runs plumb. Unsecured drop length shall not exceed 12 feet.

E. Underground Conduits:

1. Install individual, underground conduits minimum of 20 inches below grade, unless otherwise shown or indicated.

2. Perform excavation, bedding, backfilling, and surface restoration, including pavement replacement where required, in accordance with Section 31 20 00, Earth Moving, and Section 32 12 00, Flexible Paving.

3. Install warning tape 12 inches below finished grade over buried conduits.

F. Empty Conduits:

1. Install nylon pull wire in each empty conduit and cap conduits not terminating in boxes with permanent fittings designed for the purpose.

G. Field Bends: No indentations. Diameter of conduit shall not vary more than 15 percent at bends.

H. Joints:

1. Apply conductive compound to joints before assembly.
2. Make up joints tight and ground thoroughly.
3. Use standard tapered pipe threads for conduit and fittings.
4. Cut conduit ends square and ream to prevent damaging wire and cable.
5. Use full threaded couplings. Split couplings are not allowed.
6. Use strap wrenches and vises to install conduit. Replace conduit with wrench marks.
7. Apply zinc-rich paint to exposed threads and other areas of galvanized conduit system where base metal is exposed.

I. Terminations:

1. Install insulated bushings on conduits entering boxes or cabinets, except when threaded hubs are used.
2. Provide locknuts on both inside and outside of enclosure, except when threaded hubs are used.
3. Use of bushings in lieu of locknuts is not allowed.
4. Install conduit hubs on conduits entering boxes or cabinets in wet and corrosive areas.

J. Moisture Protection:

1. Plug or cap conduit ends at time of installation to prevent entrance of moisture and foreign materials.
2. Underground and embedded conduit connections shall be watertight.
3. Thruwall Seals and Conduit Sealing Bushings: Install for conduits passing through concrete slabs, floors, walls, or concrete block walls.

4. Drainage: Conduit runs shall be fully drainable. Where possible, install conduit runs to drain to one end and away from building. Avoid pockets or depressions in conduit runs.

5. Seal conduit openings within control and instrumentation panels and distribution equipment with duct sealing compound to provide watertight seal.

K. Corrosion Protection:

1. Conduit Curb:

a. For conduits routed in concrete slabs or floors and stub-ups through floor, provide (--1--)-inch high concrete curb, extending two inches from outer surface of conduit penetrating floor, to prevent corrosion. For floor-mounted equipment, concrete equipment base shall be in lieu of concrete curb.

b. Conduit stub-ups shall be 90-degree, PVC-coated, rigid, galvanized steel conduit elbow. PVC-coated elbow shall extend a minimum of ½-inch above top of concrete curb or equipment base. Should elbow not reach specified height, provide PVC-coated conduit extension to accommodate specified requirements. Provide coupling or fitting for transition from rigid galvanized steel conduit or PVC conduit in slab to PVC-coated elbow.

c. For conduits stubbing up and terminating at equipment enclosure mounted on concrete base, provide insulated grounding bushing on PVC-coated rigid steel elbow.

d. For conduits stubbing up and extending to boxes, cabinets, and other enclosures above the concrete curb in wet and dusty areas, provide conduit coupling/fittings between the PVC-coated rigid steel elbow and rigid steel conduit for transition between the two conduit types.

e. For conduits stubbing up and extending to boxes, cabinets, and other enclosures above the concrete curb or equipment base in corrosive areas, continue conduit system with PVC-coated rigid steel conduit.

2. Dissimilar Metals:

a. Prevent occurrence of electrolytic action between dissimilar metals.

b. Do not use copper products in connection with aluminum, and do not use aluminum in locations subject to drainage of copper compounds on bare aluminum.

c. Back paint aluminum in contact with masonry or concrete with two coats of aluminum-pigmented bituminous paint.

L. Non-metallic Conduit:

1. Install in accordance with manufacturer's recommendations.

2. Provide manufacturer's recommended adhesives or sealants for watertight connections.

3. Provide expansion fittings for expansion and contraction to compensate for temperature variations. Fittings shall be watertight and suitable for direct burial.

4. Transition to PVC-coated rigid steel conduit before making turn up to enclosures.

M. PVC-coated Rigid Steel Conduit:

1. Install in accordance with manufacturer's recommendations.

2. Install with manufacturer's installation tools to avoid damage to PVC coating.

3. Repair damaged PVC coating with manufacturer's recommended touch-up compound.

N. Identify conduits, including spares, in accordance with Section 26 05 53, Identification for Electrical Systems.

3.3 FIELD QUALITY CONTROL

A. Site Tests:

1. Test conduits by pulling through each conduit a cylindrical mandrel with length not less than two pipe inside diameters, having an outside diameter equal to 90 percent of conduit's inside diameter.

2. Maintain a record, by number, of all conduits successfully tested.

3. Repair or replace conduits that do not successfully pass testing, and re-test.

+ + END OF SECTION + +

SECTION 26 05 33.16

FLEXIBLE CONDUITS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install flexible metallic conduit and fittings.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. UL 360, Liquid-Tight Flexible Steel Conduit.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:

1. NEC Article 350, Liquid-Tight Flexible Metal Conduit.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Product Data:

a. Manufacturer’s literature and technical information for flexible conduit and fittings proposed for use.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Flexible Conduit (Non-hazardous Areas and Class 1, Division 2, Hazardous Areas):

1. Material: Flexible galvanized steel core with smooth, abrasion--resistant, liquid-tight, polyvinyl chloride cover. Continuous copper ground built in for sizes 3/4-inch through 1.25-inch. Material shall be UL-listed.

2. Products and Manufacturers: Provide one of the following:

a. Anaconda Sealtite Type UA by Anamet Electrical, Inc.

b. Liquatite Type L.A. by Electric-Flex Company.

c. Or approved equal.

B. Flexible Conduit Fittings:

1. Material and Construction: Malleable iron with cadmium finish. Fittings shall adapt the conduit to standard threaded connections, shall have an inside diameter not less than that of the corresponding standard conduit size and shall be UL listed.

2. Manufacturers: Provide products of one of the following:

a. Crouse-Hinds Company.

b. Appleton Electric Company.

c. Or approved equal.

3. Use: Provide on flexible conduit in non-hazardous and Class 1, Division 2 hazardous areas.

C. PVC-Coated Conduit Fittings:

1. Material and Construction: Malleable iron with standard finish and 40-mil PVC exterior coating. Fittings shall adapt the conduit to standard threaded connections and shall have an inside diameter not less than that of the corresponding standard conduit size.

2. Manufacturers: Provide products of one of the following:

a. Robroy Industries.

b. Permacote Industries.

c. OCAL, Inc.

d. Or approved equal.

3. Use: Provide on flexible conduit in areas designated as corrosive locations.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install at motors, transformers, field instruments, and equipment subject to vibration or require movement for maintenance purposes. Provide necessary reducer where equipment furnished cannot accept 3/4-inch diameter flexible conduit. Limit flexible conduit length to three feet maximum.

B. Install in conformance with the Laws and Regulations.

+ + END OF SECTION + +

SECTION 26 05 33.26

EXPANSION/DEFLECTION FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install conduit expansion and deflection fittings.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. UL 514B, Conduit, Tubing, and Cable Fittings.
   2. UL 467, Grounding and Bonding Equipment.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:
   1. NEC Article 300, Wiring Methods.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Listing of locations where fittings are required.
   2. Product Data:
      a. Manufacturer’s literature and technical information for expansion and deflection fittings proposed for use.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Products and Manufacturers: Provide one of the following:
   1. Type DX for expansion/deflection or AX for expansion only, by O-Z Gedney Company.
   2. Type XD for expansion/deflection or XJ for expansion only, by Crouse Hinds Company.
   3. Type DF for expansion/deflection or XJ for expansion only, by Appleton Electric Company.
   4. Or equal.

B. Cast gray iron alloy or bronze end couplings, malleable iron, or hot-dipped galvanized body, stainless steel clamps and tinned copper braid bonding jumper. Fitting shall be watertight, corrosion-resistant, UL-listed, and compatible with the conduit system.

C. Features:
   1. Expansion/Deflection Fittings:
      a. Axial expansion or contraction up to 3/4-inch.
      b. Angular misalignment up to 30 degrees.
      c. Parallel misalignment up to 3/4-inch.
   2. Expansion Fittings:
      a. Expansion/Contraction: Eight-inch total movement.

D. Expansion/Deflection fittings shall comply with UL 514B and UL 467.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install fittings in accordance with Laws and Regulations.

B. Provide expansion fittings on exposed conduit runs crossing structural expansion joints and where necessary to compensate for thermal expansion and contraction. Provide expansion fittings on exposed conduit runs exceeding 200 feet.

C. Provide expansion/deflection fittings on embedded conduit runs crossing structural expansion joints. Provide fittings above waterstops.

D. Unless specifically shown or indicated otherwise, when crossing structural expansion joints larger than one inch, provide expansion fitting together with expansion/ deflection fitting. Install fittings on each conduit run in accordance with manufacturer's recommendations to accommodate additional movement necessary.

E. Provide expansion/deflection fittings for underground conduit runs at penetrations of buildings, manholes, handholes, and outdoor concrete equipment pads.

F. Where required in non-metallic conduit and duct systems, provide rigid metal conduit nipples and metal rigid-to-PVC adapters for connection to fittings. Ensure that joints exposed to water or other liquid are made watertight.

+ + END OF SECTION + +

SECTION 26 05 33.33

PULL, JUNCTION, AND TERMINAL BOXES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install pull, junction, and terminal boxes.

B. Related Sections:

1. Section 26 05 05, General Provisions for Electrical Systems.
2. Section 26 05 29, Hangers and Supports for Electrical Systems.
3. Section 26 05 53, Identification for Electrical Systems.

1.2 REFERENCES

A. Standards referenced in this Section are.

1. AASHTO, Standard Specifications for Highway Bridges.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. NEC Article 314, Outlet, Device, Pull and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Product Data:

a. Manufacturer’s technical information for pull, junction, and terminal boxes proposed for use.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Pull, Junction, and Terminal Boxes:

1. General – Applicable to All Boxes:

a. Description and Performance Criteria:

1) Provide pull, junction, and terminal boxes rated at

not less than NEMA 12. Boxes shall be appropriate for each location in accordance with NEMA requirements and as required for area classifications specified in Section 26 05 05, General Provisions for Electrical Systems.

2) For flush-mounted pull boxes in slabs or pavement potentially subject to vehicular traffic, boxes and covers shall be constructed for H-20 loading in accordance with AASHTO Standard Specifications for Highway Bridges.

b. Manufacturers: Provide products of one of the following:

1) Appleton Electric Company.

2) Crouse-Hinds Company.

3) Hoffman Engineering Company.

4) Or approved equal.

c. Materials: Pull boxes embedded in concrete slabs shall be cast iron.

e. Terminal strips and terminal blocks in terminal boxes shall be mounted on terminal box sub-panels.

e. Identification: Boxes shall be identified in accordance with Section 26 05 53, Identification for Electrical Systems.

2. Materials and Construction – Dusty Locations:

a. Material: Welded and galvanized sheet steel of USS gage.

b. Gasket: Oil-resistant gasket.

c. Access: Lift-off hinges and quick-release latches.

d. Material Thickness:

1) Boxes with dimension two feet and smaller shall be 14-gage.

2) Boxes with dimension between two and three feet shall be 12 gauge.

3) Boxes with dimension of three feet or more in any direction shall be 10-gage.

3. Materials and Construction - Wet, Corrosive, or Hazardous Locations:

a. Rating:

1) Pull boxes in wet, corrosive, or outdoor areas shall be NEMA 4X.

2) Boxes for areas classified as hazardous locations, where required by NEC, shall be explosion-proof and comply with UL 886.

b. Material:

1) Cast gray iron alloy with hot-dip galvanized finish, or cast malleable iron bodies and covers.

2) Large boxes not generally available in cast iron construction shall be copper-free aluminum alloy or Type 316 stainless steel, as required by location.

3) In corrosive locations, where the conduit system is PVC-coated, boxes shall be cast metal with factory-applied 40-mil PVC coating, Type 316 stainless steel, or non-metallic thermoplastic or fiberglass reinforced plastic material.

c. Gasket:

1) Provide neoprene gaskets for wet and corrosive locations.

2) Gaskets shall be an approved type designed for the purpose. Improvised gaskets are not acceptable.

d. Access: Stainless steel cover bolts.

e. Features:

1) External mounting lugs.

2) Drilled and tapped conduit holes.

3) Boxes where conduits enter building or structure below grade shall have 1/4-inch drain hole at bottom of the box.

4) Provide threaded connections for explosion proof boxes.

B. Terminal Blocks:

1. Products and Manufacturers: Provide one of the following:

a. Allen-Bradley Company, Bulletin, Model 1492.

b. General Electric Company, Model CR151K.

c. Or approved equal.

2. Material and Construction:

a. NEMA-rated nylon modular terminal blocks.

b. 600-volt rated.

c. Control and alarm circuit terminals shall be screwed type with permanently affixed numeric identifiers beside each connection.

d. Power terminals shall be copper and rated for the circuit ampacity.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Mount boxes so that sufficient access and working space is provided and maintain clearance of not less than 1/4-inch from walls.

B. Securely fasten boxes to walls or other structural surfaces on which boxes are mounted. Provide independent supports that comply with Section 26 05 29, Hangers and Supports for Electrical Systems, where boxes will not be mounted on walls or other structural surface.

C. Install pull boxes where shown or indicated, and provide pull boxes where one or more of the following conditions exist:

1. Conduit runs containing more than three 90-degree bends.

2. Conduit runs exceeding 200 feet in length.

D. Provide removable, flame-retardant, insulating cable supports in boxes with any dimension exceeding three feet.

E. Field-apply PVC touch-up to scratched PVC boxes damaged during installation. Touch-up work shall be in accordance with manufacturer's recommendations and instructions.

F. Size junction, pull, and terminal boxes in accordance with NEC Article 314 and other Laws and Regulations.

G. Provide terminal blocks in boxes where shown and where cable terminations or splices are required.

+ + END OF SECTION + +

SECTION 26 05 33.36

OUTLET BOXES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install outlet boxes for mounting wiring devices and lighting fixtures.

B. Related Sections:
   1. Section 26 05 05, General Provisions for Electrical Systems.
   2. Section 26 05 29, Hangers, and Supports for Electrical Systems.
   3. Section 26 05 53, Identification for Electrical Systems.
   4. Section 26 27 26.13, Low-Voltage Receptacles.
   5. Section 26 27 26.23, Snap Switches.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:
   1. NEC Article 314, Outlet, Device, Pull and Junction Boxes; Fittings; and Handhole Enclosures.
   2. UL 514A, Metallic Outlet Boxes.
   3. UL 514B, Fittings for Conduit and Outlet Boxes.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product Data:
      a. Manufacturer’s technical information for outlet boxes proposed for use.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Device Boxes:
   1. Manufacturers: Provide products of one of the following:
      a. Crouse-Hinds Company.
      b. Appleton Electric Company.
      c. Or equal.

2. Material:
   a. In Wet Locations: Cast gray iron alloy or cast malleable iron with zinc electroplate finish, or aluminum bodies consistent with conduit material.
   b. Where conduit is installed concealed, boxes shall include suitable extension rings and covers, as required.
   c. Where used with PVC-coated conduit system, boxes shall include factory applied 40-mil-thick PVC coating.
   d. Cast boxes shall be hub-type and include external mounting lugs.
   e. Metallic outlet boxes shall comply with UL 514A.
   f. Fittings for outlet boxes shall comply with UL 514B.

3. NEMA rating of box shall be as required for area classifications specified in Section 26 05 05, General Provisions for Electrical Systems.

4. Cover Plates:
   a. Type 302 stainless steel alloy for indoor finished areas.
   b. Plates in corrosive locations shall include factory-applied 40-mil PVC coating.
   c. Stainless steel screws and hardware.
   d. For receptacle and switch cover plates, comply with Section 26 27 26.13, Low-Voltage Receptacles, and Section 26 27 26.23, Snap Switches.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Fasten boxes rigidly and neatly to supporting structures.

B. Securely fasten equipment to walls or other surfaces on which materials or equipment is mounted. Provide independent supports complying with Section 26 05 29, Hangers and Supports for Electrical Systems, where boxes are not mounted on walls or other surface capable of supporting the materials or equipment.

C. For units mounted on masonry or concrete walls, provide suitable 1/2-inch spacers to prevent mounting back of box directly against wall.

D. Leave no open conduit holes in boxes. Close unused openings with capped bushings.

E. Label each circuit in boxes and identify each circuit in accordance with Section 26 05 53, Identification for Electrical Systems.
F. Install outlet boxes in accordance with NEC Article 314.

+ + END OF SECTION + +

SECTION 26 05 43.13

UNDERGROUND DUCTBANKS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install underground ductbanks.

B. Coordination:
   1. Ductbank routing on the Drawings is diagrammatic. Coordinate installation with piping and other Underground Facilities and locate ductbanks clear of interferences.
   2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before underground ductbank Work.

C. Related Sections:
   1. Div 31 , Earthwork.
   2. Section 03 00 05, Concrete.
   3. Section 26 05 26, Grounding and Bonding for Electrical Systems.
   4. Section 26 05 53, Identification for Electrical Systems.
   5. Section 26 05 33.13, Rigid Conduits.
   6. Section 26 05 33.26, Expansion/Deflection Fittings.

1.2 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Layouts showing proposed routing of ductbanks and locations of manholes, handholes, and areas of reinforcement.
      b. Profiles of ductbanks showing crossings with piping and other Underground Facilities.
      c. Typical cross sections for each ductbank.

B. Informational Submittals: Submit the following:
   1. Special Procedure Submittals:
      a. Installation procedures.
   2. Field Quality Control Submittals:
      a. Field test report.

C. Closeout Submittals: Submit the following:

1. Record Drawings:
    a. Include actual routing of underground ductbank runs on record documents in accordance with Section 01 78 39, Project Record Documents.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Duct: Provide conduit and fittings in accordance with Section 26 05 33.13, Rigid Conduits. Conduit types shall be as follows:
    1. Schedule 40 PVC conduits for power circuits.
    2. Galvanized rigid steel conduits for the following types of circuits: low voltage status, analog, and communication.

B. Backfill: Provide backfill, including select backfill, in accordance with Div 31 specifications.

C. Reinforcing: Provide Ductbank reinforcing in accordance with Section 03 00 05, Concrete.

D. Concrete: Provide ductbank concrete in accordance with Section 03 00 05, Concrete.

E. Grounding: Provide ground cable in accordance with Section 26 05 26, Grounding and Bonding for Electrical Systems.

F. Conduit Spacers: Conduit spacers shall be nonmetallic, interlocking type to maintain spacing between conduits. Provide spacers suitable for all conduit types used in multiple sizes.

G. Duct Sealing Compound:
    1. Products and Manufacturers: Provide one of the following:
        a. 0-Z/Gedney, Type DUX.
        b. Or equal.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Excavation and Backfilling:
   1. Provide excavation and backfilling for ductbank installation in accordance with Div 31 specifications.
   2. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material, or other materials that can damage or contribute to corrosion of ducts or cables or prevent adequate compaction of backfill.

B. Ductbank Layout:
   1. Top of ductbank concrete shall be a minimum of 2.5 feet below grade, unless shown or indicated otherwise on the Drawings.
   2. Slope ductbank runs for drainage toward manholes and away from buildings with slope of approximately three inches vertical per 100 feet of run.

C. Ductbank Assembly:
   1. Assemble ductbanks using non-magnetic saddles, spacers, and separators. Position separators to provide minimum three-inch concrete separation between outer surfaces of each conduit. Provide side forms for each ductbank.
   2. Make bends with sweeps of not less than four-foot radius or five-degree angle couplings.

D. Concrete Placing:
   1. Provide minimum four-inch concrete covering on each side, top, and bottom of concrete envelopes around conduits. Concrete covering shall be as shown or indicated on the Drawings.
   2. Provide red dye in concrete for easy identification during subsequent excavation; all concrete in entire ductbank, including top and bottom, shall be dyed.
   3. Firmly fix conduits in place during concrete placing. Carefully place and vibrate concrete to fill spaces between conduits.

E. Conduit Transitions:
   1. Conduit installations shall be watertight throughout entire length of ductbank.
   2. Transition from non-metallic to galvanized rigid steel conduit where ductbanks enter structure walls and slabs.
   3. Terminate conduits in insulated grounding bushings.
   4. Continue conduits inside buildings in accordance with Section 26 05 33.13, Rigid Conduits, and as shown or indicated in the Contract Documents.
   5. If ducts are not concrete-encased, provide expansion and deflection fittings in accordance with Section 26 05 33.26, Expansion/Deflection Fittings.
   6. Plug and seal empty spare conduits entering structures. Conduits in use entering structures shall be sealed watertight with duct sealing compound.

F. Ductbank Reinforcing:
   1. Provide reinforcing for all ductbanks:
   2. Install ductbank reinforcement as shown or indicated on the Drawings.
   3. Provide maximum clearance of 1.5 inches from bars to edge of concrete encasement.

G. Connections to Structures:
   1. Firmly anchor ductbanks to structure walls or slabs. Epoxy-grout ductbank rebar into structure concrete to eliminate sheer forces between ductbank and structure wall concrete.
   2. Ductbank penetrations through structure walls shall be watertight.

H. Grounding:
   1. Provide bare stranded copper ductbank ground cable in each ductbank envelope. Make ground electrically continuous throughout entire ductbank system.
   2. Connect ground cable to building and station ground grid or to equipment ground buses. Also, connect ground cable to steel conduit extensions of underground ductbank system.
   3. Provide ground clamp and bonding of each steel conduit extension to maintain continuity of ground system.
   4. Terminate ground cable at last manhole or handhole for outlying structures.

I. Detectable Underground Warning Tape:
   1. Provide detectable underground warning tapes complying with Section 26 05 53, Identification for Electrical Systems, over the full length of each underground ductbank.
   2. Install warning tapes approximately 12 inches below grade.
   3. Provide multiple tapes across the width of each ductbank. Locate center of a warning tape above each edge of ductbank, and at intervals across top width of ductbank so that clear space between tapes does not exceed six inches.

J. Reused Existing Ducts:
   1. Pull rag swab through duct to remove water and to clean conduits prior to installing new cable.
   2. Repeat swabbing until all foreign material is removed.
   3. Pull mandrel through duct, if necessary, to remove obstructions.

+ + END OF SECTION + +

SECTION 26 05 43.23

MANHOLES AND HANDHOLES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install handholes for electrical systems Work.

B. Coordination:

1. Coordinate handhole installation with piping, sheeting other excavation supports, and other Underground Facilities, and locate clear of interferences.

2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before handhole for electrical systems Work.

C. Related Sections:

1. Section 03 30 05, Concrete.

2. Section 31 , Earthwork.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. AASHTO, Specifications for Highway Bridges.

2. ANSI/SCTE 77, Specification for Underground Enclosure Integrity.

3. ASTM A48/A48M, Specification for Gray Iron Castings.

4. ASTM A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

5. ASTM D4101, Specification for Polypropylene Injection and Extrusion Materials.

1.3 QUALITY ASSURANCE

A. Component Supply and Compatibility:

1. Obtain all handholes furnished under this Section from a single Supplier, unless otherwise acceptable to ENGINEER.

2. Handhole Supplier shall review and approve the Shop Drawing submittals for the handholes furnished.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Handholes: Submit schedule of handholes to be furnished and dimensions and pertinent data for each.

b. Castings:

1) Schedule of casting types and models to be furnished, with dimensional data and other pertinent data for each.

2) Fabrication and erection of all frame and cover assemblies. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Provide setting drawings for location and installation of castings and anchorage devices.

3) Where Site-specific castings are specified with unique lettering on handhole cover, provide Shop Drawing for castings indicating appropriate detail to indicate conformance to the Contract Documents.

2. Product Data:

a. Manufacturer's technical information, specifications, and literature for handholes, castings, and accessories proposed for use.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Material and Construction:

1. Material shall be in accordance with Section 03 30 05, Concrete.

2. Duct entrances shall be sized and located to suit the ductbanks.

B. Accessories:

1. Frames and Covers:

a. Manufacturers: Provide products of one of the following:

1) Neenah Foundry Company.

2) Campbell Foundry Company.

3) Or approved equal.

b. Material: Cast iron complying with ASTM A48/A48M, Class 30A, rated for AASHTO H-20 loading.

c. Covers: Watertight, sealed type marked “ELECTRICAL” in raised two-inch letters. Identify covers as shown or indicated on the Drawings.

d. Grout the frame to the handhole.

2. Insulators:

a. Products and Manufacturers: Provide one of the following:

1) Catalog No. J5122 by MacLean Power Systems.

2) Catalog No. C203-1120 by A.B. Chance Company.

3) Or approved equal.

b. Material: Porcelain.

2.2 SMALL HANDHOLES

A. Material and Construction:

1. Manufacturer: Provide products of one of the following:

a. Strongwell Quazite

b. Or approved equal

2. Material: Precast polymer concrete.

3. Duct entrances sized and located to suit ductbanks.

4. Enclosures and covers shall be UL-listed.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Excavation and Backfill:

1. Provide handholes for electrical systems where shown or indicated and verify at the Site the required locations.

2. Perform excavation and filling required for installing handholes for electrical systems, in accordance with Section 31 20 00, Earthmoving.

3. Provide handholes on granular subbase course as shown or indicated. If not shown, provide layer of compacted select fill not less than six inches deep on which handhole for electrical systems will be installed.

4. Carefully set, level, and align at proper grade handhole bases and handholes.

B. Handhole structures shall be watertight. Provide foam sealant to seal all penetrations into handholes for electrical systems.

C. Grading at Handholes:

1. Unpaved Areas:

a. Install handholes in unpaved areas as shown or directed by ENGINEER to rim elevation higher than finished grade.

b. Grade the ground surface to drain away from handholes.

c. Provide fill around handholes to level of upper rim of handhole frame, and evenly grade the surface to a one (vertical)-to-five (horizontal) slope to surrounding grade, unless otherwise shown or directed by ENGINEER.

2. Paved or Travelled Areas:

a. Install handholes in paved or travelled areas to meet final grade of paved or concrete surface.

b. In paved areas in state or county highways or municipal streets or roads, and handholes shall be 1/2-inch below elevation of final surface course (also known as top course or wearing course) of pavement.

c. Handholes shall not project above finished roadway pavement.

3. CONTRACTOR shall be solely responsible for proper height of handholes necessary to reach final grade. ENGINEER's review of Shop Drawings and other submittals for handholes is general in nature. Provide random-length precast handhole riser sections (if required) to adjust handholes to accommodate field conditions for final grading and final elevations.

3.2 FIELD QUALITY CONTROL

A. Watertightness:

1. Handholes for electrical systems shall be free of visible leakage. Inspect each handhole accompanied by ENGINEER, and repair leaks.

+ + END OF SECTION + +

SECTION 26 05 45

UTILITY SERVICES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install electric service and associated equipment at the Site.
   2. CONTRACTOR shall furnish and install the following Work regarding electric service:
      a. Transformer concrete pad will be provided by the utility but must be installed by the contractor along with associated grounding.
      b. Secondary cable and terminations, conduits, and associated underground ductbanks.
      c. Trenching for utility primary underground duct.
      e. Transformer grounding.
   3. Electric utility company, Coweta-Fayette EMC, will furnish and install the following:
      a. Primary cable and conduit, terminations, and splices.
      b. Transformer.
      c. Prefabricated transformer concrete pad. This pad will be installed by the contractor as mentioned above in point no.2.
      d. Meter Base.
      e. Meter cabinet and CT cabinet.

B. Coordination:
   1. CONTRACTOR shall coordinate with electric utility company and local telephone company relative to electric and telephone service connections and requirements. CONTRACTOR shall make all necessary arrangements with electric utility and telephone company.
   2. The Contract Price as awarded includes all costs associated with providing electric service and telephone service to the Site.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI C37.35, Guide for the Application, Installation, Operation and Maintenance of High Voltage Air Disconnecting and Load Interrupter Switches.

2. ANSI C37.46, Specifications for Power Fuses and Fuse Disconnecting Switches
3. ANSI/IEEE C62.11, IEEE Metal Oxide Surge Arresters of AC Power Circuits.

1.3 QUALITY ASSURANCE

A. Pre-installation Conference:
   1. Prior to transmitting submittals for materials and equipment related to electrical service or telephone service, and prior to installing materials and equipment associated with electrical service or telephone service, arrange a conference at the Site with the following:
      a. Electric utility company and telephone company.
      b. Supplier representatives (as required) for materials and equipment associated with electrical service or telephone service.
      c. Installers of other work related to and adjacent to electric and telephone services Work.
      d. ENGINEER and Resident Project Representative (as applicable).
      e. Other representatives directly concerned with performance of electric service and telephone service Work.
   2. Review at the conference the following relating to electrical service and telephone service Work:
      a. Review Project requirements including Contract Documents, approved Shop Drawings and other submittals, requests for interpretation transmitted by CONTRACTOR to ENGINEER, and other pertinent documents.
      b. Review scope of Work and scope of utility company work.
      c. Review required samples and submittals, both completed and to be completed.
      d. Review proposed costs for work that will be invoiced by utility companies.
      e. Review status of Work related to utility services and Progress Schedule related to utility services.
      f. Review availability of materials, tradesmen, equipment, and facilities required for progress, to avoid delays, and to protect the Work from damage.
      g. Review required inspection, testing, certifying, and quality control procedures.
      h. Review methods for complying with requirements of utility companies.
   3. Reconvene conference at earliest opportunity if additional information must be developed to conclude the required topics of the conference.
   4. Record in writing discussions of conference and decisions and agreements and disagreements; and revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them. Furnish copy of record to

each party attending and the OWNER.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Drawings showing proposed layout of electrical utility service.
      b. Drawings showing proposed layout of telephone service.
   2. Product Data:
      a. Manufacturer's literature and technical information, including technical specifications, indicating compliance with the Contract Documents for materials and equipment and construction procedures specified in this Section.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Fused Loadbreak Cutouts:
   1. Fused Loadbreak Cutouts shall be provided by the electric utility.

D. Lightning Arresters:
   1. Arresters: Arresters shall be standard distribution class valve arresters, metal-oxide type, suitable for operation on both overhead and underground distribution systems. Arresters shall be capable of cross arm mounting and shall have line and ground terminals capable of accepting copper or aluminum conductors from No.6 solid to No. 2 stranded. Test arresters in accordance with ANSI C62.11.
   2. Ratings: Arresters shall be rated for 11 KV.
   3. Identification: Provide each arrester unit with permanent nameplate that shall include the following:
      a. Manufacturer.
      b. Model.
      c. Voltage rating.
      d. Date of manufacturer.
      e. Duty cycle rating.
   4. Manufacturers: Provide products of one of the following:
      a. Cooper Power Systems.
      b. ABB Company.
      c. Or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install electric service materials and equipment in accordance with requirements of electric utility company, and install telephone service materials and equipment in accordance with requirements of telephone company. Install materials and equipment in accordance with NESC.

B. Install equipment in accordance with manufacturer's written recommendations.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Provide field testing and inspection of the load break switches. Field testing shall be in accordance with the manufacturer's recommendations and shall be performed by manufacturer's authorized representative.
   2. After installation and before equipment is energized; the load break switches shall be inspected, adjusted, and tested. The manufacturer's representative shall inform OWNER and ENGINEER if the equipment has been correctly installed, adjusted, and tested. No equipment is to be energized without the permission of OWNER.
   3. Perform the following tests and inspections before energizing load break switches. Provide test equipment and services for testing load break switches.
      1. Inspect the physical and mechanical conditions.
      2. Inspect all electrical connections to ensure connections are clean and tight, using a calibrated torque wrench.
      3. Perform operational checks and tests recommended by the equipment manufacturer. Verify that switches operate open and close correctly after they are energized.

B. Supplier's Services:
   1. Provide services of qualified factory trained specialists from manufacturer to instruct OWNER's operations and maintenance personnel in recommended operation and maintenance of gang-operated load break switches. Training requirements, duration of instruction, and qualifications requirements shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.

+ + END OF SECTION + +

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install identification for electrical apparatus and electrical Work.

B. Related Sections:

1. Section 26 05 19, Low Voltage Electrical Power Conductors and Cables.
2. Section 40 60 05, Process Control Systems General Provisions.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:

1. NEC Article 110, Requirements for Electrical Installation.
2. NEC Article 210, Branch Circuits.
3. NEC Article 215, Feeders.
4. NEC Article 504, Intrinsically Safe Systems.
5. NEC Article 700, Emergency Systems.
6. NEC Article 701, Legally Required Standby Systems.
7. NEC Article 702, Optional Standby Systems.
8. 40 CFR 1910.145 (OSHA) – Specification for Accident Prevention Signs and Tags.
9. NFPA 70E, Electrical Safety in the Workplace.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings: Submit the following:

a. Complete description and listing of proposed electrical identification and electrical identification devices for associated equipment or systems.

b. Conduit and wire identification numbering system and equipment signage.

2. Product Data:

a. Manufacturer's literature, cut sheets, specifications, dimensions, and technical data for all products proposed under this Section.

PART 2 – PRODUCTS

2.1 MANUFACTURED UNITS

A. Engraved Identification Devices (Nameplates and Legend Plates):

1. Nameplates:

a. Laminated thermoset plastic, 1/16-inch thick, engraved condensed block black lettering on white background, square corners, and beveled front edges, or match existing.

b. Size: As required.

c. Letter Size: Minimum 3/16-inch.

d. Nameplates one inch or less in height shall have one mounting hole at each end. Nameplates greater than one inch in height shall have mounting holes in the four corners.

2. Legend Plates:

a. Legend plates for pushbuttons, pilot lights, selector switches, and other panel-mounted devices shall be large size with dimensions of approximately 2-7/16 inches wide by 2-13/32 inches tall (Allen Bradley large automotive size), plastic, custom engraved with black letters on white background.

1) Provide standard-size legend plates where devices are mounted on motor control centers and spacing of devices precludes using automotive-size legend plates.

b. Lettering size and line weight shall be the same for all legend plates on the same panel or enclosure. Maximum size shall be 1/4-inch and minimum size shall be 1/8-inch.

B. Safety Signs and Voltage Markers:

1. Low-Voltage Safety Signs:

a. Products and Manufacturers: Provide one of the following:

1) B-302-86060 by Brady.

2) Or approved equal.

b. Low voltage safety signs shall be pressure-sensitive vinyl complying with 40 CFR 1910.145, five inches by 3.5 inches in size, and shall read, “DANGER – 480 VOLTS”.

2. Low-Voltage Markers:

a. Products and Manufacturers: Provide one of the following:

1) CV442xx by Brady.

2) Or approved equal.

b. Low voltage markers shall be either pressure-sensitive vinyl or vinyl cloth with black lettering on orange background and shall read, “120 VOLTS”, “208 VOLTS”, “120/208 VOLTS”, or “240 VOLTS” as required.

C. Arc-flash Safety Signs:

1. Products and Manufacturers: Provide one of the following:

a. Brady.

b. Or approved equal.

2. Warning signs shall be adhesive-backed polyester.

3. Refer to Specification 26 05 73- Arc Flash Short Circuit Study and Protective Device Coordination.

D. Voltage System Identification Directories:

1. General:

a. Directories shall be laminated thermoset plastic, 1/16-inch thick, engraved block black letters on white background, square corners, and beveled front edges.

b. Directories shall identify all voltage systems within building or structure.

c. Directories shall list the colors that identify ungrounded and grounded conductors of each system.

d. Colors shall be in accordance with Section 26 05 19, Low Voltage Electrical Power Conductors and Cables.

e. Example Directory Text:

Voltage System Identification		
System	**A, B, C**	**Neutral**
277/480	Brown, Orange, Yellow	Gray
120/208	Black, Blue, Red	White

2. Large directories for rooms shall have text height not less than 1/2-inch.

3. Small directories for equipment shall have text height of not less than 1/4-inch.

E. Conduit Labels:

1. Products and Manufacturers: Provide one of the following:

a. B-915-xxxxx by Brady.

b. Or approved equal.

2. Shall be pre-tensioned acrylic/vinyl construction coiled to completely encircle conduit for conduit up through five-inch diameter, or pre-molded to conform to circumference of conduit six-inch diameter and larger.

3. Attach strap-on style for six-inch diameter conduit with stainless steel springs.

4. Shall be blank for use with custom printed labels.

5. Custom Labels:

a. Shall have black lettering on yellow background.

b. Shall not contain abbreviations in legend.

c. Shall be custom printed on continuous tape with permanent adhesive using thermal printer specified below.

F. Wire Identification:

1. Heat Shrinkable Wire and Cable Labeling System:

a. Products and Manufacturers: Provide one of the following:

1) B-341 PS-xxx-2W by Brady.

2) Or approved equal.

b. White heat-shrinkable irradiated polyolefin shrink-on sleeves. Labels shall be thermal printed. Labels shall be not less than two inches wide.

2. Wrap-Around Wire and Cable Labeling System:

a. Products and Manufacturers: Provide one of the following:

1) THT-XX-427 by Brady.

2) Or approved equal.

b. Self-laminating white/transparent self-extinguishing vinyl strips. Length shall be sufficient to provide at least 2.5

wraps. Labels shall be thermally printed and not less than two inches wide.

G. Detectable Underground Warning Tape:

1. Products and Manufacturers:

a. Provide one of the following:

1) Indentoline by Brady.

2) Or approved equal.

2. Material: Polyethylene or polyester with detectable metal core and polyester underlaminate.

3. Width: Two inches.

4. Color and Labeling: Yellow or red with permanently imprinted black letters: “CAUTION – Buried Electric Line”, repeated continuously over full length of tape.

H. Thermal Printing System:

1. Utilize thermal transfer process to provide non-smearing labels and markers.

2. Wire and Cable Markers:

a. Portable, Products and Manufacturers: Provide one of the following:

1) TLS2200 by Brady.

2) Or approved equal.

b. Desktop, Products and Manufacturers: Provide one of the following:

1) 200M by Brady.

2) Or approved equal.

3. Cable Markers:

a. Portable, Products and Manufacturers: Provide one of the following:

1) Handimark by Brady.

2) Or approved equal.

b. Desktop, Products and Manufacturers: Provide one of the following:

1) Labelizer PLUS by Brady.

2) Or approved equal.

2.2 FABRICATION

A. Engraved Identification Devices (Nameplates and Legend Plates):

1. Nameplate and legend plate text is preliminary and subject to change pending final review and approval of nomenclature by ENGINEER after start-up and testing.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Provide electrical identification in accordance with manufacturer recommendations and as required for proper identification of equipment and materials.

B. Engraved Identification Devices (Nameplates and Legend Plates):

1. Unless otherwise indicated in the Contract Documents, attach permanent nameplates with permanent adhesive and with 3/16-inch diameter, round head, stainless steel machine screws into drilled and tapped holes.

2. Provide nameplate with 1.5-inch-high letters to identify each console, cabinet, panel, or enclosure as shown or indicated.

3. Provide nameplates for field-mounted motor starters, disconnect switches, manual starter switches, pushbutton stations, and similar equipment operating components, which shall describe motor or equipment function and circuit number.

4. Provide nameplates with 1/2-inch-high letters to identify each junction and terminal box shown or indicated.

5. On switchgear, provide nameplates for each main and feeder circuit including control fuses, and for each indicating light and instrument.

a. Provide nameplate with 1.5-inch-high letters giving switchgear designation, voltage rating, ampere rating, short circuit rating, manufacturer’s name, general order number, and item number.

b. Identify individual door for each compartment with nameplate giving item designation and circuit number.

6. Motor Control Centers:

a. Provide nameplate with 1.5-inch letters with motor control center designation.

b. Identify individual door for each unit compartment with nameplate identifying controlled equipment.

7. Except conduit, all electrical appurtenances including lighting panels, convenience outlets, fixtures, and lighting switches, shall be provided with nameplates indicating appropriate circuit breaker number(s).

8. Push Buttons:

   a. Provide legend plates for identification of functions.

   b. Provide nameplates for identification of controlled equipment.

   c. Provide red buttons for stop function.

   d. Provide black buttons for other functions.

9. Pilot Lights:

   a. Provide legend plates for identification of functions.

   b. Provide nameplates for identification of controlled equipment.

   c. Shall have lens colors as shown or indicated. Where no color is indicated, provide the following lens colors:

Color	Legend
Green	Running, Open
Red	Stopped, Closed
Amber	Alarm
Blue	Power
White	Status

10. Selector Switches:

    a. Provide legend plates for identification of functions.

    b. Provide nameplates for identification of controlled equipment.

11. Panel Mounted Instruments:

    a. Provide nameplates for identification of function.

12. Interiors of Cabinets, Consoles, Panels, Terminal Boxes, and Other Enclosures:

    a. Provide nameplates for identification.

    b. Provide each item inside cabinet, console, panel, terminal box, or enclosure with laminated plastic nameplate as

shown on approved Shop Drawings and CONTRACTOR"s other submittals. Install nameplates with adhesive.

c. Interior items requiring nameplates include:

1) Terminal blocks and strips.

2) Bus bars.

3) Relays.

4) Rear of face-mounted items.

5) Rear of door-mounted items.

6) Interior mounted items that require identification when mounted externally.

d. Circuit Breaker Directory:

1) Provide engraved laminated plastic directory listing function and load controlled for each circuit breaker within panel used for power distribution.

13. Re-label existing equipment whose designation have changed.

C. Safety Signs and Voltage Markers:

1. Provide safety signs and voltage markers on and around electrical equipment as shown or indicated.

a. Install rigid safety signs using stainless steel fasteners.

b. Clean surfaces before applying pressure-sensitive signs and markers.

2. Install high voltage safety signs on all equipment doors providing access to uninsulated conductors, including terminal devices, greater than 600 volts.

3. Provide cable tray safety signs on both sides of cable trays at maximum intervals of 20 feet. Install signs on side rails of tray as acceptable to ENGINEER.

a. Label cable trays that contain conductors greater than 600 volts with cable tray safety signs.

b. Cable trays that contain conductors greater than 208 volts and less than 600 volts shall be labeled with low voltage safety signs.

c. Cable trays that contain conductors of 120/208 volts shall be labeled with low voltage markers.

d. Do not label cable trays that contain only instrument signal cables.

e. Label cable trays that contain intrinsically safe wiring or cables in accordance with NEC Article 504.

4. Install low voltage safety signs on equipment doors that provide access to uninsulated 480-volt conductors, including terminal devices.

5. Install low voltage markers on each terminal box, safety disconnect switch, and panelboard installed, modified, or relocated as part of the Work and containing 120/208 volt conductors.

D. Voltage System Identification Directories

1. Provide voltage system identification directories as required by NEC Article 210 and NEC Article 215.

2. Provide in each electrical room voltage system identification directory mounted on wall or door at each entrance to room.

3. For panelboards, switchboards, motor control centers, and other branch circuit or feeder distribution equipment that are not located in electrical rooms, provide voltage system identification directory mounted on equipment.

a. Directories shall be affixed using epoxy glue. Screws or bolts shall not penetrate equipment enclosures.

b. Directories shall be readily visible and not obscure labels and other markings on equipment.

E. Arc-flash Safety Signs:

1. Provide arc-flash safety signs as required by NEC Article 110.

2. Provide signs for switchboards, panelboards, motor control centers, and industrial control panels. Provide signs for control panels that contain 480-volt equipment. Provide arc flash warning signs on other equipment where the incident energy is greater than 1.2 calories per square centimeter.

F. Conduit Labels:

1. Provide conduits with conduit labels unless otherwise shown or indicated.

2. Do not label flexible conduit.

3. Do not label exposed single conduit runs of less than 25 feet between local disconnect switches and their associated equipment.

4. Conduit labels shall indicate the following information:

a. Contract Number: Alphanumeric, three or four digits, as applicable.

b. Conduit Number: Alphanumeric as shown on the Drawings, as assigned by CONTRACTOR for unlabeled conduits, and in accordance with approved submittals.

5. Conduits that contain intrinsically safe wiring shall have an additional pipe marker provided that has blue letters on white background and reads, “INTRINSICALLY SAFE WIRING.”

a. Install intrinsically safe pipe markers in accordance with NEC Article 504 along entire installation. Spacing between labels shall not exceed 25 feet.

6. Provide conduit labels at the following locations:

a. Where each conduit enters and exits walls, ceilings, floors, or slabs.

b. Where conduit enters or exits boxes, cabinets, consoles, panels, or enclosures, except pull boxes and conduit bodies used for pull boxes.

c. At maximum intervals of 50 feet along length of conduit.

7. Orient conduit labels to be readable.

G. Wire and Cable Identification:

1. Color-coding of insulated conductors shall comply with Section 26 05 19, Low Voltage Electrical Power Conductors and Cables.

2. Use heat-shrinkable wire labels where wire or cable is terminated. Use wrap-around labels where wire or cable is to be labeled but is not terminated.

3. Do not provide labels for the following:

a. Bare (uninsulated) conductors, unless otherwise shown or indicated as labeled.

4. Provide wire and cable labels for the following:

a. New, rerouted, or revised wire or cable.

b. Insulated conductors.

c. Wire and cable terminations:

1) Wire labels shall be applied between 1/2-inch and one inch of completed termination.

2) Apply cable labels between 1/2-inch and one inch of cable breakout into individual conductors.

a) Label individual conductors in a cable after breakout as specified for wires.

b) Wire or cable existing cabinets, consoles, panels, terminal boxes, and enclosures.

1) Label wires or cables withing two inches of entrance to conduit.

c) Wire or cable in junction boxes and pull boxes.

1) Label wires or cables within two inches of entrance to conduit.

d) Wire and cable installed in cable tray.

1) Wire and cable shall have labels at maximum intervals of 20 feet.

e) Wire and cable installed without termination in electrical manholes.

1) Wire and cable shall have wrap-around labels applied within one foot of existing manhole.

5. Wire and Cable Identification System:

a. Wire and cable labels shall be imprinted with an identifying designator.

1) Wire and cable extending between two devices or items and that does not undergo a change of function shall be identified by a single unique designator as specified below.

b. Field Wiring:

1) Wire or cable designator shall consist of.

a) Three left most characters shall consist of the contract number under which wiring, or cable was installed.

b) Fourth character from the left shall be an asterisk (*), a plus sign (+) or a hyphen (-). Do not use other punctuation symbols in a wire designator.

c) Remaining characters shall be alphanumeric and make wire designator unique.

d) Numbering shall reflect actual designations used in the Work and shall be documented in record documents.

c. Cabinet, Console, Panel, and Enclosure Wiring, Internal:

1) New Cabinets, Consoles, Panels, and Enclosures:

a) Wire and cable inside cabinets, consoles, panels, and enclosures shall have designators as specified in Section 40 60 05, Instrumentation and Control for Process Systems.

6. Modified Cabinets, Consoles, Panels, and Enclosures

a. New or rerouted wire or cable in existing cabinets, consoles, panels, and enclosures shall be labeled as shown on the Drawings or be assigned a ten-character designator equivalent to field wire designator.

H. Wire and Cable Identification:

1. Label panel side of terminal to match panel wire number.

2. Label field side of terminal to match field wire number. Terminal number shall not include the Contract number.

I. Terminal Strip Labeling:

1. Label panel side of terminal to match panel wire number.

2. Label field side of terminal to match field wire number. Terminal number shall not include the Contract number.

+ + END OF SECTION + +

SECTION 26 05 73

ELECTRICAL POWER DISTRIBUTION SYSTEM STUDIES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, professional services, and incidentals required to perform electrical power distribution system studies.
   2. Motor starting and transformer information used in electrical power distribution system studies shall be based on equipment provided by CONTRACTOR and, where applicable, existing equipment ratings and settings.
   3. Electrical power distribution system studies shall include the following, as specified in this Section:
      a. Short-circuit study.
      b. Protective device evaluation study.
      c. Protective device coordination study.
      d. Arc flash analysis.

B. Related Sections:
   1. Section 26 05 53, Identification for Electrical Systems.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI/IEEE C37.91, Guide for Protective Relay Applications to Power Transformers
   2. ANSI/NCSL Z540.3 Requirements for the Calibration of Measuring and Test Equipment.
   3 IEEE 141, Recommended Practice for Electric Power Distribution in Industrial Plants (IEEE Red Book).
   4. IEEE 242, Recommended Practice for Protection and Coord. of Industrial and Commercial Power Systems (IEEE Buff Book).
   5. IEEE 399, Analysis (IEEE Brown Book), Recommended Practice for Power System Analysis.
   6. IEEE 1584, Guide for Performing Arc-Flash Hazard Calculations.
   7. NFPA 70E, Electrical Safety in the Workplace.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Professional Engineer:
      a. Engage a registered professional engineer legally qualified to practice in the jurisdiction where the Project is located and experienced in providing engineering services of the kind indicated. Professional engineer may be employed by independent consulting firm or manufacturer of power distribution equipment.
      b. Professional engineer shall have not less than five years of experience performing electrical power distribution system studies similar in scope and size to the studies required for the Project.
      c. Submit qualifications data.
      d. Responsibilities include but are not necessarily limited to:
         1) Performing or supervising the performance of electrical power distribution system studies and related field services.
         2) Preparing or supervising the preparation of test plans and test reports, and interpretation and engineering analysis of test data. Test reports shall bear the seal and signature of the professional engineer. State of licensure, license number, and professional engineer's name shall be clearly legible on the seal.
         3) Certifying that tests performed and results achieved conform to the Contract Documents.
   2. Field Engineer:
      a. Field engineer performing protective device testing shall be experienced in type of testing required and testing equipment used on the Project.
      b. Field engineer may be an employee of the protective device equipment manufacturer.

B. Test equipment and instrument calibration shall comply with accuracy standards of NIST and ANSI/NCSL Z540.3.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Studies:
      a. Calculations and results of the short-circuit study, protective device evaluation, and coordination studies in report format. Report shall be sealed and signed by the professional engineer retained for the studies. Submit preliminary reports (when specified) and final reports.
      b. Time current curves for protective devices included within the power system studies.

c. Calculations and results of arc-flash analysis in report format sealed and signed by professional engineer retained for the studies. Submit preliminary reports (when specified) and final reports.

2. Testing Plan: Submit work plan for field testing. Submit and obtain ENGINEER's approval prior to performing tests. Plan shall indicate schedule of field testing, time frames for tests, and duration of equipment outage for testing. Submit shutdown requests for each outage in accordance with Section 01 14 16, Coordination with Owner's Operations.
3. Field Survey Plan: Submit work plan for field survey and data gathering prior to beginning work. Plan shall indicate the schedule of work, time frames for data collection, and duration that equipment will be temporarily out of service. Submit shutdown requests for each outage in compliance with Section 01 14 16, Coordination with Owner's Operations.

B. Informational Submittals: Submit the following:
1. Test Reports:
a. Results of field testing.
2. Qualifications Statements:
a. Professional engineer.
b. Field engineer, when required by ENGINEER.

C. Closeout Submittals: Submit the following:
1. Final settings of protective devices. Submit compilation of final settings for each equipment lineup within 10 days of programming the associated protective devices.
2. Electronic Files:
a. Protective Devices:
1) Settings for all microprocessor-based protective devices.
2) Software versions used to program the protective devices.
b. Electrical Power Distribution System Studies:
1) Upon ENGINEER's approval or acceptance, as applicable, of submittals required under this Section, submit for OWNER's use all electronic files developed for the Work under this Section associated with the approved or accepted, as applicable, submittal to ENGINEER.
2) Electronic files submitted for OWNER's use shall become OWNER's property.
3) Source files for power studies performed under this Section.

1.5 ELECTRICAL POWER DISTRIBUTION SYSTEM STUDIES

A. General:
1. Perform a current and complete short-circuit study, protective device evaluation study, and protective device coordination study for the Site's

electrical distribution system. Perform studies in accordance with IEEE 141, IEEE 242, and IEEE 399.

2. Studies shall include all portions of high-, medium-, and low-voltage electrical power distribution systems, from the normal and alternate sources of power through low-voltage distribution system. Thoroughly cover in the study normal system operating method, alternate operation, and operations that could result in maximum fault conditions.
3. Promptly bring to attention of ENGINEER and OWNER problem areas and inadequacies in equipment.
4. Perform both preliminary and final short-circuit and coordination studies. Preliminary study shall verify adequacy of equipment's short-circuit ratings and establish preliminary settings required prior for energizing equipment. Perform final short-circuit and coordination study and arc flash analysis after ENGINEER's acceptance of preliminary study, but not later than the date when equipment installed under the Project is placed into service. Study data shall include the following:
    a. Preliminary Short-circuit and Coordination Study: Base the evaluation on the worst case operating mode. Include the utility-confirmed contribution.. Base the evaluation on estimated cable lengths, and proposed equipment and protective devices.
    b. Final Short-circuit and Coordination Study: Base the evaluation on utility-confirmed contribution. Evaluate the distribution system under each of the various operating modes. Base the evaluation on actual confirmed cable lengths, and installed equipment and protective devices.

B. Short-circuit Study:
    1. Perform short-circuit evaluation using computer software specifically designed for such use.
    2. Input data shall include electric utility company's short-circuit, single-, and three-phase contributions, with reactance/resistance (X/R) ratio, resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and other applicable circuit parameters.
    3. Calculate short-circuit momentary duties and interrupting duties on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.
    4. Short-circuit tabulations shall include symmetrical fault currents and X/R ratios. For each fault location, total duty on the bus and individual contribution from each connected branch, including motor back electro-motive force (EMF) current contributions, shall be listed with its associated X/R ratio.

C. Protective Device Evaluation Study:
   1. Determine adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing short-circuit ratings of these devices with the available fault currents.
   2. Apply appropriate multiplying factors based upon system X/R ratios and protective device rating standards.

D. Protective Device Coordination Study:
   1. Perform study to select or to check selections of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and setting.
   2. Overcurrent device settings estimated in the protective device coordination study shall provide complete, 100 percent selectivity. Selectively coordinate system such that only the device nearest a fault will operate to remove the faulted circuit. System selectively shall be based on both the magnitude and duration of a fault current.
   3. Study shall include all voltage classes of equipment starting at electric utility's incoming line protective device, down to and including medium- and low-voltage equipment. Phase and ground overcurrent and phase and ground fault protection shall be included, and settings for other adjustable protective devices.
   4. Plot time-current characteristics of installed protective devices on appropriate log-log paper. Maintain reasonable coordination intervals and separation of characteristic curves. Provide coordination plots for phase and ground protective devices for complete system. Use sufficient curves to clearly indicate selective coordination achieved through electric utility's main breaker, power distribution feeder breakers, and overcurrent devices at each major load center.
   5. Show maximum of eight protective devices per plot. Appropriately title each plot and include the following information as required for the circuits shown:
      a. Representative one-line diagram, legends, and types of protective devices selected.
      b. Power company's relays or fuse characteristics.
      c. Significant motor starting characteristics.
      d. Parameters of transformers, magnetizing inrush and withstand curves in accordance with ANSI C37.91.
      e. Operating bands of low-voltage circuit breaker trip curves, and fuse curves.
      f. Relay taps, time dial and instantaneous trip settings.
      g. Cable damage curves.
      h. Symmetrical and asymmetrical fault currents.
   6. Provide selection and settings of protective devices separately in tabular format listing circuit identification, IEEE device number, current

transformer ratios, manufacturer, type, range of adjustment, and recommended settings. Provide a tabulation of recommended power fuse selection for all fuses in system.

E. Arc-Flash Analysis:
   1. Conduct arc flash analysis after acceptance by ENGINEER of short-circuit study and coordination study. Perform arc flash analysis for each operating mode of the system, in accordance with IEEE 1584 and NFPA 70E.
   2. Document the protection and calculation procedures and coordination review in testing report. Present analysis results in tabular format showing the following:
      a. Bus and protection device name.
      b. Bolted and arcing fault values.
      c. Protective device trip times.
      d. Arc flash boundary, working distance, and incident energy.
      e. Required protective flame-resistant (FR) clothing class.

1.6 STUDY REPORT

A. Summarize results of electrical power distribution system studies in a typed or computer-printed report that includes the following:
   1. Description, purpose, basis, written scope, and single-line diagram of power distribution systems evaluated.
   2. Tabulations of circuit breaker, fuses, and other equipment ratings versus calculated short-circuit duties. Evaluation of short-circuit calculations and identification of underrated equipment.
   3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, and fuse selection. Include an evaluation and discussion of logical compromises for proposed protection.
   4. Fault current tabulation including definition of terms and guide for interpretation.
   5. Tabulation of appropriate tap settings for relay seal-in units.
   6. Tabulation of equipment survey information.

B. Electrical power distribution system studies report shall include a separate section addressing arc flash analysis. In addition to protection and calculation procedures, and coordination review and analysis results, report shall include protective device evaluation for each high-incident energy case to determine if adjustments can improve system performance relative to arc flash hazard level.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PREPARATION

A. General:
   1. Coordinate with professional engineer performing the studies and assist professional engineer with collecting information necessary to complete the specified studies.
   2. Prior to performing studies, obtain information pertaining to existing system necessary for performing studies.

B. CONTRACTOR's professional engineer shall confirm and establish proper settings for protective devices. Professional engineer shall collect data and coordinate with equipment Suppliers to establish proper settings for the devices provided. Document in the study all devices and settings.

3.2 FIELD TESTING

A. Site Tests:
   1. Provide protective device field testing in accordance with manufacturers' recommendations. Field testing shall be by CONTRACTOR's field engineer, after submittal of and ENGINEER's acceptance of electrical power distribution system studies. Field testing results shall be documented in a report that shall include final settings of protective devices.
   2. Field engineer shall provide necessary tools and equipment and adjust, set, calibrate, and test protective devices. Protective relays and meters in medium- and low-voltage equipment shall be set, adjusted, calibrated, and tested in accordance with manufacturers' recommendations and the coordination study. Provide minor adjustments, repairs, and lubrication necessary for proper operation.

   3. Solid state and multi-function trip devices shall be set, including required programming necessary for the protection required. Devices shall be checked, configured, and tested for setting and proper operation.

3.3 INSTALLATION

A. Provide personnel protective equipment labels in accordance with Section 26 05 53, Identification for Electrical Systems.
   1. Supplier Services: Provide training for OWNER's operation and maintenance personnel in personnel protection equipment. Provide at least eight hours of training, in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.

+ + END OF SECTION + +

SECTION 26 22 14

DRY-TYPE LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install dry type low-voltage distribution transformers.

B. Related Sections:

1. Section 26 05 05, General Provisions for Electrical Systems.
2. Section 26 05 26, Grounding and Bonding for Electrical Systems.
3. Section 26 05 53, Identification for Electrical Systems.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. NEMA ST-20, Dry Type Transformers for General Applications.
2. NEMA TP-1, Guide for Determining Energy Efficiency for Distribution Transformers.
3. NEMA TP-2, Standard Test Method for Measuring the Energy Consumption for Distribution Transformers.
4. UL 1561, Dry Type General Purpose, and Power Transformers.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. NEC Article 450, Transformers and Transformer Vault (Including Secondary Ties).

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Schedule of transformers to be furnished with ratings and other required technical data.

b. Proposed location for each transformer, including pad layout, dimensions, and appurtenances.

2. Product Data:

a. Supplier's technical information for transformers proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Dry Type Two-Winding Transformer:

1. Type: Dry type, air cooled, low temperature rise. Transformers 15 kVA and larger shall be energy efficient, complying with NEMA TP-1 Class 1 efficiency levels. Transformers less than 15 kVA shall be general purpose. Transformer must have copper windings.

2. Rating: KVA, primary voltage and connection, secondary voltage and connection, frequency and number of phases shall be as shown on the Drawings.

3. Insulation: Insulation and average winding temperature rise (in a 40 degree C maximum ambient) for rated kVA per the following table. Energy efficient transformers shall be capable of 15 percent continuous overload at 150 degrees C temperature rise.

kVA Rating	Insulation Class (Degrees C)	Temperature Rise (Degrees C)
1 to 15 kVA	185	115
25 to 500 kVA	220	115

4. Winding Taps, Transformers 15 kVA and Less: Two 5-percent below rated voltage, full capacity taps on primary winding.

5. Winding Taps, Transformers 25 kVA and Larger: Two 2-1/2-percent above rated voltage and four 2-1/2+ percent below rated voltage, full capacity taps on primary.

6. Basic impulse level shall be 10 kV.

7. Sound Level: NEMA ST-20 standard.

8. Enclosure: UL listed for the application.

9. Identification: Identify transformers in accordance with Section 26 05 53, Identification for Electrical Systems, with the transformer number and voltages, connection data, kVA ratings, impedance, and overload capacity.

10. Transformers shall comply with NEMA ST-20, NEMA TP-1, NEMA TP-2, and UL 1561.
11. Transformers shall bear the label of the Underwriters' Laboratories, Inc.

B. Manufacturers: Provide products of one of the following:

1. Cutler-Hammer.
2. General Electric Company.
3. Square D Company.
4. Siemens.
5. Or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the conditions under which the dry type transformers are to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install transformers on walls or floors at locations shown. Install floor mounted transformers on raised concrete bases. Provide sufficient access and working space for convenient and safe operation and maintenance.

B. Mount transformers so that vibrations are not transmitted to the building structural parts and other equipment. Make connections to transformers with flexible conduit.

C. Adjust tap settings to provide proper voltage at panelboards.

D. Install dry type transformers in conformance with governing codes and manufacturer's instructions and recommendations, and the Contract Documents.

+ + END OF SECTION + +

SECTION 26 24 16

PANELBOARDS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install panelboards.

B. Related Sections:

1. Section 26 05 05, General Provisions for Electrical Systems.
2. Section 26 05 53, Identification for Electrical Systems.
3. Section 26 22 14, Dry-Type Low-Voltage Distribution Transformers
4. Section 26 43 00, Surge Protective Devices.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. NEMA PB 1, Panelboards.
2. UL 67, Panelboards.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
   a. Listing of panelboards to be furnished with identification of their proposed location, and all electrical characteristics, including number and rating of branch circuit breakers and enclosure type.
2. Product Data:
   a. Manufacturer’s technical information for panelboards proposed for use, including product literature and specifications. Indicate options and features to be provided.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements; Comply with the following:

1. NEC Article 408, Switchboards and Panelboards.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Packing:

a. Inspect prior to packing to assure that assemblies and components are complete and undamaged.

b. Protect mating connections.

c. Cover all openings into enclosures with-vapor inhibiting, water-repellent material.

2. Deliver materials and equipment to Site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in concrete in ample time to prevent delaying the Work. Upon deliver, check materials and equipment for evidence of water that may have entered equipment during transit.

3. Comply with Section 01 65 00, Product Delivery Requirements.

B. Storage and Protection:

1. Store panelboards in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.

2. Comply with Section 01 66 00, Product Storage and Handling Requirements.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Panelboards:

1. Manufacturers: Provide products of one of the following:

a. General Electric Company.

b. Eaton/Cutler-Hammer.

c. Schneider Electric/Square D Company.

d. Or approved equal.

2. Rating: Voltage rating, current rating, number of phases, number of wires and number of poles as shown or indicated on the Drawings.

3. Circuit Breakers: Molded case, bolt-in thermal magnetic type with number of poles and trip ratings as shown or indicated. Where indicated on the Drawings, circuit breakers shall be ground fault circuit interrupting type equipped with solid state sensing and five-milliamp sensitivity.

4. Circuit breakers for 480-volt panelboards shall have minimum interrupting rating of 35,000 ampere RMS symmetrical, unless otherwise indicated on the Drawings. Circuit breakers for other panelboards shall also have minimum interrupting rating of 35,000 ampere RMS symmetrical, unless otherwise indicated on the Drawings.

5. Bus Bars: Bus bars shall be 98 percent conductivity copper. Four-wire panelboards shall have solid neutral bar. Each panel shall have ground bus bar.

6. Main: Panelboards shall have main circuit breaker unless the Drawings specifically indicate main lugs only.

7. Connect branch circuit breakers for sequence phasing.

8. Enclosures: Panel enclosures shall be as required for the area classifications indicated in Section 26 05 05, General Provisions for Electrical Systems, unless otherwise indicated on the Drawings.

9. Construction: Code-grade steel, ample gutter space, flush door, flush snap latch and lock. Panelboards shall comply with NEMA PB 1 and UL 67.

10. Trim: Surface or flush as required.

11. Directory: Typed or computer-printed card, with transparent protective cover in frame on back of door giving circuit numbers and area or equipment served.

12. Identification: Identify panelboards in accordance with Section 26 05 53, Identification for Electrical Systems. Identification shall indicate panel number and voltage.

13. Directory of Existing Panelboards: When adding or removing breakers or loads from existing panelboards, provide a new typed or computer-generated directory card, indicating the circuit numbers and equipment served.

14. Provide surge protective device in accordance with Section 26 43 00, Surge Protective Devices, for each panelboard shown or indicated on the Drawings. Surge protective device shall be included and factory-mounted within panelboard-by-panelboard manufacturer. Surge protective device monitoring and display shall be visible from front of panelboard.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Mounting: Install panelboards at locations shown or indicated. Set cabinets so that top branch circuit breaker is not over six feet above the floor.

B. Directory: Complete typewritten or computer-printed directory indicating items controlled by each circuit breaker and the size of feeder serving the panel.

C. Arrange circuits to balance the loads on the panelboards.

D. Identify panelboards in accordance with Section 26 05 53, Identification for Electrical Systems.

E. Install in accordance with Laws and Regulations, manufacturer's recommendations, and the Contract Documents. Verify proper installation prior to energizing panelboards.

+ + END OF SECTION + +

SECTION 26 27 26.13

LOW-VOLTAGE RECEPTACLES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install low-voltage receptacles.

B. Related Sections:
   1. Section 26 05 05, General Provisions for Electrical Systems.
   2. Section 26 05 53, Identification for Electrical Systems.
   3. Section 26 05 33.36, Outlet Boxes.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. UL 498, Standard for Attachment Plugs and Receptacles.
   2. UL 514D, Cover Plates for Flush-Mounted Wiring Devices.
   3. UL 943, Standard for Ground-Fault Circuit-Interrupters.
   5. UL 1449, Standard for Surge Protective Devices.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:
   1. Americans with Disabilities Act.
   2. NEC Article 406, Receptacles, Cord Connectors, and Attachment Plugs (Caps).

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product Data: Manufacturer’s technical information for receptacles and cover plates proposed for use.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Ground Fault Interrupting Receptacles:
   1. Duplex grounding receptacle, two-pole, three-wire, NEMA 5-20R configuration, 125-volt AC, 20 amperes, gray color with ground fault circuit interrupting (GFCI) protection.

2. Ground fault interrupting receptacles shall comply with UL 943.
3. Provide Type 302 stainless steel cover-plate conforming to UL 514D. Provide weatherproof-while-in-use cover where shown on the Drawings as "WIP" or "WPU" and provide where located in wet or corrosive location.
4. Products and Manufacturers: Provide one of the following:
   a. GFR5362SGY by Hubbell, Inc.
   b. 2091-GRY by Pass & Seymour.
   c. Or equal.
5. Weather-resistant Ground Fault Interrupting Receptacles
   a. Products and Manufacturers: Provide one of the following:
      1) 2095TRWRGRY by Pass & Seymour.
      2) Or equal.

B. Weatherproof-While-in-Use Covers:
1. Where receptacles are shown on the Drawings as "WIP" or "WPU", and where receptacles are installed in wet locations as defined in area classification portion of Section 26 05 05, General Provisions for Electrical Systems, provide receptacles as specified in Paragraph 2.1.A of this Section, as applicable, with weatherproof-while-in-use covers as specified below.
2. Provide covers that are UL-listed, weatherproof while receptacle is in use, and are of ultraviolet-resistant construction suitable for outdoor use in accordance with NEC 406.
3. Material:
   a. Non-metallic box with hinged, non-metallic cover.
   b. Sealing gaskets between box and cover.
   c. Stainless steel screws and hardware.
   d. Color: Gray finish
4. Products and Manufacturers: Provide one of the following:
   a. TayMac Corporation.
   b. Pass and Seymour Type WIU
   c. Or approved equal equal.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Non-hazardous Locations: Install receptacles at locations shown, in outlet or device boxes in accordance with Section 26 05 33.36, Outlet Boxes.

B. Install receptacles with ground pole in the down position.

C. Mount receptacles 18 inches above finished floor in non-hazardous locations and 4.5 feet above finished floor in hazardous locations, in accordance with the Americans with Disability Act, unless otherwise shown or indicated in the Contract Documents.

D. Install in conformance with Laws and Regulations.

E. Identification:
   1. Identify each conductor with circuit number and lighting panel number in accordance with Section 26 05 53, Identification for Electrical Systems.
   2. Identify each receptacle with permanent phenolic tag. Tags shall include circuit number and lighting panel number.

+ + END OF SECTION + +

SECTION 26 27 26.23

SNAP SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install snap switches for lighting and other systems.

B. Related Sections:
   1. Section 26 05 53, Identification for Electrical Systems
   2. Section 26 05 33.36, Outlet Boxes.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. UL 20, General Use Snap Switches.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product Data: Manufacturer's technical information for switches proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Switches for Non-Hazardous Locations:
   1. Single pole AC toggle switch, quiet type, 120/277-volt AC, 20 amperes, Ivory, specification grade.
      a. Products and Manufacturers: Provide one of the following:
         1) Catalog No. 1221-I, by Harvey Hubbel, Inc.
         2) Catalog No. 1991-I, by Arrow-Hart, Inc.
         3) Catalog No. 20AC1-I, by Pass & Seymour
         4) Or equal.

   2. Single pole, three-way AC toggle switch, quiet type, 120/277-volt AC, 20 amperes, Ivory, specification grade.
      a. Products and Manufacturers: Provide one of the following:
         1) Catalog No. 1223-I, by Harvey Hubbell, Inc.
         2) Catalog No. 1993-I, by Arrow-Hart, Inc.

3) Catalog No. 20AC3-I, by Pass & Seymour
4) Or equal.

3. Two-pole AC toggle switch, quiet type, 120/277-volt AC, 20 amperes, Ivory, specification grade.
   a. Products and Manufacturers: Provide one of the following:
      1) Catalog No. 1222-I, by Harvey Hubbel, Inc.
      2) Catalog No. 1992-I, by Arrow-Hart, Inc.
      3) Catalog No. 20AC2-I, by Pass & Seymour
      4) Or equal.

4. Switches in non-hazardous areas shall be UL-listed in accordance with UL 20.

B. Switch Covers:
   1. Indoor covers shall be Type 304 stainless steel.
   2. Outdoor, wet, or corrosive location covers shall be weatherproof and corrosion resistant.

C. Key Operated On-Off Switches:
   1. Key operated switches shall be complete with legend plate and NEMA 4 enclosure and two keys for each switch.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switches at locations as shown or indicated in the Contract Documents in outlet or device boxes, in accordance with Section 26 05 33.36, Outlet Boxes.

B. Mount wall switches 4.0 feet above finished floor unless otherwise noted.

C. Identify each conductor with circuit number and lighting panel number. Identification shall be in accordance with Section 26 05 53, Identification for Electrical Systems.

+ + END OF SECTION + +

SECTION 26 29 13

REDUCED VOLTAGE SOLID STATE MOTOR CONTROLLERS

Part 1 - GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install reduced voltage solid state (RVSS) motor controllers.

B. Related Sections:

1. Section 26 05 05, General Provisions for Electrical Systems.

2. Section 26 05 53, Identification for Electrical Systems.

3. Section 26 29 33, Control Stations.

4. Section 40 60 05 Instrumentation and Control for Process Systems

C. Definitions:

1. The Reduced Voltage Solid State (RVSS) Motor Controller Unit shall refer to the actual controller unit that will be mounted within the specified enclosure.

2. The Reduced Voltage Solid State (RVSS) Motor Controller System shall refer to the controller unit and all items specified under Controller System Options.

1.02 REFERENCES

A. Standards referenced in this Section are:

Standard	Title
NEMA ICS 2	Controllers, Contactors and Overload Relays Rated 600 Volts.
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum).

1.03 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Listing of RVSS motor controller systems to be furnished, listing for each the installation location, NEMA rating and enclosure size, and equipment to be controlled.

b. Customized wiring diagrams for RVSS motor controller system.

2. Product Data:

a. Manufacturer's technical information, specifications, and standardized wiring diagrams for RVSS motor controller systems.

PART 2 - PRODUCTS

2.01 GENERAL

A. All references to vendors and "approved manufacturers" are included for description of quality and content of the designated equipment/materials. Equivalent items may be accepted if they meet all standards of quality and purpose for the intended use, as determined by Gwinnett County.

2.02 EQUIPMENT

A. Manufacturers: Provide products of one of the following:

1. Square D Company.

2. Rockwell Automation Allen-Bradley Company.

3. General Electric Company.

4. Benshaw.

5. Eaton.

6. Engineer Approved Equal.

B. General:

1. Type: Combination type with magnetic-only motor circuit protector with interrupting rating of not less than 65,000 ampere RMS symmetrical, unless otherwise indicated on the Drawings. Magnetic coil operated, NEMA horsepower rated, with thermal overload protection. Coil shall be rated 120 vac.

2. Enclosures: Panel enclosures shall be as required for area classifications specified in Section 26 05 05, General Provisions for Electrical Systems, unless otherwise indicated on the Drawings.

3. Functional Type: Reduced Voltage Solid-State Starter

    a. General:

        1) Provide solid-state, step-less, current limiting, soft-start, motor controllers (RVSS) as shown or indicated on the Drawings.

        2) RVSS shall be three-phase type and shall include an overload relay and isolation contactor.

        3) Provide subsystems that will protect RVSS from damage due to over-current and over-voltage.

        4) Current Rating: 115 percent of motor nameplate rated current, continuous, minimum.

    b. Required Features:

        1) RVSS shall be compatible for communication with Alcovy River Pump Station Control Panel via Ethernet IP. Provide Ethernet connection accordingly.

        2) Adjustable current limit of not more than 250 percent of motor nameplate full-load current throughout entire motor acceleration period including first three cycles of voltage waveform from instant start signal is engaged.

        3) Adjustable voltage acceleration, from two to 30 seconds to limit inrush and establish stating time

        4) Adjustable voltage deceleration, from two to 30 seconds.

        5) Phase loss detection.

        6) LED diagnostic indicators.

        7) Static over-current and over-voltage trip.

        8) Phase reversal, line or fuse loss, and under-voltage protection.

        9) Power unit over temperature protection.

        10) Motor inverse time overload protection.

11) Input line transient over-voltage protection.

c. Enclosure:

1) Provide NEMA 4 enclosure suitable for wet and corrosive areas.

2) Cooling fans, if required, shall incorporate anti-friction bearings and internal impedance type motor protection.

3) If cooling fans are used, enclosure for that section shall be NEMA 12 FVF, or NEMA 12 EFVFF force ventilated with filters, in accordance with NEMA ICS 1-110, installed by motor control center manufacturer.

d. On start-up, start driven equipment at zero current and allow driven equipment to accelerate to maximum speed without exceeding the set current limit.

e. On normal shutdowns, ramp driven equipment down at set deceleration rate that is non-regenerative for motor prior to shutdown.

f. On emergency shutdowns, remove power to motor control circuit.

g. Diagnostic LEDs: Provide LEDs on unit front that indicate the following:

1) Control power on.

2) In Remote indication.

3) In Local indication

4) Motor Running.

5) System fault.

6) Winding Temp High.

7) Suction Low Pressure

8) Moisture Detection

9) Motor Off.

Refer to electrical and instrumentation drawings for additional information.

h. Control Outputs:

1) Control output shall be electrically isolated, dry, normally open SPDT contacts, rated 10 amps at 120 vac.

2) Provide the following control outputs:

a) Motor running.

b) System fault.

c) Reset

Refer to electrical and instrumentation drawings for additional information.

i. The Controller shall provide as standard, the following protection features:

1) Motor Thermal Overload

2) Soft Start thermal overload

3) PTC input

4) Motor Shaft Torque (Max) machine process protection.

5) Motor Shaft Torque (Min) machine process protection.

6) Phase imbalance

7) Phase reversal

8) Over voltage

9) Under voltage

10) Locked Rotor

11) Excessive Starts per hour for application

12) Phase loss input / output

13) Motor output loss

4. Control power transformer fused and grounded on low-voltage (120 vac) side for each starter.

5. Auxiliary contacts for motor space heaters, remote status signals, and interlocks as shown or indicated on the Drawings and as required.

6. Overload Relays: Provide an overload relay for each motor starter. Overload relays shall be in accordance with:

a. Electronic Overload Relays: Relays shall be electronic type, multi-function, adjustable, current sensing type, that include overload, phase-unbalance, phase-loss, and equipment type ground fault in one package.

b. Each overload relay shall be manual-reset type and include provisions for resetting by an insulating button on front of starter unit door.

c. Overload relay shall include normally-open auxiliary contact for remote alarm purposes.

d. Size overload relay for full-load amperes and service factor of actual motors installed.

7. Provide an integrated unit with microprocessor logic board and door mounted digital display and keypad.

8. Pushbuttons, selector switches, pilot lights, and other devices shall be as shown on the Drawings and in accordance with Section 26 29 33, Control Stations.

9. Full-voltage/BYPASS selector switch. Ensure power contacts are totally enclosed, double break, made of silver-cadmium oxide, and assembled to allow inspection and replacement without disturbing linear load wiring. Provide a dry contact to provide “bypass mode” to SCADA.

10. Provide nameplate identifying equipment controlled in accordance with Section 26 05 53, Identification for Electrical Systems.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.

2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.

3. Test continuity of each circuit.

4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages.

5. Test each motor for proper phase rotation.

6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment. Demonstrate operation of RVSS locally, from RTU, and from FCWS SCADA system.

B. Enclosed controllers will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.02 INSPECTION

A. Examine conditions under which Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.03 INSTALLATION

A. General:

1. Install equipment in accordance with the Contract Documents, Laws and Regulations, and manufacturer's installation instructions.

2. Install equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.

3. Securely fasten equipment to walls or other surfaces on which equipment is mounted. Provide suitable 1/4-inch spacers so that enclosure is not installed directly against walls. Provide supports to rigidly support equipment reasonably close to motor where no wall or surface capable of supporting equipment exists.

+ + END OF SECTION + +

SECTION 26 41 13

LIGHTNING PROTECTION SYSTEM FOR STRUCTURES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, services, and incidentals shown, specified, and required to furnish and install lightning protection systems for:
      a. Elevated Water Storage Tank

B. Coordination:
   1. Review installation procedures included under other Sections and coordinate installation of items to be installed with or before lightning protection systems.

C. Related Sections:
   1. Section 26 05 26, Grounding and Bonding for Electrical Systems.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. Lightning Protection Institute (LPI), LPI 175, Standard of Practice.
   2. LPI 176, Standard of Materials.
   3. NFPA 70, National Electrical Code.
   4. NFPA 780, Standard for the Installation of Lightning Protection Systems.
   5. UL 96A, Installation Requirements for Lightning Protection Systems.
   6. UL 651, Schedule 40 and 80 PVC Conduit.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Lightning Protection System Subcontractor:
      a. Retain services of lightning protection Subcontractor regularly engaged in providing Master Labeled lightning protection systems.
   2. Subcontractor shall be LPI-certified Master Installer or Inspector.
   3. Subcontractor shall be listed with UL.

B. Component Supply and Compatibility:
   1. Obtain all materials equipment included in this Section regardless of component manufacturer from a single lightning protection system manufacturer.

2. Lightning protection system manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
3. All components shall be specifically constructed for specified service conditions and shall be integrated into the overall system by lighting protection system manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Complete scaled drawings showing proposed routing and layout of lightning protection system with installation details. Drawings shall include equipment connection details and downlead details.
   2. Product Data:
      a. Manufacturer's catalog cuts and technical information.
      b. Technical specifications.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Certificates of LPI code compliance provided by manufacturer, together with UL Master Label certificate or letter of finding for each structure.
   2. Field Quality Control Submittals:
      a. Master Installer or Inspector's final inspection report following installation.
   3. Qualifications Statements:
      a. Lightning protection system Subcontractor.

1.5 GUARANTEE

A. Guarantee:
   1. Lightning protection system shall be guaranteed by lightning protection system manufacturer against defective parts and installation for one year from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 SYSTEM PERFORMANCE

A. System Description:
   1. Each lightning protection system shall consist of a complete cable network on the roof or top of structure involving all air terminals, splices, and bonds with cable downleads routed concealed either directly in the building construction or in conduit to ground, and ground rods all connected together in an appropriate

manner and certified by LPI to provide a zone of protection to entire structure against lightning strikes, in accordance with NFPA 780.

2. Provide complete, certified lightning protection system. Provide bonding connections and miscellaneous items for complete system.

2.2 MANUFACTURERS

A. Manufacturers: Provide products of one of the following:
   1. Heary Brothers Lightning Protection Company.
   2. Thompson Lightning Protection, Inc.
   3. Or approved equal.

2.3 MATERIALS

A. General:
   1. Size materials in accordance with NFPA 780, UL 96A, and LPI 176.
   2. Materials and equipment shall be labeled or listed by UL for use in Master Labeled lightning protection systems. Completed system shall conform to NFPA 70, NFPA 780, LPI 175, LPI 176, and UL96A.
   3. Materials shall comply in weight, size, and composition for class of structure to be protected in accordance with the following:
      a. Use Class I materials for systems on structures not exceeding 75 feet in height.
      b. Use Class II materials for systems on structures exceeding 75 feet above grade.
   4. Materials shall be corrosion-resistant, heavy-duty type. Unless otherwise specified, materials shall be Type 316 stainless steel, copper, or high copper-content bronze castings. Bolts, screws, and hardware shall be Type 316 stainless steel.
   5. Use aluminum materials in locations where system components are mounted on aluminum surfaces to avoid electrolytic corrosion of dissimilar metals.
   6. Provide fittings, mounting bases, couplings, connectors, fasteners, and other system devices required for complete system.

B. Ground Rods: Comply with Section 26 05 26, Grounding and Bonding for Electrical Systems.

C. Ground Cables:
   1. Ground cables shall be copper, except in connections to aluminum surfaces as required to prevent dissimilar metals reaction.
   2. Ground cable stranding, number and size shall be suitable for classification of structure to be protected.
   3. Exposed ground cable shall be corrosion resistant.

D. Air Terminals:
   1. Air terminals shall be stainless steel 5/8-inch diameter and minimum of 18 inches long.
   2. Air terminals shall include a cast bronze point protector, stainless steel adapter, and copper base.

E. Non-Metallic Conduit and Fittings:
   1. Non-metallic conduit shall be Schedule 80 PVC plastic, rated for 90 degrees C, conforming to UL 651.
   2. Non-metallic fittings shall be of same material and manufacturer as base conduit. Provide cement for joining fittings to conduit. Fittings shall be by same manufacturer as base conduit.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine the conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install main conductors to provide two-way path from each air terminal horizontally or downward to connections with ground terminals.

B. Install conductors free of excessive splices and sharp bends. Conductor bends shall form an included angle of not less than 90 degrees and shall not have bend radius less than eight inches. Secure conductors to structure at intervals not exceeding three feet.

C. Conceal down conductors where possible in exterior wall construction. Space down conductors at intervals averaging not more than 100 feet around perimeter of structure. Provide at least two down conductors for each protected structure.

D. For structural steel frame construction, down conductors at upper and lower extremities and at intervals not exceeding 200 feet shall be connected to structural steel. Make connections to steel frame with bonding plates having eight square inches of contact, or by exothermic weld connections.

E. Provide air terminals at intervals not exceeding 20 feet along ridges and around perimeter of flat or gently-sloping roofs. Air terminals shall project a minimum of 10 inches above the area protected.

F. Protect flat or gently-sloping roofs exceeding 50 feet in width, by providing additional air terminals at intervals not exceeding 50 feet on flat or gently-sloping area. Locate air terminals within two feet of roof edges and outside corners of protected areas. Air terminal spacing exceeding these dimensions will be allowed if the area protected is within a "zone of protection" from lightning strikes.

G. Provide air terminals for stacks, flues, mechanical equipment, and other objects, having metal thickness less than 3/16-inch and not located within a "zone of protection". Connect objects having metal thickness 3/16-inch or greater to lightning protection system.

H. Do not connect copper equipment to aluminum surfaces, except using bimetal transition fitting. Lead coating is unacceptable for bimetal transition.

I. Install roof penetrations using through-roof assemblies with solid bars and appropriate roof flashing. Conductors shall not pass directly through roof.

J. Grounded metal bodies shall be bonded to the system using bonding connections and fittings. When ground conductors are installed in conduit, conduit shall be non-metallic.

K. Bond building ground systems including electrical, communication, and telephone services and arresters.

L. Bond metal pipes and roof mounted metal structure to the roof ground loop or to downlead cables.

M. Provide ground electrodes for each down conductor dedicated for lightning protection system and bond electrodes to building or structure grounding system. Connect down conductor to ground rod using high-strength, removable ground clamp. Provide bronze ground rod clamp having at least 1.5 inches of contact between rod and conductor, measured parallel to the axis of the rod, at ground test wells.

3.3 FIELD QUALITY CONTROL

A. Inspection:
   1. During installation, lightning protection system shall be inspected by Master Installer or Inspector at several stages during installation in accordance with LPI requirements.
   2. Do not conceal system components until inspection has been completed and successfully inspected and observed by ENGINEER.
   3. Upon completion of lightning protection system, arrange for final lightning system inspection and submit final inspection report to ENGINEER. Final lightning system inspection shall be performed by Master Installer or Inspector in accordance with LPI requirements.

+ + END OF SECTION + +

SECTION 26 43 00

SURGE PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install surge protective devices (SPD).
   2. SPDs furnished under this Section shall be ANSI/UL 1449 Type 2 integrating both surge suppression and high-frequency noise filtering suitable for use on low-voltage distribution systems.

B. Related Sections:
   1. Section 26 05 05, General Provisions for Electrical Systems.
   2. Section 26 24 16, Panelboards.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI/UL 1449, Surge Protective Devices.
   2. IEEE C62.41, Recommended Practice on Surge Voltages in Low-voltage AC Power Circuits.
   3. IEEE C62.45, Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1,000 V and Less) AC Power Circuits.
   4. UL 1283, Electromagnetic Interference Filters.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Shall have at least five years experience manufacturing and servicing products substantially similar to those required and shall be able to submit documentation of at least five installations in satisfactory operation for at least five years each.

B. Component Supply and Compatibility:
   1. Obtain all products included in this Section regardless of component manufacturer from a single SPD manufacturer.
   2. SPD manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. Components shall be suitable for the specified service conditions and shall be integrated into overall assembly by SPD manufacturer.

C. Regulatory Requirements: Comply with the following:
   1. NEC 110.9, Requirements for Electrical Installations, Interrupting Rating.
   2. NEC 240.21, Overcurrent Protection, Location in Circuit.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Electrical and mechanical drawings for each type of unit, showing electrical ratings, dimensions, mounting provisions, connection details, and layout diagrams.
      b. Components list and nameplate schedule.
      c. Summary sheets with schedules of equipment.
   2. Product Data:
      a. Manufacturer’s technical information, including catalog information.
      b. Manufacturer's technical specifications with assembly and component ratings.

B. Informational Submittals: Submit the following:
   1. Certifications:
      a. Certification that SPD devices comply with standards referenced in this Section.
   2. Source Quality Control Submittals:
      a. Report of results of testing and inspections performed at manufacturer’s shop.
   3. Supplier Reports:
      a. Submit written report of results of each visit to Site by Supplier’s service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
   4. Qualifications Statements:
      a. Manufacture, when requested by ENGINEER.

C. Closeout Submittals: Submit the Following
   1. Operations and Maintenance Data:
      a. Submit in accordance with Section 01 78 23, Operations and Maintenance Data.
      b. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.
   2. Warranty Documentation: Submit example warranty at time of shipment of the equipment. Include final warranty accepted by ENGINEER in the operations and maintenance manual for the equipment.

1.5 DELIVERY, STORAGE, AND HANDLING.

A. Delivery:
   1. Upon delivery, check for evidence of water that may have entered equipment during transit.

B. Storage:
   1. Store SPD equipment in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.
   2. Protect equipment from corrosion and deterioration.

1.6 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive OWNER of other rights or remedies OWNER may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by CONTRACTOR under the Contract Documents. The obligations of CONTRACTOR under the Contract Documents shall not be limited in any way by the provisions of the specified special warranty.

B. Special Warranty on Materials and Equipment:
   1. Provide manufacturer's written warranty, running to the benefit of OWNER, agreeing to correct, or at option of OWNER, remove or replace materials or equipment specified in this Section found to be defective during a period of five years after the date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide equipment of one of the following:
   1. General Electric.
   2. Schneider Electric/Square-D Company.
   3. Eaton/Cutler-Hammer.
   4. Or equal.

2.2 EQUIPMENT

A. General:
   1. The power system shall be protected from voltage surges at the power service point, and other points within the electrical system as noted. The SPD shall be provided integral to panelboard enclosure wherever shown on drawings.
   2. SPD shall be modular, high-energy, parallel design with fast-acting transient voltage suppression using metal oxide varistors. Equipment shall provide noise attenuation with electromagnetic interference filter.

3. SPD shall comply with requirements of the following:
   a. ANSI/UL 1449.
   b. UL 1283.
   c. IEEE C62.11, IEEE C62.41 and IEEE C62.45.
4. SPD shall be suitable for operation under the following environmental conditions:
   a. Relative Humidity: Zero to 95 percent, non-condensing.
   b. Frequency: 47 to 63 Hertz.
   c. Temperature: Zero to 149 degrees F.
5. SPD operating voltage and IEEE C62.41 and IEEE C62.45 Category A, B, and C application environments shall be suitable for the associated SPD location(s) shown or indicated on the Drawings.
6. SPD shall be suitable for internal and external mounting. Where shown on the Drawings, SPD shall be factory-mounted and integrated into distribution equipment specified under the following Sections:

   1. Section 26 24 16, Panelboards.

B. SPD shall include a surge suppression path for each mode as required for the system configuration shown on the Drawings. Each mode shall be individually fused and equipped with thermal cutouts. SPD short-circuit rating shall be 200 kA. Protection modes shall include, to the extent applicable, the following:
   1. Line-to-line.
   2. Line-to-neutral.
   3. Line-to-ground.
   4. Neutral-to-ground.

C. SPD shall include electromagnetic interference/radio frequency interference (EMI/RFI) noise rejection filter with attenuation up to 30 dB from 10 kHz to 100 MHz.

D. SPDs and components in the operating path shall have maximum continuous operating voltage greater than 115 percent of nominal system operating voltage.

E. ANSI/UL 1449 minimum withstand rating shall be 20 kA per pole, and ANSI/UL 1449 voltage protection rating for SPD shall not exceed the following:

Modes	208Y/120	480Y/277
L-N,L-G, N-G	800	1200
L-L	1200	2000

F. SPD surge capacity based upon IEEE C62.41 location category shall, as a minimum, be the following:

Category	Application	Per Phase	Per Mode
C	Service entrance	240 kA	120 kA

B	High exposure locations (Distribution equipment)	160 kA	80 kA
A	Branch locations	120 kA	60 kA

2.3 ACCESSORIES

A. Provide SPD equipped with the following accessories:
   1. Surge counter with display for indicating the number of surges detected.
   2. LED indicators for monitoring device status.
   3. Audible alarm and silence switch for indicating an inoperative condition.
   4. Dry contacts, “Form C”, for remote annunciation of unit status.
   5. Indicators, counter, alarm, and silence switch shall be visible and accessible from front of the SPD. When SPD is integral to switchgear, motor control center, panelboard, or other equipment, indicators, counter, alarm, and silence switch shall be visible and accessible from front of the equipment in which the SPD is installed.
   6. Enclosure for each externally mounted SPD: NEMA rating shall be as required for area classifications specified in Section 26 05 05, General Provisions for Electrical Systems.

2.4 SOURCE QUALITY CONTROL

A. Perform manufacturer’s standard factory tests on equipment. Tests shall be in accordance with IEEE C62.45 and ANSI/UL 1449.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials and equipment will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install SPD at locations shown on the Drawings in accordance with equipment manufacturer’s recommendations, Laws, and Regulations, and the Contract Documents.

B. Conductor length between suppressor and connection point shall be as short and as straight as possible.

+ + END OF SECTION + +

SECTION 26 50 00

LIGHTING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install lighting fixtures and associated controls.

B. Coordination:
   1. Coordinate location of fixtures with piping, ductwork, openings, and other systems and equipment and locate clear of interferences.
   2. Coordinate fixtures to be mounted in hung ceilings with the ceiling suspension system proposed.

C. Related Sections:
   1. Section 26 05 05, General Provisions for Electrical Systems.
   2. Section 26 05 53, Identification for Electrical Systems.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. UL 1598, Safety of Luminaires.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:
   1. NEC Article 410, Luminaires, Lamp holders, and Lamps.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Schedule of light fixtures to be furnished, indicating fixture type and location for each.
      b. Customized wiring diagrams.

   2. Product Data:
      a. Manufacturer’s technical information, specifications, standard wiring diagrams, and catalog cuts for lighting fixtures proposed.
      b. Fixture construction details.

c. ETL photometric and isocandle curves for each fixture proposed.
d. Verification that recessed fixtures to be mounted in hung ceilings are compatible with ceiling suspension system proposed.

B. Informational Submittals: Submit the following:
1. Manufacturer's Instructions:
a. Instructions and recommendations for handling, storing, and protecting the equipment.
b. Installation instructions for the equipment, including setting drawings, templates, and directions and tolerances for installing anchorage devices.

C. Maintenance Material Submittals: Submit the following:
1. Spare Parts and Extra Stock Materials: Furnish spare parts for each type of unit required as indicated in Part 2 of this Section.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:
1. Upon delivery, inspect equipment for evidence of water that may have entered equipment during transit.

B. Storage:
1. Store lighting fixtures, controls, related materials and equipment in clean, dry location with controls for uniform temperature and humidity. Protect materials and equipment with coverings and maintain environmental controls.
2. Store materials and equipment for easy access for inspection and identification. Keep materials and equipment off ground, using pallets, platforms, or other supports. Protect materials and equipment from corrosion and deterioration.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Lighting fixtures required shall be in accordance with the Lighting Fixture Schedule shown on respective drawings. Fixtures shall be complete with supports, and incidentals, as required.

B. Type: Lighting fixtures required shall be in accordance with the Lighting Fixture Schedule on the Drawings. Fixtures shall be complete with supports, ballasts, lamps, and incidentals, as required.

1. LED fixtures shall be modular and allow for separate replacement of LED lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side.

2. Dimmable LED fixtures shall have either a 0-10 volt, 3-wire dimming driver, or a two-step (50%-100%) line voltage, two switch controlled dimming driver, as shown on the drawings.

C. Fixtures shall be listed in accordance with UL 1598.

D. Hardware: Provide necessary hangers, supports, conduit adaptors, reducers, hooks, brackets, and other hardware required for safe fixture mounting. Hardware shall have protective, non-corrosive finish.

E. Outdoor Fixtures: Provide each fixture to be installed outdoors with cut-off lens to reduce the fixture's light pollution emissions.

F. Time Switch:
   1. Type: Astronomic dial time switch with day-omitting device.
   2. Products and Manufacturers: Provide of one of the following:
      a. Z Series by Tork Time Controls, Inc.
      b. Or equal.
   3. Timing Motor: Heavy-duty, synchronous, self-starting, high torque, 120-volt or 277-volt, 60 Hertz, as shown on the Drawings.
   4. Capacity: 40 amps per pole at 277 volts.
   5. Dial: 24-hour rotation, with gear to provide one revolution per year that automatically raises the "ON" and "OFF" settings each day according to seasonal changes of sunset and sunrise.
   6. Reserve Power: Spring driven reserve sufficient to operate time switch contacts for not less than 30 hours after power failure. On restoration of power, time switch shall transfer to synchronous motor drive and automatically rewind reserve.

G. Lighting Contactor and Controls:
   1. Provide a lighting contactor and control system for control of each area where shown on the Drawings.
   2. Product and Manufacturer: Provide products of one of the following:
      a. Type SM03 by Square D Company.
      b. Or approved equal.
   3. System shall include:
      a. Enclosure sized as required, complete with input control fuse and screw type terminal blocks rated 300-volt, 20-amp quantity for all circuits, unless indicated otherwise on the Drawings.
      b. Single coil, electrically-operated, mechanically-held contactor. Contactor shall be rated 30-amp, 600-volt, with 120-volt operating coil, unless indicated otherwise on the Drawings. Number of poles shall be as shown on the Drawings. Provide multiple contactors when necessary.
      c. Where lighting contactors are controlled by photocell, provide a 120-volt, two-pole control relay, enclosure mounted to convert the two-wire photocell control to three-wire control required by contactor. Control

shall include a cover mounted on-off-auto selector switch for "manual" or "auto" selection of operation. In "auto" position, contactor shall respond to photocell.

d. Enclosure: As required for area classification per Section 26 05 05, General Provisions for Electrical Systems.

e. Identify panel in compliance with Section 26 0 53, Identification for Electrical Systems.

H. Photocell:

1. Products and Manufacturers: Provide one of the following:
   a. 2100 Series by Tork Time Controls, Inc.
   b. Or approved equal.
2. Cadmium sulfide hermetically-sealed cell, fully temperature compensated, with time delay of not less than 15 seconds to prevent false switching.
3. Built-in fail safe light level selector, adjustable within limits of two to 50 foot-candles and factory set at 25 foot-candles.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:

1. Fixture mounting heights and locations indicated on the Drawings are approximate and are subject to revision in the field where necessary to clear conflicts and obstructions.
2. Mounting Heights: Mounting heights or elevations are to bottom of fixture or to centerline of device.
3. Install fixtures in accordance with Laws and Regulations, the Contract Documents, and manufacturer instructions and recommendations.
4. Mount fixtures so that sufficient access is available for ready and safe maintenance.
5. Securely fasten equipment to walls or other surfaces on which equipment is mounted.

B. Suspended Fixtures:

1. Pendant-mount using 1/2-inch diameter conduit stems.
2. Ground to outlet box.
3. Attach mounting to building structure with expansion anchors.
4. Fixtures shall not be dependent on the outlet box cover screws for support.

C. Surface Mounted Fixtures:
   1. Attach to appropriate outlet box.
   2. Attach to surface using fasteners and sealing washers when mounting fixture in damp or wet locations.

D. Boxes and Fixtures:
   1. For units mounted against masonry or concrete walls, provide suitable 1/4-inch spacers to prevent mounting back of box directly against wall.
   2. Bolt units rigidly to building with expansion anchors, toggle bolts, hangers, or Unistrut.
   3. Do not install boxes with open conduit holes.
   4. Cable each circuit and identify with tag.

E. Mount photocells as required and adjust foot-candle setting for proper dusk and dawn photo-control. Provide wiring in conduit from photocell to controls.

+ + END OF SECTION + +

DIVISION 31 - EARTHWORK

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SECTION 31 20 00

EARTH MOVING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals required to perform all excavating, filling, and grading, and disposing of earth materials as shown, specified, and required for construction of structures, Underground Facilities, roads, and other facilities required to complete the Work.
   2. Preparation of subgrade for slabs and pavements is included under this Section.
   3. No classification of excavated materials will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof, except rock requiring drilling, blasting or special equipment for removal, which is under Section 31 23 16.26, Rock Removal.

B. Work Performed By Others:
   1. None.

C. Related Sections:
   1. Section 01 45 29, Testing Laboratory Services.
   2. Section 01 57 05, Temporary Controls.
   3. Section 03 00 05, Concrete.
   4. Section 31 23 16.26, Rock Removal.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI/AISC 360, Specification for Structural Steel for Buildings.
   2. ASTM D422, Test Method for Particle-Size Analysis of Soils.
   3. ASTM D698, Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3)).
   4. ASTM D1556, Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   5. ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   6. ASTM D2216, Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
   7. ASTM D4253, Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

8. ASTM D4254, Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
9. ASTM D4318, Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
11. ASTM D6938, Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
12. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.

1.3 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section, have the following meaning:
   1. “Subgrade” is the uppermost surface of native soil material unmoved from cuts; the bottom of excavation.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. CONTRACTOR’s Testing Laboratory:
      a. Retain the services of independent testing laboratory to perform testing and determine compliance with the Contract Documents of the materials specified in this Section.
      b. Testing laboratory shall comply with ASTM E329 and requirements of Section 01 45 29, Testing Laboratory Services Furnished by Contractor.
      c. Testing laboratory shall be experienced in the types of testing required.
      d. Selection of testing laboratory is subject to ENGINEER's acceptance.

B. Quality Assurance Testing:
   1. Quality assurance testing is in addition to field quality control testing required under Part 3 of this Section.
   2. Materials used in the Work may require testing and retesting, as directed by ENGINEER, during the Project. Allow free access to material stockpiles and facilities at all times. Tests not specifically indicated to be performed at OWNER's expense, including retesting of rejected materials and installed Work, shall be performed at CONTRACTOR’s expense.
   3. CONTRACTOR’s Testing Laboratory Scope:
      a. Collect samples and perform testing of proposed fill materials in the laboratory and in the field to demonstrate compliance of the Work with the Contract Documents.
      b. Testing laboratory shall perform testing required to obtain data for selecting moisture content for placing and compacting fill materials.
      c. Submit to ENGINEER and CONTRACTOR written report results of each test.

4. Required Quality Assurance Material Testing by CONTRACTOR's Testing Laboratory:
    a. Gradation in accordance with ASTM D422. Perform one test for every 500 cubic yards of general fill material incorporated into the work.
    b. Atterberg limits in accordance with ASTM D4318. Perform one test for every 500 cubic yards of the general fill incorporated into the work.
    c. Moisture/density relations in accordance with ASTM D698 or ASTM D1557, ASTM D4253, or ASTM D4254, as applicable.
    d. Minimum of two (2) moisture/density relations in accordance with ASTM D698 on excavated material that is to be used as trench fill material.

C. Regulatory Requirements:
    1. Perform excavation work in compliance with requirements of authorities having jurisdiction and Laws and Regulations, including:
        a. OSHA, 29 CFR Part 1926, Section .650 (Subpart P – Excavations).
    2. Obtain required permits and approvals for excavation and fill Work, including work permits from right-of-way owners and permits from environmental authorities having jurisdiction over discharge of water from excavations.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
    1. Shop Drawings:
        a. Modifications to the Work proposed due to intended excavation plan.

B. Informational Submittals: Submit the following:
    1. Procedure Submittals:
        a. Excavation Plan: Prior to starting excavation operations, submit written plan to demonstrate compliance with OSHA 29 CFR Part 1926.650. As a minimum, excavation plan shall include:
            1) Name of CONTRACTOR's "competent person" in responsible charge of excavation and fill Work.
            2) Excavation method(s).
            3) Copies of required permits and approvals, from authorities having jurisdiction and affected utility owners, for excavation methods proposed.
        b. Proposed compaction procedure and compaction equipment proposed for use. Where different procedures or equipment will be used for compacting different types of material or at different locations at the Site, indicate where each procedure and equipment item will be used.

2. Quality Assurance Test Results Submittals:
   a. Submit results of quality assurance testing performed by in accordance with Paragraph 1.4.B of this Section, unless included as part of another submittal under this Section. Submit results for the following quality assurance testing:
      1) Tests on borrow fill material.
      2) Optimum moisture – maximum dry density curve for each type of fill material.
3. Field Quality Control Submittals:
   a. Submit results of testing and inspection performed in accordance with the field quality control Article in Part 3 of this Section, including:
      1) Field density testing.
      2) Tests of actual unconfined compressive strength or bearing tests of each stratum.
4. Qualifications Statements:
   a. Quality Assurance Testing laboratory. Testing laboratory to be Owner Approved. Submit name and qualifications of testing laboratory to be employed, and qualifications of testing laboratory's personnel that will perform quality assurance testing required in this Section.
   b. Field Quality Control Testing Laboratory: Names and qualifications of testing laboratory employed, and qualifications of testing laboratory's personnel that will perform field quality control testing as required under this Section.

1.6 SITE CONDITIONS

A. Subsurface Information: The Supplementary Conditions indicate information available relative to subsurface conditions at the Site. Such information and data is not intended as a representation or warranty of continuity of conditions between soil borings or test pits, nor of groundwater levels at dates and times other than date and time when measured, nor that purpose of obtaining the information and data were appropriate for use by CONTRACTOR. OWNER will not be responsible for interpretations or conclusions drawn therefrom by CONTRACTOR.

B. Soil borings and other exploratory operations may be made by CONTRACTOR, at no additional cost to OWNER. Coordinate CONTRACTOR-performed test borings and other exploratory operations with OWNER and utility owners as appropriate. Perform such explorations without disrupting or otherwise adversely affecting operations of OWNER or utility owners. Comply with Laws and Regulations relative to required notifications.

C. Existing Structures:
   1. The Contract Documents show or indicate certain structures and Underground Facilities adjacent to the Work. Such information was obtained from existing records and is not guaranteed to be correct or

complete. CONTRACTOR shall explore ahead of the excavation to determine the exact location of all existing structures and Underground Facilities. Existing structures and Underground Facilities shall be supported and protected from damage by CONTRACTOR. Immediately repair and restore existing structures and Underground Facilities damaged by CONTRACTOR without additional cost to OWNER.

2. Movement or operation of construction equipment over Underground Facilities shall be at CONTRACTOR's sole risk and only after CONTRACTOR has prepared and submitted to ENGINEER and utility owners (as applicable), and received acceptance therefrom, a plan describing CONTRACTOR's analysis of the loads to be imparted and CONTRACTOR's proposed measures to protect structures and Underground Facilities during the Project.
3. Coordinate with utility owners for shut-off of services in active piping and conduits. When required by utility owner, OWNER will assist CONTRACTOR with utility owner notifications. Completely remove buried piping and conduits indicated for removal and not otherwise indicated as being abandoned or to remain in place.
4. In general, service lines and laterals to individual houses and businesses are not shown; however, CONTRACTOR shall assume that a service exists for each utility owner to each house, business, and property.
5. Do not interrupt existing utilities serving facilities occupied and used by OWNER or others, except when such interruption is indicated in the Contract Documents or when allowed in writing by ENGINEER after acceptable temporary utility services are provided by CONTRACTOR for the affected structure or property.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General Fill:
   1. Material shall be free of: rock and gravel larger than three inches in any dimension, debris, waste, frozen materials, organic material, and other deleterious matter.
   2. Fill shall have a liquid limit not greater than 40, and plasticity index not greater than 20.
   3. Previously-excavated materials complying with the Contract Documents may be used for general fill.
   4. When on-Site materials are found unsuitable for use as general fill, provide select fill or approved off-Site general fill materials. Prior to using off-Site material as general fill, furnish submittal for and obtain ENGINEER's approval of the material proposed for use.

B. Select Fill:
   1. Material shall be well-graded, crushed aggregate, free of organic material. Material shall be in accordance with Georgia Department of Transportation Section 815 Graded Aggregate, Group II Aggregate.

C. Subbase Material:
   1. Material shall be well-graded, crushed aggregate, free of organic material. Material shall be in accordance with Georgia Department of Transportation Section 815 Graded Aggregate, Group II Aggregate.
   2. Subbase material is suitable bedding material.

D. Trench Fill:
   1. Material shall be free of: rock and gravel larger than three inches in any dimension, debris, waste, frozen materials, organic material, and other deleterious matter.
   2. Previously-excavated materials complying with the Contract Documents requirements for general fill may be used for trench fill. Previously-excavated materials to be used for trench fill require
   3. When on-Site materials are found unsuitable for use as trench fill, provide select fill or approved off-Site trench fill materials. Prior to using off-Site material as trench fill, furnish submittal for and obtain ENGINEER's approval of the material proposed for use.

E. Pipe Bedding Material:
   1. Aggregate material shall be crushed stone and gravel, free of: rock or gravel larger than 1-inch in any dimension, debris, waste, frozen materials, organic material and other deleterious matter. Material shall be in accordance with Georgia Department of Transportation Section 812 Graded Aggregate, Group II Aggregate
   2. Sand material, where required, shall consist of natural or manufactured granular material and shall contain no organic material. Sand shall be non-plastic, when tested in accordance with ASTM D4318, 100 percent shall pass a 1/2-inch screen and not more than five percent shall pass a No. 200 screen.

2.2 SOURCE QUALITY CONTROL

A. Perform quality assurance testing, and submit results to ENGINEER, in accordance with the 'Quality Assurance" Article in Part 1 of this Section.

PART 3 – EXECUTION

3.1 INSPECTION

A. Provide ENGINEER with sufficient notice and with means to examine areas and conditions under which excavating, filling, and grading will be performed. ENGINEER will advise CONTRACTOR in writing when ENGINEER is aware of conditions that may be detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.3 PREPARATION

A. Site Preparation:
   1. Clear areas to be occupied by permanent construction of all trees, brush, roots, stumps, logs, wood and other materials and debris. Clean and strip vegetation, sod, topsoil, and organic matter from subgrades where fills will be placed, and from areas where structures will be constructed. Remove from the Site and properly dispose of all waste materials.
   2. Burning is not allowed at the Site.

B. Use of Explosives:
   1. Use of explosives is not allowed.

C. Dust Control:
   1. Control objectionable dust caused by CONTRACTOR's operation of vehicles and equipment, clearing, and other actions. To minimize airborne dust, apply water or use other methods subject to ENGINEER’s acceptance and approval of authorities having jurisdiction.

D. Maintenance and Protection of Traffic:
   1. Keep all streets and traffic ways open for passage of traffic and pedestrians during the Project, unless otherwise approved by owner of the street, traffic way, or right-of-way, as applicable. Construction traffic shall access the Site only via entrance(s) indicated in Section 01 55 13, Access Roads and Parking Areas.
   2. When required to cross, obstruct, or temporarily close a street or traffic way, provide and maintain suitable bridges, detours, and other acceptable temporary expedients to accommodate traffic. Closings of street or traffic way shall be for shortest time practical, and passage shall be restored immediately after completion of fill and temporary paving or bridging.
   3. Give required advance notice to fire department, police department, and other emergency services as applicable of proposed construction operations.
   4. Give reasonable notice to owners or tenants of private property who may be affected by construction operations. Give such notice not less than 3 days prior to construction that will affect the property.

5. Hydrants, valves, fire alarm boxes, postal boxes and delivery service boxes, and other facilities that may require access during construction shall be kept accessible for use.
6. Provide temporary signage, signals, barricades, flares, lights and other equipment, service, and personnel required to regulate and protect traffic and warn of hazards. Such Work shall comply with requirements of owner of right-of-way and authorities having jurisdiction at the Site. Remove temporary equipment and facilities when no longer required, and restore grounds to original or to specified conditions, as applicable.

3.4 DEWATERING

A. Dewatering – General:
   1. Provide and maintain adequate drainage and dewatering equipment to remove and dispose of all surface water and ground water entering excavations, or other parts of the Work and work areas. Keep each excavation dry during excavation, subgrade preparation, and continually thereafter until the structure to be built therein is acceptable to ENGINEER and backfilling operations are completed and acceptable to ENGINEER.
   2. Keep all working areas at the Site free of surface water at all times. Provide temporary drainage ditches and temporary dikes, and provide required temporary pumping and other work necessary for diverting or removing rainfall and all other accumulations of surface water from excavations and fill areas. Perform diversion and removal of surface water in manner that prevents accumulation of water behind permanent or temporary structures and at any other locations in the construction area where such accumulations may be detrimental.
   3. Water used for working or processing, resulting from dewatering operations, or containing oils or sediments that will reduce the quality of the surface water or groundwater downstream of the point of discharge, shall not be directly discharged. Divert such waters through temporary settling basin or filter before discharging to surface water, groundwater, or drainage routes.
   4. CONTRACTOR shall be responsible for condition of piping, conduits, and channels used for drainage and such piping, conduits, and channels shall be clean and free of sediment.
   5. Remove water from excavations as fast as water collects.

B. Disposal of Water Removed by Dewatering System:
   1. CONTRACTOR's dewatering system shall discharge to a suitable location acceptable to OWNER, in accordance with Laws and Regulations.
   2. Dispose of water removed from excavations in a manner that does not endanger health and safety, property, the Work, and other portions of the Project.
   3. Dispose of water in manner that causes no inconvenience to OWNER, others involved in the Project, and adjacent and downstream properties.

3.5 EXCAVATION

A. Perform all excavation required to complete the Work as shown, specified, and required. Excavations shall include removing and handling of earth, sand, clay, gravel, hardpan, soft, weathered or decomposed rock, pavements, rubbish, and other materials within the excavation limits. Where the excavation includes rock that requires drilling or specialized equipment for removal, remove rock in accordance with Section 31 23 16.26, Rock Removal.

B. Excavation Protection:
   1. Provide excavation protection system(s) in accordance with Laws and Regulations to prevent injury to persons and property, including Underground Facilities.
   2. Excavation Less Than Five Feet Deep: Excavations in stable rock or in soil conditions where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded, or shored and braced.
   3. Excavations Greater Than Five Feet Deep: Excavations in stable rock may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded, or shored and braced.

C. Maintain excavations in dry condition in accordance with “Dewatering” Article in Part 3 of this Section.

D. Elevation of bottom of footings shown is approximate. ENGINEER may direct such minor changes in dimensions and elevations as may be required to secure a satisfactory footing.

E. When excavations are made below required grades without written order of ENGINEER, fill such excavations with compacted select fill, as directed by ENGINEER, at CONTRACTOR’s expense.

F. Extend excavations sufficiently on each side of structures, footings, and similar construction to allow setting of forms, installation of excavation supports, and the safe sloping of banks, as necessary.

G. Subgrades – General:
   1. Subgrades shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud, muck, and other soft or unsuitable materials; and shall remain firm and intact under all construction operations. Subgrades that are otherwise solid but become soft or mucky on top due to construction operations shall be reinforced with well-graded, crushed aggregate, free of organic material. Material shall be in accordance with Georgia Department of Transportation Section 815 Graded Aggregate, Group II Aggregate.

Finished elevation of stabilized subgrades shall not be above subgrade elevations shown.

2. If, in ENGINEER's opinion, subgrade becomes softened or mucky because of construction delays, failure to dewater properly, or other cause within CONTRACTOR's control, subgrade shall be excavated to firm material, trimmed, and backfilled with select fill material at CONTRACTOR's expense.

H. Pipe Trench Preparation:
   1. Not more than 40 feet of trench may be opened in advance of installing pipe in trench.
   2. Trench width shall be minimized to greatest extent practical, and shall comply with the following:
      a. Trench width shall be sufficient to provide space for installing, jointing and inspecting piping. Refer to the Drawings for trench requirements. In no case should trench be wider at top of pipe than pipe barrel OD plus two feet, unless otherwise shown or indicated.
      b. Enlargement of trench width at pipe joints may be made when required and approved by ENGINEER.
      c. Trench width shall be sufficient for shoring and bracing, or shielding and dewatering.
      d. Trench width shall be sufficient to allow thorough compaction of fill adjacent to bottom half of pipe.
      e. Do not use excavating equipment that requires the trench to be excavated to excessive width.
   3. Depth of trench shall be as shown or indicated. If required and approved by ENGINEER in writing, depths may be revised.
   4. Where ENGINEER considers existing material beneath bedding material unsuitable, remove and replace such unsuitable material with select fill material.

3.6 UNAUTHORIZED EXCAVATION

A. All excavations outside lines and grades shown or indicated and that are not approved by ENGINEER, together with removing and disposing of the associated material, shall be at CONTRACTOR's expense. Fill unauthorized excavations with properly-compacted select fill material at CONTRACTOR's expense.

3.7 EROSION AND SEDIMENT CONTROLS

A. Provide temporary erosion and sediment controls in accordance with Section 01 57 05, Temporary Controls. When applicable, also comply with requirements of the erosion and sediment control plan approved by authorities having jurisdiction.

3.8 TRENCH SHIELDS

A. Excavation of earth material below bottom of trench shield shall not exceed the limits established in Laws and Regulations.

B. When using a shield for installing piping:
   1. Portions of trench shield extending below the mid-diameter of an installed, rigid pipe, such as prestressed concrete pipe and other types of rigid pipe, shall be raised above the pipe's mid-diameter elevation prior to moving the shield along the trench for further construction.
   2. Bottom of shield shall not at any time extend below mid-diameter of installed pipe that is flexible or has flexing capability, such as steel, ductile iron, PVC, CPVC, polyethylene, and other pipe that has flexing capability.

C. When using a shield for installing structures, bottom of the shield shall not extend below the top of the bedding for the structures.

D. When removing the shield or moving the shield ahead, exercise extreme care to prevent moving piping, structures, and other Underground Facilities, and prevent disturbance of bedding material for piping, structures, and other Underground Facilities. When piping, structures, or Underground Facilities are disturbed, remove and reinstall the disturbed items in accordance with the Contract Documents.

3.9 FILL AND COMPACTION – GENERAL PROVISIONS

A. Provide and compact all fill required for the finished grades as shown and as specified in this Section.

B. Place fill in excavations as promptly as progress of the Work allows, but not until completing the following:
   1. ENGINEER's authorization after observation of construction below finish grade, including dampproofing, waterproofing, perimeter insulation, and similar Work.
   2. Inspection, testing, approval, and recording of locations of Underground Facilities.
   3. Removal of concrete formwork.
   4. Removal of shoring and bracing, and filling of voids with satisfactory materials.
   5. Removal of trash and debris.
   6. Permanent or temporary horizontal bracing is in place on horizontally-supported walls.
   7. Field testing of tanks, Underground Facilities including piping and conduits, and water-retaining structures.

C. Fill that includes organic materials or other unacceptable material shall be removed and replaced with approved fill material in accordance with the Contract Documents.

D. Placement – General:
   1. Place fill to the grades shown or indicated. Bring up evenly on all sides fill around structures and Underground Facilities.
   2. Place fill materials at moisture content and density as specified in this Article's requirements on compaction density. Furnish and use equipment capable of adding measured amounts of water to the fill materials to bring fill materials to a condition within required moisture content range. Furnish and use equipment capable of discing, aerating, and mixing the fill materials to ensure reasonable uniformity of moisture content throughout the fill materials, and to reduce moisture content of borrow materials by air drying, when necessary. When subgrade or lift of fill materials requires moisture-conditioning before compaction, fill material shall be sufficiently mixed or worked on the subgrade to ensure uniform moisture content throughout the lift of material to be compacted. Materials at moisture content in excess of specified limit shall be dried by aeration or stockpiled for drying.

   3. Perform compaction with equipment suitable for the type of fill material placed. Select and use equipment capable of providing the minimum density required in the Contract Documents. Use light compaction equipment, with equipment gross weight not exceeding 7,000 pounds within horizontal distance of ten feet from the wall of completed, below-grade structures. Furnish and use equipment capable of compacting in restricted areas next to structures and around piping and Underground Facilities. Effectiveness of the equipment selected by CONTRACTOR shall be tested at start of compacted fill Work by constructing a small section of fill within the area where fill will be placed. If tests on the test section of fill indicate that required compaction is not obtained, do one or more of the following: increase the amount of coverages, decrease the lift thicknesses, or use different compactor equipment.
   4. Place fill materials in horizontal, loose lifts, not exceeding specified uncompacted thickness as shown on the drawings. Place fill in a manner ensuring uniform lift thickness after placing. Mechanically compact each lift, by not less than two complete coverages of the compactor. One coverage is defined as the conditions reached when all portions of the fill lift have been subjected to the direct contact of compactor's compacting surface. Compaction of fill materials by inundation with water is unacceptable.
   5. Do not place fill materials when standing water is present on surface of the area where fill will be placed. Do not compact fill when standing water is present on the fill to be compacted. Do not place or compact fill in a frozen condition or on top of frozen material. Fill containing organic materials or

other unacceptable material previously described shall be removed and replaced prior to compaction.

6. If required densities are not obtained because of improper control of placement or compaction procedures, or because of inadequate or improperly-functioning compaction equipment, CONTRACTOR shall perform all work required to provide the required densities. Such work shall include, at no additional cost to OWNER, complete removal of unacceptable fill areas and replacement and re-compaction until acceptable fill is provided.
7. Repair, at CONTRACTOR's expense, observed or measured settlement. Make repairs and replacements as required within 30 days after being so advised by ENGINEER.

E. Fill Against Concrete:
   1. Placing fill against concrete below finished grade is not allowed until the concrete has attained its specified strength, as determined by duration of concrete curing and testing of field-cured concrete cylinders. Requirements for strength and curing time are in Section 03 00 05, Concrete.
   2. Elevation of fill placed against concrete walls shall not differ by more than two feet on each side of walls, unless walls are adequately braced or all floor framing is in place up to and including grade level slabs.
   3. Backfill structural foundation units as soon as practicable, in accordance with this Section, after concrete has gained sufficient strength to avoid damage, to avoid ponding of surface water and accumulation of debris.
   4. Where fill is placed against waterproofed surface, exercise care that waterproofing material is not damaged.

F. Fill in Electrical Ductbank Trenches:
   1. Provide general fill for full depth of electrical ductbank trench, below and above electrical ductbank. Where one ductbank passes beneath another pipe or ductbank, provide select fill to the elevation of the bottom of upper ductbank or pipe, as applicable.
   2. Placing and compacting fill in electrical ductbank trenches shall comply with requirements of Paragraph "G. Fill in Pipe Trenches", of this Article.

G. Fill in Pipe Trenches:

   1. Piping trenches may be backfilled prior to testing of piping, unless nature of the test requires observation of pipe during testing. Do not construct building or structure over piping until piping has been successfully tested and passed.
   2. Pipe Bedding: Pipe bettering material shall be as follows:
      a. Install PVC, CPVC, HDPE, and FRP piping on a layer of sand. Sand shall extend to 12 inches above top of pipe and to the trenchwalls on each side of the pipe.

b. Unless otherwise shown, install other types of piping on not less than six-inch layer of aggregate pipe bedding material.

3. Placing and Compacting Pipe Trench Fill: Unless otherwise shown, placement and compaction of pipe trench fill materials shall comply with the following:
   a. Pipe bedding material shall be spread and the surface graded to provide a uniform and continuous support beneath piping at all points between bell holes or pipe joints. Slight disturbance of installed pipe bedding material surface during withdrawal of pipe slings or other lifting tackle is acceptable.
   b. After each pipe's bedding material has been graded, and the piping has been aligned, joined in accordance with the Contract Documents, and placed in final position on bedding material, provide and compact sufficient pipe trench fill material under and around each side of the pipe and back of the bell or end thereof to hold piping in proper position and maintain alignment during subsequent pipe jointing and embedment operations. Deposit and compact pipe trench fill material uniformly and simultaneously on each side of piping to prevent lateral displacement of piping. Place and compact pipe trench fill material to an elevation 12 inches above top of pipe, unless otherwise shown or specified.
   c. Each layer of pipe trench fill material shall be compacted by at least two complete coverages of all portions of surface of each lift using appropriate compaction equipment.
   d. Method of compaction and compaction equipment used shall be appropriate for material to be compacted and shall not transmit damaging shocks to the piping.

H. Temporary Pavement:
   1. Place 1.5 inches of temporary asphalt concrete pavement immediately after filling excavations in paved roadways and other paved areas that will remain for permanent use.
   2. Maintain surface of paved area over the fill in good and safe condition during progress of the Work, and promptly fill depressions over and adjacent to the fill area caused by settlement of fill.
   3. Permanent replacement pavement shall be equal to that of the existing roadways, unless otherwise shown or specified.

I. Subbase Placement:
   1. Provide subbase material where shown to the limits shown or indicated.
   2. Place subbase material in compacted lifts not exceeding depth of six inches each.

J. Drainage Fill Placement:
   1. Provide drainage fill material where shown to the limits shown or indicated.

2. Place drainage fill material in compacted layers of uniform thickness not exceeding depth of six inches each. Compact lifts of drainage fill using suitable compaction equipment.

K. Compaction Density Requirements:
1. Compaction required for all types of fills shall be in accordance with Table 31 23 05-A of this Section. Moisten material or aerate the material as necessary to provide the moisture content that will facilitate obtaining the required compaction.

TABLE 31 23 05-A
REQUIRED MINIMUM DENSITY

Material	Percent Compaction (ASTM D698)	Uncompacted Lift (inches)
General Fill		
More than five feet below final grade	98	8
Less than five feet below final grade	95	8
Select Fill		
Below concrete slabs	98	8
Below pavement and sidewalks	98	12
Behind concrete walls	95	8
Subbase Material		
Below pavement and sidewalks	98	12
All other locations	95	8
Trench Fill		
More than five feet below final grade	98	8
Less than five feet below final grade	95	8
Pipe Bedding Material		
Below structures or pavement	98	8
All other locations	95	6
Drainage Fill	N/A	6

2. Fill shall be wetted and thoroughly mixed to achieve optimum moisture content plus-or-minus three percent, with the following exceptions:
   a. On-site clayey soils: Optimum to plus three percent.
3. Replace natural, undisturbed soils or compacted soil subsequently disturbed or removed by construction operations with materials compacted as indicated.
4. Field quality control testing for density; to verify that specified density was obtained, will be performed during each day of compaction Work. Responsibility for field quality control testing is specified in the "Field Quality Control" Article in Part 3 of this Section.

5. When field quality control testing indicates unsatisfactory compaction, provide additional compaction necessary to obtain the specified compaction. Perform additional compaction Work at no additional cost to OWNER until specified compaction is obtained. Such work includes complete removal of unacceptable (as determined by ENGINEER) fill areas and replacement and re-compaction until acceptable fill is provided in accordance with the Contract Documents.

L. Replacement of Unacceptable Excavated Materials: In cases where over-excavation to replace unacceptable soil materials is required, backfill the excavation to required subgrade with select fill material and thoroughly compact in accordance with the "Compaction Density Requirements" in this Article. Slope the sides of excavation in accordance with the maximum inclinations specified for each structure location.

3.11 GRADING

A. General:
   1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
   2. Smooth subgrade surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free of irregular surface changes, and shall comply with the following:

   1. Grassed Areas or Areas Covered with Gravel, Stone, Wood Chips, or Other Special Cover: Finish areas to receive topsoil or special cover to within not more than one inch above or below the required subgrade elevations.
   2. Pavements: Shape surface of areas under pavement to line, grade, and cross section, with finish surface not more than 1/2-inch above or below the required subgrade elevation.

C. Grading Surface of Fill Under Concrete Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a ten foot straight edge.

D. Compaction:
   1. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.12 PAVEMENT SUBBASE COURSE

A. General:

1. Place subbase material, in layers of specified thickness, over ground surface to support pavement base course.
2. After completing filling and grading, shape and compact pavement subgrade to an even, firm foundation in accordance with this Section. Remove unsuitable subgrade materials, including soft materials, boulders, vegetation, and loose stones, and replace with compacted fill material as directed by ENGINEER.

B. Grade Control:
1. During construction, maintain lines and grades including crown and cross-slope of subbase course.

C. Placing of Pavement Subbase Course:
1. Place subbase course material on prepared subgrade in layers of uniform thickness, in accordance with indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placing operations.
2. After completing compaction, other than that necessary for bringing material for the next course, do not haul or drive over the compacted subbase.
3. Do not install pavement subbase in excess of 500 feet in length without compacting to prevent softening of the subgrade.
4. If subgrade material becomes churned up into or mixed with the subbase material, remove the mixed material and replace with clean, compacted subbase material.

3.13 DISPOSAL OF EXCAVATED MATERIALS

A. General:
1. CONTRACTOR shall dispose of material removed from excavations that does not comply with requirements for fill, or is in excess of the quantity required for fill at a location suitable to the OWNER.
2. Disposal of materials shall be in compliance with Laws and Regulations, at no additional cost to OWNER.

3.14 FIELD QUALITY CONTROL

A. Site Tests: CONTRACTOR will employ a testing laboratory to perform field quality control testing. Testing laboratory to be approved by Owner.
1. Testing Laboratory Scope:
   a. Perform field moisture content and density tests to ensure that the specified compaction of fill materials has been obtained.
   b. Tests of actual unconfined compressive strength or bearing tests on each stratum.
   c. Report results of each test to ENGINEER and OWNER..
2. Required Material Tests:

a. Compaction: Comply with ASTM D1556 and ASTM D6938, as applicable.

3. Authority and Duties of Testing Laboratory:
   a. Technicians representing the testing laboratory shall inspect the materials in the field, perform testing, and report findings to ENGINEER and CONTRACTOR. When materials furnished or the Work performed does not comply with the Contract Documents, technician will direct attention of ENGINEER and CONTRACTOR to such failure.
   b. Technician will not act as foreman or perform other duties for CONTRACTOR. Work will be checked as it progresses, but failure to detect defective Work or non-complying materials shall not in any way prevent later rejection when defect is discovered, nor shall it obligate ENGINEER for Substantial Completion or final acceptance. Technicians are not authorized to revoke, alter, relax, enlarge, or release requirements of the Contract Documents, or to approve or accept any portion of the Work.
4. Responsibilities and Duties of CONTRACTOR:
   a. Use of testing laboratory shall in no way relieve CONTRACTOR of the responsibility to provide materials and Work in full compliance with the Contract Documents.
   b. To facilitate testing laboratory, CONTRACTOR shall advise testing laboratory at least two days in advance of filling operations to allow for completion of field quality control testing and for assignment of personnel.
   c. It shall be CONTRACTOR's responsibility to accomplish the specified compaction for fill and other earthwork. CONTRACTOR shall control construction operations by confirmation tests to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the Contract Documents relative to compaction, control.
   d. CONTRACTOR shall demonstrate adequacy of compaction equipment and procedures before exceeding one or more of the following quantities of earthwork. Each test location shall include tests for each layer, type, or class of fill to finish grade.
      1) 200 linear feet of trench fill and under all structures and pavement.
      2) 10 cubic yards of select fill as specified in Table 31 23 05-A.
      3) One test per 1,500 square feet, or fraction thereof, of each lift of general fill or backfill areas compacted by other than hand-operate machines.
      4) 50 cubic yards of subbase material as specified in Table 31 23 05-A.

5. Testing laboratory will inspect and indicate acceptable subgrades and fill layers before construction work is performed thereon. Testing of subgrades and fill layers shall be taken as follows:

a. Trenches for Structures, and Underground Facilities (including pipelines and buried ductbanks):
   1) Along Dirt or Gravel Roads or Off Traveled Right-of-Way: Two locations every 500 linear feet.
   2) Crossing Paved Roads: Two locations along each crossing.
   3) Under Pavement Cuts or Within Two Feet of Pavement Edges: One location every 400 linear feet.

b. Footing Subgrade: For each stratum of soil on which footings will be placed, perform not less than one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to ENGINEER.

c. For Select Fill: On 30-foot intervals on all sides of the structure for every compacted lift, but not less than one per lift on each side of the structure for structures less than 60 feet long on a side.

d. For General Fill: One per 1,000 square feet on every compacted lift.

e. Subbase Material: One per 1,000 square feet on every compacted lift.

6. Periodic compliance tests will be made by ENGINEER to verify that compaction is complying with the requirements specified, at no cost to CONTRACTOR. CONTRACTOR shall remove the overburden above the level at which ENGINEER wishes to test and shall fill and re-compact the excavation after testing is complete.

7. If testing laboratory reports or inspections indicate subgrade, fills, or bedding compaction below specified density, CONTRACTOR shall remove unacceptable materials as necessary and replace with specified materials and provide additional compaction at CONTRACTOR's expense until subgrades, bedding, and fill are acceptable. Costs for retesting of subgrade, fills, or bedding materials that did not originally comply with specified density shall be paid by CONTRACTOR.

+ + END OF SECTION + +

SECTION 31 23 16.26

ROCK REMOVAL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to perform rock removal required for the Work, including disposing of excavated rock material.
   2. Obtain permits required by authorities having jurisdiction for rock removal Work, including transporting, storing, and using blasting materials.
   3. Perform rock removal Work in compliance with Laws and Regulations applicable permits, and requirements of authorities having jurisdiction.

B. Coordination:
   1. Review procedures under this and other Sections and coordinate the Work that must be performed with or before rock removal.

C. Related Sections:
   1. Section 31 20 00, Earth Moving.

D. Measurement: Limits of rock removal shall be as follows:
   1. Structures: : Limit for all structures shall be bounded by the following:
      a. Bottom of footing, drainage course material, or compacted backfill.
      b. Pre-construction rock surface.
      c. Vertical planes located 12 inches outside footing.
   2. Trenches: Limit for trenches shall be bounded by the following:
      a. Width of trenches shall be the outside diameter or outside edge (as applicable) of the Underground Facility plus two feet, exclusive of pipe bells, branches, hubs, spurs, or cradles. Sides of trench shall be considered vertical.
      b. Depth of trench shall be six inches below the outside of the Underground Facility in the trench unless indicated otherwise on the Drawings.
      c. Length shall be equal to installed length of the Underground Facility, measured horizontally.
   3. No payment will be made for additional quantity outside the limits described in this Section.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. United States Bureau of Mines (USBM), Report of Investigations (RI) 8507.

1.3 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section, have the following meaning:
   1. "Rock removal" is removal of igneous, metamorphic, or sedimentary rock or stone; boulders over two cubic yards in volume in open areas and boulders over one cubic yard in volume in trenches; and mass concrete; that cannot be removed using rippers or other mechanical methods and therefore requires drilling or use of large excavator-mounted pneumatic breakers. The following material will not be measured nor allowed for payment as rock removal:
      a. Soft, weathered or disintegrated rock that can be removed by normal excavating equipment, including bulldozers with rippers and large trackhoes with rock teeth or rock buckets.
      b. Loose or previously blasted rock.
      c. Broken stone in rock fills.
      d. Rock or stone that falls into the excavation from outside limits of excavation shown or indicated in the Contract Documents.
      e. Boulders that can be removed without drilling, blasting, or pneumatic breakers.
      f. Pavements, sidewalks, and gutters of concrete, asphalt, or masonry.
   2. "Trenches" means excavations having vertical sides whose depth exceeds its width, made for Underground Facilities and drainage beds.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Professional Engineer:
      a. Contractor or Subcontractor shall retain a registered professional engineer legally qualified to practice in same state as the Site. Professional engineer shall have at least five years experience conducting preblast surveys, structural evaluations, and structural condition assessments.
      b. Responsibilities include:
         1) Preparing or supervising preparation of preblast survey.
         2) Preparing written requests for clarifications or interpretations of the Contract Documents for submittal to Engineer by Contractor.
         3) Signing and sealing preblast survey report.
         4) Performing condition assessments of structures damaged by blasting.

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Test and Evaluation Reports:
      a. Rock surface survey information, in accordance with Article 3.1 of this Section.

b. Preblast survey report, in accordance with Paragraph 3.2.D of this Section.
c. Blasting records, when requested by Engineer, in accordance with Paragraph 3.3.F of this Section.
d. Vibration and overpressure monitoring results, in accordance with Paragraph 3.4.A.3 of this Section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 EXAMINATION

A. Top-of-Rock Survey:
1. Prior to rock removal, Contractor shall survey and measure the elevation of the top of rock to determine the in-place quantity of rock to be excavated.
2. Uncover rock to be excavated in sections or areas acceptable to Engineer for surveying.
3. Conform to Section 01 71 23, Field Engineering.
4. Submit to Engineer field notes, site plan showing rock elevations measured, cross-sections of rock surface when necessary or required by Engineer, and detailed estimation of quantity of rock to be excavated.

3.2 ROCK REMOVAL

A. Perform rock removal adjacent to Underground Facilities and above-ground utilities and life-safety facilities with utmost care, after properly notifying and coordinating with utility owners, life-safety facility owners, and authorities having jurisdiction.

B. Removal by Methods Other than Blasting:
1. Where conditions of hazard exist, or clearances with existing facilities, piping, or structures are very small, or where the potential for damage to persons or property is strong, perform rock removal by means other than blasting.
2. Blasting is not allowed on this site.

C. Removal and Disposal of Rock:
1. Remove broken rock from excavations with suitable equipment in accordance with Section 31 20 00, Earth Moving.
2. Do not use excavated rock as backfill. Dispose of excavated rock off the Site or at a suitable location as approved by the OWNER at Contractor's expense in compliance with Laws and Regulations.

3.3 UNAUTHORIZED ROCK REMOVAL

A. Rock removal outside the limits shown or indicated in the Contract Documents or that is not approved by Engineer, including removal, disposal, and backfill, will be at Contractor's expense.

B. Fill unauthorized excavation below pipe or foundation with compacted select backfill as directed by Engineer in writing, at no additional cost to Owner. Backfill other unauthorized excavation as specified in Section 31 20 00, Earth Moving.

+ + END OF SECTION + +

SECTION 31 63 16

AUGER CAST GROUT PILES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install and test auger cast grout piles. Included are the following:
      a. Test piles as shown, specified or directed by the ENGINEER, in writing.
      b. Pile load tests as directed by the ENGINEER, in writing. Load tests shall be performed on test piles prior to installation of production piles.
   2. Extent of auger cast grout piles is as shown and as directed by the ENGINEER, in writing.

B. Pile Capacity:
   1. At locations specified and shown:
      a. Provide and install Auger Cast Grout pile foundation with a compression capacity (allowable capacity) as required by Tank Manufacturer's design following recommendations indicated in the Contract Geotechnical Engineering Evaluation Report.
   2. Piles consist of auger cast grout 16 inch or 18 inch diameter piles designed as a steel reinforcement cage surrounded by cement grout.

C. Coordination:
   Review installation procedures under other Sections and coordinate the installation of piles.

D. Related Sections:

   Section 03 00 05, Concrete.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American Concrete Institute, (ACI).
      a. ACI 305, Hot Weather Concreting.
      b. ACI 306, Cold Weather Concreting.
   2. American Society for Testing and Materials, (ASTM).
      a. ASTM A 615, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

b. ASTM C 33, Specification for Concrete Aggregates.
c. ASTM C 109, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch Cube Specimens).
d. ASTM C 150, Specification for Portland Cement.
e. ASTM C 192, Practice for Making and Curing Concrete Test Specimens in the Laboratory.
f. ASTM C 618, Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
g. ASTM C 939, Test Method for Flow of Grout for Preplaced-Aggregate Concrete.
h. ASTM D 1143, Test Method for Piles Under Static Axial Compressive Load.
i. ASTM D 1586, Test Method for Penetration Test and Split-Barrel Sampling of Soils.
j. ASTM D 3689, Test Method for Individual Piles Under Static Axial Tensile Load.

1.3 QUALITY ASSURANCE

A. Concrete Testing Service:
1. CONTRACTOR shall employ, at his own expense, a testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
a. Testing agency shall meet the requirements of ASTM E 329.
b. Selection of a testing laboratory is subject to OWNER'S approval.
c. Submit a written description of the proposed concrete testing laboratory giving qualifications of personnel, laboratory facilities, equipment, and other information, which may be requested by OWNER.
2. Materials and installed Work may require testing and retesting, as directed by ENGINEER, at any time during the progress of the Work. Allow free access to material stockpiles and facilities at all times. Tests not specifically indicated to be done at OWNER'S expense, including the retesting of rejected materials and installed Work, shall be done at CONTRACTOR'S expense.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
1. Shop Drawings:
a. Full data on type of pile proposed and on equipment to be utilized.
b. Description and sketch or catalog data of the pile installation rig including leads, auger, grout pump and auger motor.
c. Proposed pile installation sequence referenced to the pile plan as shown.
d. Proposed pile installation procedures.
e. Pile numbering plan.

f. Complete data on pile load test equipment instrumentation, load equipment calibration, load application and protection, if any.

g. Proportioning of grout and installation of auger cast grout piles shall be performed in accordance with the provisions of these Specifications. Provide a description of the materials to be used and the proposed method of operations and furnish records and data to demonstrate that the finished piles will meet, in all respects, the quality and properties required by these Specifications.

B. Informational Submittals: Submit the following:

1. Source Quality Control Submittals:

a. Grout Mix Design and Test Reports: Ten days prior to start of the Work, the proposed grout mix design, flow cone and strength test results on samples of grout demonstrating conformance to contract requirements.

2. Site Quality Control Submittals:

a. Submit each test report for load test within two days after completion of tests.

3. Qualification Statements:

a. Qualifications of personnel supervising the performance of pile installation.

C. Closeout Submittals: Submit the following:

1. Record Documentation:

a. Submit the installation record of each pile to ENGINEER not later than two days after installation is completed. Include the Project name and number, name of CONTRACTOR, name of Installer, pile location and number, computed pile capacity, rate of operation of pile installation equipment, pile dimensions, tip elevation, elevation of butt, ground elevation, pile deviation, quantity of grout placed and any unusual occurrences during pile installation.

b. Submit Record Drawings showing exact location of each pile as installed.

1.5 DELIVERY, STORAGE AND HANDLING

A. Except for piles to be used for test purposes, materials ordered or delivered to the Site prior to verification of the assumed pile length, will be at CONTRACTOR'S risk.

B. After pile lengths are verified, deliver materials to the Site in such quantities and at such times to assure the continuity of pile driving operations to the Project Schedule.

C. Store piles in orderly groups above ground and blocked during storage to minimize possible distortion.

D. Supplier of grout shall be located in close proximity to the Project and not more than 30 minutes driving time away.

1.6 JOB CONDITIONS

A. Site Information:
Additional test borings and other exploratory operations may be made by CONTRACTOR at no additional cost to OWNER, provided such operations are acceptable to ENGINEER, in accordance with contract documents.

B. Line and Level:
ENGINEER or OWNER will establish a benchmark on the Site and a baseline for the use of CONTRACTOR in establishing lines and levels for the Work. CONTRACTOR shall establish and locate all other lines and levels and be responsible for the correct location and deviation measurements of all piles.

C. Protection:
1. Protect structures, underground utilities and other construction from damage caused by pile installation operations.
2. When structures are adjacent to pile installation operations, provide surveyed elevation benchmarks on structures where directed by ENGINEER before commencing Work. Record and report the elevation of each benchmark at least twice a day while pile installation is in progress. Should benchmark readings indicate any displacement, halt operations and provide corrective action acceptable to ENGINEER.

D. Cost of ENGINEER'S Redesign:
1. Piling driven incorrectly, out of position, or which is defective in any way shall be corrected as directed by ENGINEER and as described hereinafter.
2. ENGINEER will record all time required by him and their consultants, if any, in redesigning piling, foundations or other related structural work and in making revisions to the Contract Documents.
3. CONTRACTOR shall reimburse OWNER for the additional services of the ENGINEER and their consultants based on a charge of 2.5 times salary costs.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete shall conform to the requirements of Section 03 00 05, Concrete, except coarse aggregate shall be as specified herein.
1. Portland cement shall conform to the requirements of ASTM C 150.
2. Pozzolan shall, if used, conform to the requirements of ASTM C 618, Class F.
3. If CONTRACTOR elects to use a mortar fluidifier, he shall submit manufacturer's data on the use of this product to ENGINEER for review and approval.

4. Water shall be fresh, clean, and free from injurious amounts of sewage, oil, acid, alkali, salts, or inorganic matter.
5. Other admixtures shall not be used.
6. Fine aggregate shall meet the requirements of current ASTM C 33 standards, except that grading may be modified if compressive strength requirements are satisfied.

B. Reinforcing Bars shall have a minimum yield of 60,000 psi and shall conform to the requirements contained in Section 03 00 05, Concrete.

C. Grout Mix for Auger Drilled and Grouted Piles:
1. Grout shall consist of a mixture of Portland cement, sand and water proportioned and mixed to provide grout capable of maintaining solids in suspension without appreciable water gain, but placed without difficulty, and laterally penetrate and fill voids in the foundation material. Materials shall be proportioned to attain a minimum 28 day compressive strength of 5,000 psi.
2. Grout mix shall be tested in accordance with the requirements of ASTM C 109 and ASTM C 192 for each day during which piles are placed. All samples will be taken at the mid-point of installation of a pile.
3. Only approved pumping, continuous mixing and agitating equipment shall be used in the preparation and handling of the mortar. Oil or other rust inhibitors shall be removed from mixing drums and grout pumps. Materials shall be such as to produce homogeneous grout of the desired consistency.
4. Grout pump shall be a positive displacement piston type pump capable of developing displacing pressures at the pump up to 350 psi. Minimum volume of grout pumped for each hole shall be at least equal to 125 percent of the volume of the augered hole.

2.2 EQUIPMENT FOR INSTALLING PILES

A. Equipment for Installing Auger Drilled and Grouted Piles:
1. Hole through which the high-strength grout is pumped during the placement of the pile, shall be located at the bottom of the auger head, below the bar containing the cutting teeth.
2. Auger flighting shall be continuous from the auger head to the top of auger, with no gaps or other breaks. Pitch of the auger flighting shall not exceed nine inches.
3. Augers over 40-feet in length shall contain a middle guide.
4. Piling leads should be prevented from rotating by a stabilizing arm.
5. Piling leads for auger flights shall be clearly marked in five feet increments on all sides of lead tower. Numerals shall be of adequate size such that they are readable from a distance of 40-feet.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the areas and conditions under which augered grout-injected piles are to be installed. Notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.

3.2 PRE-INSTALLATION WORK

A. Site Conditions:
   1. Do not install piles until earthwork in area, which piles are to occupy, has been completed, as follows:
      a. Excavations: Earth excavation shall be complete before piles are installed. Remove excess spoils from excavated area.
      b. Fills: Construct and compact fills to the elevation of the grade shown. Remove excess spoils from fill area.

3.3 GENERAL REQUIREMENTS

A. Piles shall be installed with due consideration for the safety of adjacent structures and existing active utilities by a method, which leaves their strength unimpaired, and which develops and retains the required load bearing capacity.

B. Augered grout-injected piles shall be made by rotating a 16-inch or 18-inch diameter continuous-flight hollow-shaft auger into the ground to a tip elevation as shown in the Contract Drawings or as directed by ENGINEER. Grout shall then be injected through the auger shaft as the auger is being withdrawn in such a way as to exert removing pressure on the earth filled auger as it is being withdrawn as well as lateral pressure on the soil surrounding the mortar filled pile hole. Reinforcing shall be placed after grout injection.

C. Each pile shall contain reinforcing bars as shown in the Contract Drawings for compression piles conforming to Section 03 00 05, Concrete, placed through the hollow shaft auger which shall act as the centralizer to assure minimum grout cover. The bars shall extend the full length of the pile in all piles. Piles with bars of insufficient length shall be rejected.

D. CONTRACTOR shall submit a schedule for pile installation. Piles shall not be installed until the schedule is accepted by the ENGINEER. Piles closest to existing structures shall be installed and tested first followed by piles progressively further away.

3.4 PILE INSTALLATION

A. General:
   1. Installation shall be performed in an orderly sequence progressing in one direction across each foundation element.
   2. Continuously install each pile at the locations indicated, to the elevation determined for each pile by the ENGINEER.
   3. Carefully plumb the leads and the auger before installation.
   4. When installing piles within 20 feet of existing structures, the weight of the augers and auger head shall be at least 7.0 kips to increase the rate of auger penetration. Auger rotation shall stop immediately, after reaching maximum depth and shall not start again until grouting has begun.
   5. In the event that nonaugerable material is encountered such as cobbles, boulders, rock ledge, metal, timbers, or debris which causes the rate of penetration to be reduced to less than one foot per minute or causes the pile to drift from its location, the pile shall be completed to the depth of the nonaugerable material in accordance with these Specifications. The length of such short piles shall be included in the total linear feet of pile for payment. If required by the ENGINEER, one or more additional adjacent piles shall be placed and the length of these additional piles shall also be included in the total linear feet of piles for payment. Piles mistakenly placed by CONTRACTOR will not be paid for.

B. Installation:
   1. Grout shall be pumped as soon as practicable after mixing, and in no case shall grout be used which does not reach its final position in the pile within 1-1/2 hours after truck mixed grout leaves the plant as evidenced by the delivery ticket provided to the inspector.
   2. Only approved mixing and pumping equipment shall be used in the preparation and handling of grout. A screen to remove oversize particles shall be placed at the pump inlet. All soil or other rust inhibitors shall be removed from the mixing drums, stirring mechanisms, and other portions of the equipment in contact with the grout before the mixers are used.
   3. All materials shall be accurately measured by volume or weight as they are fed into the mixer. Time of mixing shall be not less than one minute. If agitated continuously, the grout may be held in the mixer or agitator for a period not exceeding two hours at grout temperatures below 70°F and for a period not exceeding 1-1/2 hours at higher temperatures. When a set retarding admixture is used, the grout may be held for a period of two hours at temperatures below 90°F. Grout shall not be placed when its temperature exceeds 90°F.
   4. Accurate records shall be maintained showing the depth to which piles are placed and the quantity of grout placed. Any unusual conditions encountered during pile installation shall be noted. The leads of the rig shall be clearly marked in one-foot increments.
   5. Piles installed the same day shall not be closer than nine feet center to center of each other.

6. The hole in the bottom of the auger shall be plugged while being advanced into the ground. The plug shall be fabricated from steel tubing to fit snuggly into the hole. Plug shall be removed by grout pressure or with the reinforcing bar.
7. Grout shall be pumped with initial pressure of approximately 250 psi at the pump as the auger is withdrawn allowing the mortar to fill the hole, preventing its collapse, and permitting lateral intrusion of the mortar into the surrounding soil. A second pressure gage shall be provided located as close to the auger rig as possible such that it is just touching the ground when the auger is in the raised position. The range of this gage shall not exceed twice the normal pumping pressure.
8. Grout pump shall be provided with a calibrated pressure gage in clear view of the equipment operator. A digital counter shall be used to measure the number of grout pump strokes during installation. Grout pump shall be calibrated at the beginning of the Work to determine the number of pump strokes to fill a 55-gallon drum with mortar. Pump shall be recalibrated following repair or switching pumps or at least once at the request of ENGINEER during pile installation. CONTRACTOR shall have on hand a spare counter and a spare pump. Spare pump shall be utilized when the primary pump is not functioning properly and when directed by ENGINEER.
9. Positive rotation of the auger shall be maintained throughout placement of the grout. Rate of grout injection and rate of auger withdrawal from the soil shall be so coordinated as to maintain at all times a positive pressure on these gages, which will, in turn, indicate the existence of a removing pressure on the bottom of the auger flight in conformance with Article 3.3, above. Total volume of grout shall be at least 15 percent greater than the theoretical volume for each five-foot segment of pile, except after grout is flowing at the ground surface from the auger blade, a minimum of five cubic feet per five-foot segment shall be pumped. However, the total volume of grout pumped shall be at least 25 percent greater than the theoretical volume of the pile. If pumping of grout is interrupted for any reason or if a return at the surface is noted, CONTRACTOR shall reinsert the auger at least five feet into the pile and regrout.
10. If less grout is placed than the net volume required for any five-foot increment, the piles shall be reinstalled by rotating the auger to the bottom of the pile followed by controlled removal and mortar injection.
11. A head of at least ten feet of grout above the injection point shall be maintained around the perimeter of the auger flights during raising of the auger so that the grout has a displacing action, removing any loose material from the hole. This head shall be initially established by raising the auger 6- inches from the bottom while rotating, pumping grout until a sufficient quantity is measured, lowering the auger to its original level and finally starting the removal process.
12. Auger hoisting equipment shall be so designed as to enable the auger to be withdrawn smoothly and steadily. Augers in excess of 40 feet in length shall be provided with a traveling guide.
13. Magnitude of removing pressure and performance of other augering and grouting operations such as the rate of augering, rate of grout injection, and control of grout return around the auger flight are dependent on soil conditions

and equipment capability and shall be entirely the responsibility of CONTRACTOR.

14. The spoil and excess grout that accumulates around the auger during injection of the grout shall be continuously cleared away so that the installation can be properly inspected. Excess grout and spoil shall be removed from the Work area at the end of each day. Do not use back-hoe or equivalent equipment adjacent to freshly placed piles within a 48-hour period to avoid possible damage to reinforcement and piling.
15. Provide protective cover for each pile after installation.
16. Test each truckload of grout using the Flow Cone Test ASTM C 939, except a 3/4-inch opening is used rather than the 1/2-inch opening specified. Maintain grout fluidity of between 15 and 25 seconds.
17. Should water or ponding collect at the top of a freshly grouted pile, the water shall be removed immediately by bailing-out and replaced with fresh grout.
18. A 1-1/4-inch outside diameter flush joint casing capped at both ends and filled with oil shall be substitute for the 1.128-inches diameter reinforcing bar in one of the test compression piles to permit telltale installation.
19. A reinforcing cage, a minimum of 15 feet in length, shall be installed in the top of the load test pile. The cage shall consist of eight No. 6 rebars equally spaced, with No. 3 ties at 12-inch O.C.
20. Reinforcing cages for pile extensions shall be installed as shown.

C. Installation Tolerances:
   1. Install piles within the following maximum tolerances:
      a. Location: 3-inches from the location indicated for the center of gravity of each single pile or pile groups.
      b. Plumbness: Maintain 2-inches in ten feet from the vertical.

D. Corrective Action:
   1. ENGINEER may survey the piles at any time. If any discrepancy is detected, CONTRACTOR shall replace the pile or piles, at no additional cost to the OWNER.
   2. As soon as possible, after completion of installation of piles, CONTRACTOR shall prepare an accurate survey made by a licensed surveyor and furnish ENGINEER with a record showing the final position of the top of each pile and location of unacceptable piles.
   3. ENGINEER will check the piling and determine its acceptability. If not acceptable, the ENGINEER will advise CONTRACTOR what additional piles must be furnished or other corrective measures to be taken.
   4. ENGINEER will provide redesign, as required, because of piles installed out of location. All corrective measures, including cost of ENGINEER'S redesign, shall be at CONTRACTOR'S expense.
   5. Partial surveys of piles at cutoff elevation may be submitted, as driving proceeds, in order to expedite the Work.

E. Jetting:

1. Jetting shall not be employed.

F. Damaged Piles or Piles Out of Tolerance:
   1. Damaged piles, and piles installed outside the required installation tolerances, will not be accepted.
   2. Cut-off and abandon piles rejected after installation and replace with new piles.
   3. Install additional piles where the centerline deviation exceeds 3-inches and a redesign indicates a load on any pile exceeding 110 percent of the design load. Where these additional piles necessitate changes in pile cap dimensions or reinforcement, CONTRACTOR shall carry out all corrective measures required to obtain the approval of ENGINEER, at no additional cost to the OWNER. Should it be impractical to install additional piles in particular situations, provide reinforced concrete straps or other measures as directed by ENGINEER for redistributing the design loading, at no additional cost to the OWNER.

G. Cutting-Off:
   1. Cut-off the tops of piles, square with pile axis and at the elevations indicated by removing fresh mortar from the top of the pile or by cutting off hardened mortar down to final cut-off point at any time after initial set has occurred.

H. Cold Weather Placing:
   1. Protect mortar work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in conformance with the requirements of ACI 306.

I. Hot Weather Placing:
   1. When hot weather conditions exist that would seriously impair the quality and strength of mortar, place mortar in, in conformance with the requirements of ACI 305.

3.5 FIELD QUALITY CONTROL

A. Install and load test piles in order to confirm or modify design pile lengths. Pile load test shall be performed in accordance with ASTM D 1143 or ASTM D 3689, and as modified herein. Provide complete testing materials and equipment as required and perform test only in the presence of ENGINEER. Test piles shall be installed and loaded from the excavation subgrade level.

B. Test piles furnished and installed by CONTRACTOR to determine lengths of piles, may be located, cut off, and become part of the foundation system provided the pile conforms to these Specifications requirements.

C. Test Pile Required:
   1. Provide two test piles for pile load test. The piles should be loaded in compression. A telltale shall be installed in the compression piles as described

in Paragraph 3.5.H.1., below. The test piles shall be installed with tip level as shown. ENGINEER may adjust this level based on the boring test.

D. Installing Test Pile:
   1. Submittals required:
      a. General location of the test piles. CONTRACTOR shall submit a sketch showing the detail of the pile test set up as required in ASTM D 1143 or ASTM D 3689 and the specific location of the test pile.
   2. Pre-pile Installation:
      a. CONTRACTOR shall retain a qualified boring contractor to perform split spoon sample boring at the test location and obtain samples at 5 feet intervals. The test pile shall be installed to a tip elevation as directed by ENGINEER. A hollow-stem auger will not be permitted to advance these holes.
   3. At pile test area, install test pile as shown on the approved pile test set up. Tip elevations shall be as shown. Test pile shall be installed from the excavation level.

E. Pile Design Load:
   1. The required safe working capacity for piles shall be provided by the Tank Manufacturer.
   2. Tension piles working capacity as required by the Tank Manufacturer.

F. Test Load:
   1. Load test piles to twice the required design load, followed by unloading and reloading to three times the design load or failure.

G. Pile Load Testing - Downward Load:
   1. Perform a load test in accordance with ASTM D 1143 using Section 5.1, Standard Loading Procedure, and Section 5.3, Loading in Excess of Standard Test Load. The maximum required load for Section 5.3 shall be three times the design load or failure. Following unloading of the test under Section 5.1, rebound measurements for at least 15 hours shall be made prior to reload.

H. General Load Test Requirements:
   1. Test load shall be applied by jacking with a hydraulic jack against a dead weight loaded platform or against a reaction beam attached to four or more anchor piles. Center to center spacing between test pile and closest anchor pile shall not be less than nine feet. Hydraulic jack shall be equipped with an accumulator and the necessary gages and piping which shall transmit constant load to the pile with deviations of less than 500 pounds from the applied load. Provide a calibration curve for the jack and gage to be used obtained within seven days of the commencement of the load test and certified by a recognized testing laboratory. Load test shall include the use of a recently calibrated load cell and a ball joint to assure concentric loading of the pile top. Submit a description of the operation for the accumulator and a Shop Drawing of the

proposed loading platform and dead weights or reaction beam and anchor piles to be used, prior to the start of the Work. Beam sizes and details of all connections shall be included. A telltale consisting of a 1/2-inch diameter pipe shall be placed inside the 1-1/4-inch casing installed in the compression pile with the tip installed to an elevation which will permit a measurement of deflection of the pile tip during load tests. The telltale shall be inserted in the casing prior to removal of the auger. A load frame shall be placed above the piles to facilitate measurement of pile tip deflections. An example of load frame is shown on Figure 7 of ASTM D 1143. Provide a dial gage to measure pile tip movement as indicated by the telltale rod.

2. Pile movement observations shall be made following application of each load increment and recorded at intervals of 1/2 minute, one minute, two minutes, four minutes, and each four minutes thereafter. The application of load increment except in the instance of total load where, after four minutes reading, the time interval shall be successively doubled until the final settlement limitation is reached and the load removed.

I. Preparation of Grout Test Specimens:
   1. Throughout each eight-hour shift, at least six test specimens of grout shall be prepared by pouring grout, taken from the auger discharge, into 2-inch by 2-inch by 2-inch cube molds and tested in accordance with ASTM C 1017.

J. Test Reports:
   1. Prepare report for test pile, to include the following:
      a. Date of installation.
      b. Test pile location.
      c. Ground elevation.
      d. Ground designation and dimensions of pile.
      e. Total penetration.
      f. Starting and finishing times.
      g. Total installation time.
      h. Quantity of mortar placed and any unusual conditions encountered.
   2. Submit test pile reports of equipment used, including complete pump information, type and operating pressure.

+ + END OF SECTION + +

DIVISION 32 - EXTERIOR IMPROVEMENTS

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SECTION 32 12 00

FLEXIBLE PAVING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install flexible, hot-mix, hot-laid, asphalt concrete pavement.
   2. The Work includes:
      a. Preparation such as sawcutting, milling where shown or indicated, cleaning, and other preparation for installing flexible pavements.
      b. Providing asphalt concrete paving materials.
      c. Providing tack coat material.
      d. Providing pavement markings where shown or indicated.
      e. Providing quality controls and testing.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before flexible paving Work.

C. Related Sections:
   1. Section 09 91 00, Painting.
   2. Section 31 20 00, Earth Moving.
   3. Section 32 16 13, Concrete Curbs, Gutters and Sidewalks.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. AASHTO M320, Specification for Performance-Graded Asphalt Binder.
   2. AASHTO MP1a, Specification for Performance-Graded Asphalt Binder.
   3. AI MS-2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
   4. ASTM C1371, Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
   5. ASTM C1549, Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
   6. ASTM D242/D242M, Specification for Mineral Filler For Bituminous Paving Mixtures.
   7. ASTM D692/D692M, Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.

8. ASTM D946/D946M, Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
9. ASTM D977, Specification for Emulsified Asphalt.
10. ASTM D1073, Specification for Fine Aggregate for Bituminous Paving Mixtures.
11. ASTM D1188, Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
12. ASTM D2726, Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
13. ASTM D2950, Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
14. ASTM D3549, Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
15. ASTM D6690, Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
16. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.
17. ASTM E408, Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
18. ASTM E1918, Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
19. ASTM E1980, Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
20. FS TT-P-115, Paint, Traffic, Highway, White and Yellow.
21. USGBC LEED-NC, Reference Guide, For New Construction and Major Renovation.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Reference Specifications and Details:
      a. Comply with applicable requirements of Georgia Department of Transportation Standard Specifications and Standard Details.
   2. Obtain required highway and street rights-of-way work permits.
   3. Jurisdiction:
      a. Paved areas to be constructed are jurisdiction of City of Fayetteville.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Submit the proposed asphalt concrete mix design for each asphalt concrete material, and other bituminous materials, required under this Section, providing complete data on materials, including location in the Work, source, material content and percentages, temperatures and all other pertinent data. Indicate proportion of bituminous material from reclaimed asphalt pavement.

b. Proposed gradation for each aggregate to be used in flexible paving. Submit gradation test results for the same material furnished on a previous project. Indicate the proportion of reclaimed asphalt pavement.
c. In lieu of the information required under Paragraphs 1.4.A.1.a and 1.4.A.1.b, above, submit certificates of compliance with the reference specifications indicated in Article 1.3 of this Section, for each for the following:
1) Each mix design required.
2) Bituminous materials required.
3) Aggregates to be used in flexible paving, from each material source and each required gradation.
4) Density of uncompacted asphalt concrete material.
5) Density of previously-compacted, previously-tested asphalt concrete material.
6) Density and voids analysis for each asphalt concrete material test specimen.
7) Evidence of asphalt concrete plant inspection and compliance with the reference specifications indicated in Article 1.3 of this Section.
8) Proportion of reclaimed asphalt pavement in bituminous materials and aggregate.

2. Product Data:
a. Manufacturer's complete product data on all pavement marking materials proposed for use, including product literature, specifications, and recommended application techniques and other installation data.

B. Informational Submittals: Submit the following:
1. Quality Assurance Test Data Submittals and Source Quality Control Submittals:
a. Submit for quality assurance tests and source quality control tests required.
2. Delivery Tickets:
a. Submit copy of delivery ticket for each load of asphalt concrete, tack coat materials, and other materials obtained from asphalt concrete production facility, signed by CONTRACTOR
3. Field Quality Control Submittals:
a. Submit results of required field quality control testing.
4. Qualifications:
a. Asphalt concrete production facility, when required by ENGINEER.
b. CONTRACTOR's testing laboratory, when required by ENGINEER.

1.5 SITE CONDITIONS

A. Weather Limitations:
1. Temperature:
a. For base course and binder course paving lifts equal to or greater than two inches thickness, atmospheric temperature shall be 40 degrees F and rising.

b. For surface course paving or other pavement courses in lifts less than two inches thick, temperature of surface on which pavement is to be placed shall be 50 degrees F or greater.

2. Prohibitions:
   a. Do not place flexible paving materials when weather is foggy or during precipitation.
   b. Do not place flexible paving materials when the base on which the material will be placed contains moisture in excess of optimum.
   c. Place flexible paving materials only when ENGINEER concurs that weather conditions are suitable.

PART 2 – PRODUCTS

2.1 SYSTEM PERFORMANCE

A. System Description:
   1. Provide subbase course of the thickness shown or indicated, in accordance with Section 31 20 00, Earth Moving.

2.2 ASPHALT CONCRETE MIXES

A. Asphalt Concrete Mixtures: Provide the following materials designed and manufactured in accordance with reference specifications indicated in Article 1.3 of this Section:
   1. Base Course: Georgia Department of Transportation SectionNo. 300.
   2. Binder Course: Georgia Department of Transportation Section No. 300.
   3. Surface Course (Wearing Course, Top Course): Georgia Department of Transportation Section No. 400.

2.3 BITUMINOUS MATERIALS

A. Bituminous Materials for Asphalt Concrete:
   1. Bituminous materials for asphalt concrete shall comply with the reference specifications indicated in Article 1.3 of this Section, for the asphalt concrete mixes specified.
   2. Bituminous Materials from Reclaimed Asphalt Pavement (RAP): When use of RAP in bituminous materials is acceptable, comply with requirements for RAP in Article 2.4 of this Section.

B. Tack Coat:
   1. Tack coat shall be emulsified asphalt.
   2. Provide Georgia Department of Transportation Section No. 413, in accordance with reference specifications indicated in Article 1.3 of this Section.

C. Crack Sealant:
   1. Provide Georgia Department of Transportation Section No. 407, in accordance with reference specifications indicated in Article 1.3 of this Section.

2.4 AGGREGATES IN FLEXIBLE PAVEMENTS

A. Aggregates for Asphalt Concrete – General:
   1. Aggregate materials used in flexible pavement shall be in accordance with the reference specifications indicated in Article 1.3 of this Section, for the asphalt concrete mix designs indicated.

B. Reclaimed Asphalt Pavement (RAP):
   1. Processed material obtained by milling or full depth removal of existing asphalt concrete pavement may be used as aggregate in asphalt concrete base course and binder course.
   2. Maximum proportion of RAP in the asphalt concrete provided shall comply with requirements of the reference specifications indicated in Article 1.3 of this Section.
   3. When RAP is used, comply with Contract Documents requirements for the applicable asphalt concrete course mix design, bituminous materials, and aggregates.

2.5 PAVEMENT MARKING MATERIALS

A. Material:
   1. Pavement marking paint shall have chlorinated rubber base.
   2. Factory-mixed, quick-drying and non-bleeding, complying with FS TT-P-115, Type III.

B. Colors:
   1. Roadway Center Markings Between Opposing Traffic Lanes: Yellow.
   2. Roadway Side Striping: White, unless otherwise shown or specified. On roads with divided median, right-side striping of each direction shall be white, and left-side striping shall be yellow.
   3. Roadway Miscellaneous Lane Markings (turn lane arrows and text): White.
   4. No-Parking Areas: Yellow.
   5. Handicap Parking Spaces: Unless otherwise indicated with signs, provide handicap symbol on pavement with white paint on blue background.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine the subbase and base on which flexible paving will be installed. Notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Do not place materials on subgrades, or subbase that is muddy or has water thereon.

3.2 PREPARATION

A. Preparation: Before starting installation of flexible paving, perform the following:
   1 Grade Control: Establish and maintain throughout flexible paving installation the required lines and grades, including crown and cross-slope for each asphalt concrete course during construction operations.
   2. Prepare subgrade and provide subbase for flexible pavement in accordance with Section 31 20 00, Earth Moving. Before installing flexible pavement, obtain ENGINEER's concurrence that subgrade and subbase are suitable for installing flexible pavement.
   3. Coordinate placement of flexible pavement with the Work included under Section 32 16 13, Concrete Curbs, Gutters and Sidewalks, and Work including drainage structures, manholes, valve boxes, and similar items.
   4. Provide appropriate maintenance and protection of traffic measures during placement of pavement.

B. Milling:
   1 Perform milling of existing pavement where shown or indicated.
   2. "Milling" consists of the milling, shaping, and removing portions of existing surfaces by cold milling process and subsequent cleaning.
   3. Milling Equipment:
      a. Milling machines shall be power-operated, self-propelled machines capable of removing the desired thickness of existing surfaces. Machines shall have sufficient power, traction, and stability to accurately maintain depth of cut and slope. Machines shall produce a finished profile and cross slope to within 1/4 inch of that required and shall produce uniform surface texture free of gouges and ridges greater than 3/8-inch deep.
      b. Machines shall be equipped with a means to control dust and other particulate matter created by the cutting action.
      c. Provide equipment that removes milled material as quickly as the rate of milling.
      d. Use vacuum trucks, street sweepers or power brooms to clean milled surfaces.
   4. Milling Operations:
      a. Perform milling to so that, when final course of pavement is placed, required elevations and grades are provided. Where required, establish a taut reference string line to control line and grade of milling.
      b. Minimize the time between milling and placement of pavement over milled surface.
      c. Areas not accessible to the milling machine, such as around or adjacent to drainage structures, manholes, curbs, and transverse joints on structures, may be removed by a small milling machine, handwork or other method acceptable to ENGINEER.
      d. Remove milled material as soon as it is milled. Remove fines and other material prior to opening milled area to traffic. Control objectionable dust emissions. When traffic has been allowed into milled area or when

more than 48 hours have elapsed since milling, clean the milled area again prior to applying tack coat.

e. Maintain drainage to drainage inlets and other drainage structures in a manner acceptable to ENGINEER.

f. Properly dispose of milled material at a location away from the Site.

C. Surface Preparation:

1. Repair surface defects in existing pavement to provide uniform surface to receive new pavement.
2. Provide crack sealant to completely fill cracks more than 1/16-inch wide in areas shown or indicated on the Drawings.
3. Clean existing surfaces over which asphalt concrete pavement will be installed, by removing from the surface foreign material, excess asphalt concrete, excess joint sealant, and crack filler, and other undesirable matter.
4. Provide tack coat as indicated in Article 3.3 of this Section.

3.3 INSTALLATION OF FLEXIBLE PAVING

A. General:

1. Provide final pavement surfaces of uniform texture, at required grades and cross-sections.
2. Construct roadways to the lines, grades, and typical sections shown or indicated.

B. Installation of Asphalt Concrete:

1. Asphalt concrete mixture shall be transported to the site of paving and placed as soon as possible after mixing.
2. Placement of each asphalt concrete course shall be completed over the full width of the section under construction during each day's paving operations.
3. Spread and finish asphalt concrete courses by means of self-propelled mechanical spreading and finishing equipment. Compacted thickness of layers placed shall not exceed 150 percent of specified thickness unless approved in writing by ENGINEER.
4. Compaction:
   a. Rollers:
      1) Use sufficient rolling equipment to satisfactorily compact and finish the quantity of asphalt concrete placed. There shall be not less than two rollers on the Project at all times. When acceptable to ENGINEER, one of the rollers may be a pneumatic-tire roller.
      2) During rolling operations, roller speed shall not exceed three miles per hour. When sufficient number of rollers is not available, reduce the quantity of asphalt concrete placed to accommodate the available rollers' speed.
      3) Required rollers shall be at the Site, in acceptable operating condition, prior to placing of asphalt concrete.

4) Use of vibratory rollers in lieu of steel-wheeled rollers is acceptable, however when thickness of asphalt concrete is one-inch or less, rolling shall be in the static mode.

b. Rolling of initially-placed asphalt concrete material, or breakdown rolling, shall begin as soon as the asphalt concrete mixture will bear the roller without undue displacement.

c. Rolling shall be longitudinal, overlapping on successive trips by not less than one-half roller rear wheel width, and not more than three-quarters of roller rear wheel width. Alternate trips of the roller shall be of slightly different lengths.

d. At all times, roller motion shall be slow enough to avoid displacing the asphalt concrete.

e. Operate rollers continuously from breakdown of laid asphalt concrete through finish rolling.

f. Perform finish rolling using a steel-wheeled roller or a vibratory steel-wheel roller operating in the static mode.

g. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

h. At each location not accessible to roller, thoroughly compact asphalt concrete with tampers and finish, where necessary, with a hot smoothing iron to provide uniform, smooth layer over the entire area so compacted.

5. Each compacted asphalt concrete course shall be within plus or minus 1/4-inch of the indicated thickness.

6. Placement of Adjacent Strips of New Asphalt Concrete:

a. When more than one width of asphalt concrete material will be placed, a six-inch wide strip of asphalt concrete adjacent to the area on which the future material is to be placed shall not be rolled until such future material is placed.

b. Do not leave the unrolled strip unrolled for more than two hours after placement, unless the six-inch unrolled strip is first heated with a joint heater.

c. After the first strip or width of asphalt concrete is compacted, place, finish, and compact the second width or strip as required for the first width, except that rolling shall be extended to include the six-inch strip of the first width not previously compacted.

C. Construction Joints:

1. Construction joints shall be made in such a manner as to ensure a neat junction, thorough compaction, and bond throughout.

2. Provide a transverse joint extending over the full width of the strip being laid and at right angles to its centerline at end of each workday and at other times when the placement of hot-mix asphalt concrete will be suspended for a period of time that will allow asphalt concrete mixture to chill.

3. Thoroughly compact by rolling the forward end of a freshly laid strip of asphalt concrete before the asphalt concrete mixture becomes chilled. When the Work is resumed, the end shall be cut vertically for the full depth of the layer.

D. Joining of Pavements:
   1. When pavement is to join existing or previously-laid pavement, the existing or previously-laid pavement shall be neatly and carefully edged to allow for overlapping and feathering of the subsequent course of asphalt concrete material.
   2. Where new pavement is to meet existing pavement, the existing pavement shall be sawcut and notched.
   3. Where new pavement will meet existing asphalt pavement, remove existing pavement 12 inches onto undisturbed existing pavement course at edges where new pavement will meet existing pavement.
   4. Tack Coat:
      a. Provide tack coat material at the following locations:
         1) At edges where new pavement will connect to existing or previously-installed pavement.
         2) On surface of existing or previously-installed pavement course over which new pavement will be installed, prior to placement of the subsequent pavement course. Tack coat may be deleted when a succeeding layer of asphalt pavement is being applied over a freshly-placed asphalt pavement course that has been subjected to very little or no traffic, with approval of ENGINEER
         3) Where new pavement will abut curbing, concrete gutters, drainage structures and frames, manhole cover frames, valve boxes, and similar items.
      b. Tack Coat Installation: Install tack coat immediately prior to installing pavement. Place pavement while tack coat is wet. Apply tack coat in accordance with reference specification indicated in Article 1.3 of this Section.

E. Curing:
   1. Do not allow traffic onto pavement until directed by ENGINEER. Traffic will not be allowed on new asphalt concrete pavement until surface temperature is less than 140 degrees F.
   2. Hold construction traffic on new pavement to a minimum as acceptable to ENGINEER.

F. Asphalt Concrete Curbs: Provide extruded asphalt curbs of the height and profile indicated on the Drawings.

G. Defective Pavement Work:
   1. When directed by ENGINEER, remove and replace defective flexible paving Work. Cut out such areas of defective pavement and fill with fresh asphalt concrete materials, compacted to required density.

3.4 ADJUSTING

A. Frames and Covers:
   1. Set frames of drainage structures, manholes, valve boxes, and similar items to final grade. Adjust frames of existing structures and frames furnished under

other Sections. Frames shall be substantially similar elevation to finished surface course of pavement.

2. Replace covers and gratings of existing structures immediately following adjusting associated frames. Install covers and gratings of structures provided under the Project as quickly as possible.
3. Where there is a delay between adjusting of frames and installation of surface course, provide temporary bituminous material around perimeter of each frame to smooth vehicle access over the frame. Maintain and repair temporary bituminous material as required until placement of surface course. Remove temporary bituminous material before installing surface course.

B. Pavement Adjustment:
   1. Repair or replace in manner acceptable to ENGINEER areas of pavement that are observed to pond or collect water.

3.5 CLEANING

A. Cleaning: After completing the paving operations, clean surfaces of excess or spilled bituminous materials, excess asphalt concrete, and foreign matter.

3.6 PROTECTION

A. Protect finished pavement until pavement has become properly hardened and cool.

B. Cover openings of drainage structures, manholes, valve boxes, and similar items in the paved area until permanent coverings are provided.

3.7 PAVEMENT MARKINGS

A. Provide pavement markings at the locations shown or indicated, in accordance with Section 09 91 00, Painting.

+ + END OF SECTION + +

SECTION 32 16 13

CONCRETE CURBS AND GUTTERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete curbs and gutters.
   2. Types of Work required under this Section include:
      a. Conventionally-formed or machine-formed curb.
      b. Conventionally-formed or machine-formed curb and gutter.
   3. Width, thickness, geometry, and extent of curb and gutter shall be as shown or indicated on the Drawings.

B. Related Sections:
   1. Section 03 11 00, Concrete Forming.
   2. Section 03 15 00, Concrete Accessories.
   3. Section 03 20 00, Concrete Reinforcing.
   4. Section 03 30 00, Cast-In-Place Concrete.
   5. Section 07 92 00, Joint Sealants.
   6. Section 31 23 00, Earth Moving.
   7. Section 31 23 16.13, Trenching.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. AASHTO M252, Specification for Corrugated Polyethylene Drainage Pipe.
   2. ASTM D1248, Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Installer:
      a. Installer shall have not less than two years experience installing concrete curbs, gutters, and sidewalks similar to those required for the Work.
      b. When required by ENGINEER, submit record of experience documenting not less than three successful, completed projects. For each project, submit name the following information: project name, location of project, approximate quantity of concrete curb, gutter, and sidewalk constructed by installer, contract price of concrete curb, gutter, and

sidewalk construction, and name and contact information for project owner and the project's construction-phase engineer.

B. Regulatory Requirements:
   1. Reference Specifications and Details:
      a. Comply with applicable requirements of Georgia Department of Transportation Standard Specifications and Standard Details.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Submit concrete mix design when mix design is different from that submitted under Division 03 Sections on concrete. Submit in accordance with Division 03 Sections on concrete.
      b. Proposed reinforcing materials.
      c. Schedule of proposed underdrain piping sizes and materials by location in the Project.
      d. Expansion joint sealant
   2. Product Data:
      a. Concrete Materials: Submit Supplier's technical information for materials proposed for use, when concrete materials are different from those submitted under Division 03 Sections on concrete.
      b. Reinforcing Steel: Submit fabricator's technical information, including catalog information and specifications, for materials proposed for use, sufficient for ENGINEER to verify compliance with the Contract Documents.
      c. Expansion Joint Filler: Submit Supplier's technical information, including manufacturer's product data, brochure, and specifications, for materials proposed for use, when materials are different from those submitted under Division 03 Sections on concrete.
      d. Underdrain Piping: Manufacturer's product data, brochure, and specifications for underdrain piping proposed for use.

B. Informational Submittals: Submit the following:
   1. Certifications:
      a. When concrete materials are different from those approved under Division 03 Sections on concrete, submit certifications as required in concrete Specifications Sections referred to in this Section.
   2. Site Quality Control Submittals:
      a. Concrete test results for the Work included under this Section.
   3. Qualifications Statements:
      a. Installer, when requested by ENGINEER.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Comply with Division 03 Sections on concrete referenced in this Section.

1.6 SITE CONDITIONS

A. Weather and Temperature Limitations:
   1. When temperature and environmental conditions warrant, comply with requirements for cold weather placing and hot weather placing under Division 03 Sections referenced in this Section, unless otherwise required under this Section.
   2. Temperature of aggregate base material under concrete shall be 39 degrees F or higher. Aggregate base material shall not have snow, ice, frost, or standing water on its surface at the time of concrete placing. Use of insulating materials and heating equipment may be required before concrete placing begins.
   3. Discontinue concrete placing when the air temperature falls below 39 degrees F. Do not place concrete in the rain.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Aggregate Bedding Material for Curbs and Gutters: Subbase in accordance with Section 31 20 00, unless otherwise shown or indicated.

B. Concrete Materials:
   1. Comply with applicable requirements of: Section 03 05 00, Concrete; including requirements for formwork, concrete materials, admixtures, bonding materials, curing materials, and others as required.
   2. Concrete Mix, Design, and Testing:
      a. Comply with applicable requirements of Section 03 05 00, Cast-in-Place Concrete, for concrete mix design, sampling, and testing, and quality control.
      b. Design the mix to produce concrete of properties of compressive strength, slump range, and air content as specified in Section 03 05 00, Cast-in-Place Concrete.
      c. When machine-formed equipment is used for constructing concrete curbs, or gutters, concrete so placed shall have properties in accordance with Section 03 05 00, Cast-in-Place Concrete, except that maximum slump shall be 2.5 inches and air content shall be two percent of design.

C. Expansion Joint Material:
   1. Preformed Expansion Joint Filler: Comply with Section 03 05 00, Concrete Accessories, for preformed expansion joint fillers.
   2. Joint Sealant: For joint sealants and accessories used on expansion joints, comply with Section 07 92 00, Joint Sealants.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine subgrade, subbase, and conditions under which the Work is will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are been corrected.

B. Subgrade:
   1. Verify that earthwork is completed to correct line and grade.
   2. Verify that subgrade is smooth, properly compacted, and free of frost and excessive moisture in accordance with Division 31 Section on excavation and fill.
   3. Do not commence the Work under this Section until conditions are satisfactory.

3.2 AGGREGATE BASE FOR CURBS AND GUTTERS

A. Aggregate Base under Curb and Gutter:
   1. Install aggregate fill in accordance with Section 31 23 00, Earth Moving. Properly compact aggregate fill to thickness shown or indicated in the Contract Documents.
   2. When thickness of aggregate base is not shown or indicated, provide six-inch thick aggregate base under curbs and gutters.

3.3 CONSTRUCTION OF FORMS

A. Conventional Forms:
   1. Set forms to line and grade. Forms shall be free from warp.
   2. Install forms along full length of curb and gutter.
   3. Forms shall extend to the full depth of the curb and gutter (as applicable) and be secured so no displacement occurs during concrete placing.

B. At CONTRACTOR's option, machine-formed concrete curbs and gutters are acceptable.

3.4 REINFORCING

A. General:
   1. Locate, place, and support reinforcing in accordance with Section 03 05 00, Concrete Reinforcing, unless otherwise shown on the Drawings.
   2. Size of reinforcing shall be as shown or indicated in the Contract Documents.

B. When machine-formed concrete curbs and gutters are provided, reinforcing shall be suitable for the forming/placing method, at no additional cost to OWNER. Obtain ENGINEER's approval of alternate reinforcing prior to placing concrete.

3.5 CONCRETE PLACING

A. General:

1. Comply with Section 03 05 00, Cast-in-Place Concrete, and this Section relative to mixing and placing concrete.

B. Placing:
   1. Curbs and Gutters: Place concrete using methods that prevent segregation of the mix. Consolidate concrete along face of forms with an internal vibrator.
   2. Machine-Formed:
      a. At CONTRACTOR's option, automatic curb and gutter machine may be used for installing concrete.
      b. Machine forming shall produce curbs and gutters of required cross-section, lines, grades, finish, and jointing, as specified for conventionally-formed concrete.
      c. At curb cuts and driveway entrances, cut-out concrete and hand-finish the curbing to provide the required curb cut or driveway entrance, as applicable.
      d. If results do not comply with the Contract Documents, remove and replace at no additional cost to OWNER.

C. Curbs:
   1. Provide curb-cuts and driveway entrances for vehicle passage and pedestrian passage where shown, and when not shown but where existing sidewalks and curbs are being replaced, provide curb-cut or driveway entrance (as applicable) at location of existing driveways and pedestrian access ramps in sidewalks.
   2. Neatly form transitions from curb to curb-cut or driveway entrance.
   3. Unless otherwise shown or indicated, top of curb at curb-cut or driveway entrance shall be not greater than 1/4-inch above elevation of finished pavement surface.

D. Gutters:
   1. Unless otherwise shown or indicated, top of gutter shall be not greater than 1/4-inch above elevation of finished pavement surface.

3.6 JOINTS

A. General:
   1. Provide expansion joints, contraction joints, and construction joints in concrete curbs and gutters.
   2. Provide expansion, contraction, and construction joints perpendicular to formed faces of curb and gutter.
   3. Construct transverse joints at right angles to the Work centerline and as shown.

B. Contraction Joints: Provide joints as indicated below:
   1. Curbs and Gutters: Provide at intervals of ten feet on centers. Joint shall be not less than 1/8- inch and not more than 1/4-inch in width, and have a depth of 1.5 inches.
   2. Joints may be formed or sawcut.

C. Construction Joints: Place construction joints at locations where concrete placing operations are stopped for more than 30 minutes, except where such pours terminate at expansion joints.

D. Expansion Joints:
   1. General: Provide preformed expansion joint filler at locations indicated. When curb and gutter is not poured monolithically, provide expansion joints where each abuts the other.
   2. Curbs and Gutters: Provide 11/16-inch wide preformed expansion joint filter at the intervals of 30 feet along curb and gutter; at expansion joints in pavement; at movable structures (such as bridges); and between curb or gutter and: structures, returns, and at 30-foot intervals along length of curb or gutter.
   3. Place top of expansion joint material not less than 1/2-inch or more than one-inch below concrete surface. Apply joint sealer on top of expansion joint material flush with concrete surface, and in accordance with sealant manufacturer's instructions and Section 07 92 00, Joint Sealants.

3.7 CONCRETE FINISHING

A. Smooth exposed surface by screeding and floating. Perform hand-screeding when conventionally-formed concrete is provided.

B. Work edges of gutter back top edge of curb, and transverse joints; and round to 1/4-inch radius.

C. Complete surface finishing by drawing a fine-hair broom across surface, perpendicular to line of traffic.

3.8 CURING

A. General:
   1. Protect and cure finished concrete curbs and gutters in accordance with Section 03 05 00, Concrete.
   2. Cure driveways and sidewalks at driveways for not less than three days prior to opening to vehicle traffic. In colder weather, as indicated in Article 1.6 of this Section, curing period shall be not less than six days prior to opening to vehicle traffic unless other provisions to determine strength are provided and approved by ENGINEER.

3.9 REPAIR AND CLEANING

A. Repair or replace broken or defective curbs, gutters, and sidewalk as directed by ENGINEER.

B. Sweep the concrete curb and gutter Work and wash free of stains, discolorations, dirt, and other foreign material.

+ + END OF SECTION + +

SECTION 32 31 00

FENCING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install fencing.
   2. Extent of fencing is shown or indicated.
   3. Types of materials required under this Section include:
      a. Aluminum-coated, steel chain link fabric.
      b. Galvanized steel framework.
      c. Polyvinylchloride fusion-bonded finish.
      d. Gate operators and associated control systems.
      e. Barbed wire.
      f. Grounding and bonding.
      g. Auxiliary system components, gates, accessories, fasteners, and fittings.
   4. Substitutions: Structural shapes of satisfactory sections and equal strengths may be substituted upon Engineer's approval of Contractor's substitution request.

B. Related Sections:
   1. Section 03 30 00, Cast-In-Place Concrete.
   2. Section 09 91 00, Painting.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASTM A53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   2. ASTM A90/A90M, Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
   3. ASTM A123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   4. ASTM A153/A153M, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. ASTM A428/A428M, Test Method for Weight [Mass] of Coating on Aluminum-Coated Iron or Steel Articles.
   6. ASTM A491, Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
   7. ASTM A780, Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

8. ASTM A817, Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric.
9. ASTM A1011/A1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
10. ASTM B6, Specification for Zinc.
11. ASTM D412, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension.
12. ASTM D746, Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
13. ASTM D792, Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
14. ASTM D1499, Practice for Filtered Open-Flame Carbon-Arc Exposures of Plastics.
15. ASTM D2240, Test Method for Rubber Property—Durometer Hardness.
16. ASTM F552, Terminology Relating to Chain Link Fencing.
17. ASTM F567, Practice for Installation of Chain-Link Fence.
18. ASTM F626, Specification for Fence Fittings.
19. ASTM A653, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
20. ASTM F668, Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
21. ASTM F900, Specification for Industrial and Commercial Swing Gates.
22. ASTM F1043, Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
23. ASTM F1083, Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
24. ASTM F1184, Specification for Industrial and Commercial Horizontal Slide Gates.
25. ASTM F1664, Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.
26. ASTM F1665, Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used With Chain-Link Fence.
27. CLFMI CLF 2445, Product Manual.
28. CLFMI, Step-by-Step Installation Guide.
29. IEEE C2, National Electrical Safety Code.
30. IEEE 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements.
31. NEMA ICS 1, Industrial Control and Systems General Requirements.
32. NEMA ICS 2, Industrial Control and Systems: Controllers, Contactors and Overload Relays Rated 600 Volts.
33. NEMA ICS 6, Industrial Control and Systems Enclosures.
34. NEMA MG 1, Motors and Generators.
35. UL 467, Grounding and Bonding Equipment.

1.3 TERMINOLOGY

A. The following words or terms are not defined but, when used in this Section, have the following meaning.
   1. "Knuckling" describes the type of selvage obtained by interlocking adjacent pairs of wire ends and then bending the wire ends back into a closed loop.
   2. "Gate operating cycle" is one gate opening plus one gate closing.
   3. "Fencing" describes an assembly of metal components, including wire chain-link fabric fastened to top, bottom and intermediate horizontal rails and to vertical line posts, corner posts and terminal posts. This assembly includes all auxiliary components, gates, fittings, fasteners, and other accessories, all with specified protective coatings.

B. Terminology used in this Section and not defined in this Article will be construed in accordance with the terminology used in CLF 2445 and ASTM F552.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Erector/Installer:
      a. Engage a single erector that is skilled and trained, and possesses successful and documented experience installing fencing, and employs only workers with specific skill and successful experience in the type of Work required.
      b. Erector shall be acceptable to fencing manufacturer,
      c. Submit name and qualifications of erector with the following information for a minimum of three successful projects:
         1) Names and telephone numbers of owner and architect or engineer responsible for project.
         2) Approximate fencing contract amount.
         3) Quantity of fencing installed.

B. Component Supply and Compatibility:
   1. Provide fencing as complete system with all gates, hardware, appurtenances and other components produced by a single manufacturer, including custom erection accessories, fittings, clamps, and fastenings as required for complete system.
   2. Provide electrical components, devices and accessories from a single manufacturer regularly engaged in manufacturing such items, acceptable to, and coordinated by, fencing manufacturer.

C. Regulatory Requirements:
   1. Comply with Laws and Regulations, including:
      a. Americans with Disabilities Act of 1990 (Public Law 101-336), Appendix A of 28 CFR 36, Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Drawings at scale of 1/4-inch equal to one foot of typical fence assembly, identifying all materials, dimensions, sizes, weights, and finishes of rails, posts, braces, supports and other fencing components. Show fence heights, and locations of gates. Show gate swing, or other operation, hardware, and accessories. Include plans, elevations, and sections, with required installation and operating clearances, and details of post anchorage, attachments, and bracing.
      b. Large-scale details drawn at scale of three inches equal to one foot for all connections and gate details, including motor mounting arrangements.
      c. List of all hardware, fasteners, and accessories.
   2. Product Data:
      a. Copies of manufacturer's technical product information, and specifications for all fencing components, including auxiliary system components such as gate operators and motors.
      b. Data substantiating that materials proposed comply with the following:
         1) Physical properties of PVC protective coating, in compliance with ASTM D1499.
         2) Weight of aluminum coating on wire fabrications, in compliance with ASTM A428.
         3). Weight of zinc coating on pipe fabrications, in compliance with ASTM A90.
   3. Samples: Engineer's review will be for color and texture only. Compliance with other requirements is Contractor's responsibility. Submit the following:
      a. Each fencing component, fastener, post, rail, support, chain-link fabric type, and other auxiliary and miscellaneous items labeled with identification of proposed use and location.
      b. Sample of each chain-link fabric material, six inches square; and framework members, and typical accessories, each approximately six inches long.
      c. Full range of manufacturer's standard and custom color Samples.

B. Informational Submittals: Submit the following:
   1. Certifications:
      a. Submit shipping list for materials used, endorsed with manufacturer's voucher, signed by authorized employee of manufacturer, certifying that material used in fencing complies with the Contract Documents and with the approved submittals.
      b. Certification that electrical components, devices, and accessories are listed and labeled by testing agency acceptable to authorities having jurisdiction at the Site and are marked for intended use.

2. Design Data: Submit with the Shop Drawings:
    a. All structural calculations verifying that all system components comply with requirements of authorities having jurisdiction at the Site.
    b. When proposing fencing framework or other structural components that varies from the Contract Documents, submit fabricator's structural calculations for design of proposed fencing. Structural analysis shall verify that all system components including supports, gates, fasteners, fittings, and connections comply with the Contract Documents and requirements of authorities having jurisdiction at the Site.
3. Manufacturer's Instructions:
    a. Manufacturer's installation instructions.
4. Field Quality Control Submittals:
    a. Indicate and interpret test results for compliance of chain link fence and gate grounding and bonding with performance requirements specified in the Contract Documents.
5. Qualifications Statements:
    a. Erector.

C. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data: Submit fencing system operations and maintenance manual in accordance with Section 01 78 23, Operations and Maintenance Data, for the following:
    a. PVC finish.
2. Warranty documentation.
3. Keys: Submit specified number of keys for locksets, padlocks, and control stations.

D. Maintenance Material Submittals: Submit the following:
1. Extra Stock Materials:
    a. Furnish extra stock materials from same manufactured lot as materials installed.
    b. Provide minimum of five percent excess over required number of fencing components. Pack in cartons and store at the Site, where directed by Owner.
    c. Do not provide partial containers or packages of materials. Round-up quantities to furnish only complete, unopened, and undamaged containers and packages.
    d. Submit quantities of each system component required for the Work, based on actual purchase order to manufacturer for materials to be used for this Project, with calculations substantiating quantity of extra stock materials furnished.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:
1. Packaging and Marking: Comply with CLFMI CLF 2445.

2. Deliver materials in manufacturer's original, unopened packaging with all factory-applied tags, labels and other identifying information intact, legible and accurately representing material on approved submittals.

B. Storage of Materials:
   1. Store all materials under weatherproof cover, off the ground and away from other construction activities.
   2. Do not store material in a manner that would create a humidity chamber. Provide for free movement of air under protective cover and between components of the fencing.

C. Handling of Materials:
   1. Handle material in manner that is in compliance with manufacturer's recommendations and that avoids damaging coatings.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities unless allowed:
   1. In Section 01 14 16, Coordination with Owner's Operations; or
   2. Under the following conditions, only after providing temporary utility services according to requirements indicated.
      b. Do not proceed with utility interruptions without Engineer's written permission.

B. Obtain measurements at the Site to verify layout information and dimensions for fencing and gates in relation to reference points provided by Owner or indicated in the Contract Documents.

1.8 WARRANTY

A. General Warranty: The special warranties specified in this Article shall not deprive Owner of other rights or remedies Owner may otherwise have under the Contract Documents and shall be in addition to and run concurrent with other warranties made by Contractor under the Contract Documents.

B. Special Warranties:
   1. Submit manufacturer's written ten-year warranty against cracking and peeling of PVC coating, and against rusting or corrosion of metal.

PART 2 – PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design Considerations:

1. Verify size of framing members shown or indicated in the Contract Documents. Where structural analysis indicates the need, provide additional members, or increased member size, thickness, or weight.
2. Modifications may be made only as necessary to meet Site conditions to ensure proper fitting and support of the Work and only upon submittal of Shop Drawings and receipt of approval by Engineer.

2.2 MATERIALS

A. General:
1. Tube sizes specified are nominal outside dimension.
2. Roll-formed section sizes are nominal outside dimensions.
3. Wire gages shall conform to American Steel and Wire Company gage.
4. Heat-form arcs and chords before applying protective coatings to metal.
5. Sizes specified are given for uncoated metal. Protective coatings are in addition to specified metal dimensions, gages, and sizes.
6. Provide weights of zinc and aluminum coatings on wire and pipe fabrications in accordance with CLFMI CLF 2445.
7. Provide thickness of PVC coating on wire and pipe fabrications in accordance with CLFMI CLF 2445.

B. Chain-Link Fence Fabric:
1. One-piece fabric widths, for fencing 12 feet and less in height, complying with CLFMI CLF 2445.
2. Wire mesh shall be woven throughout in form of approximately-uniform square mesh with parallel sides and horizontal and vertical diagonals of approximately-uniform dimensions, of size and gage specified and in compliance with ASTM A817, Type 1, cold-drawn carbon steel wire with minimum breaking strength of 2,170 pounds and coated with aluminized finish, as specified. Fabric shall be as recommended by CLFMI for heavy industrial usage.
3. Provide fence fabric imprinted with manufacturer’s trade name, country of origin, core wire gage, and finished outside diameter gage.
4. Provide fabric knuckled to eliminate exposure of sharp edges.
5. Fabric Gage: Provide the following:
   a. No. 6-gage wires.
6. Mesh Size: Provide the following:
   a. Two-inch mesh.

2.3 FRAMEWORK

A. General: The following table presents actual OD and equivalent nominal NPS size and trade size of round members:

Actual OD (inches)	NPS Size (inches)	Trade Size (inches)

1.315	1.0	1-3/8
1.660	1.25	1-5/8
1.900	1.5	2
2.375	2.0	2.5
2.875	2.5	3
3.500	3.0	3.5
4.000	3.5	4
6.625	6.0	6-5/8
8.625	8.0	8-5/8

B. Pipe shall be commercial grade, plain-end steel pipe with standard-weight walls. Steel strip used for manufacture of pipe shall comply with ASTM F1083, Schedule 40 pipe with minimum yield strength of 25,000 psi and protected with zinc, as specified.

C. Fittings: Comply with ASTM F626.

D. End, Corner, and Pull Posts: Provide end, corner, and pull posts of following minimum sizes:
   1. Up to six feet fabric height:
      a. 2.375 inches OD pipe weighing 3.65 pounds per linear foot.
   2. Over six feet fabric height and less than eight feet fabric height:
      a. 2.875 inches OD pipe weighing 5.79 pounds per linear foot.
   3. Over eight feet fabric height:
      a. 3.50 inches OD pipe weighing 7.58 pounds per linear foot.

E. Line Posts: Provide line posts of following minimum sizes and weights:
   1. Up to six feet fabric height:
      a. 1.90 inches OD pipe weighing 2.72 pounds per linear foot.
   2. Over six feet fabric height and less than eight feet fabric height:
      a. 2.375 inches OD pipe weighing 3.65 pounds per linear foot.
   3. Over eight feet fabric height:
      a. 3.50 inches OD pipe; weight of 7.58 pounds per linear foot.

F. Gate Posts: Provide gate posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
   1. Up to six feet wide:
      a. 2.875 inches OD pipe weighing 5.79 pounds per linear foot.
   2. Over six feet wide and up to 13 feet wide:
      a. Four inches OD pipe weighing 9.11 pounds per linear foot.
   3. Over 13 feet wide and up to 18 feet wide:
      a. 6.625 inches OD pipe weighing 18.97 pounds per linear foot.
   4. Over 18 feet wide:
      a. 8.625 inches OD pipe weighing 28.55 pounds per linear foot.

G. Top Rail: Provide top rails, unless otherwise shown or indicated, conforming to the following:

1. 1.900 inch OD pipe weighing 2.72 pounds per linear foot.
2. Provide in manufacturer's longest lengths, with expansion-type coupling 0.051-inch thick rail sleeves, approximately seven inches long, for each joint.
3. Provide means for attaching top rail securely to each gate, corner, pull, and end post.

2.4 GATES

A. Swing gates shall comply with ASTM F900.

B. Sliding gates shall comply with ASTM F1184.

3. Keeper: Provide a gate keeper for vehicle gates that automatically engages gate leaf and holds gate leaf in open position until manually released.

D. Padlocks: Provide each gate with heavy-duty bronze padlock and shackle chain as follows:
1. Product and Manufacturer: Provide one of the following:
a. No. 160DHM with 11/32-inch marine brass shackle by Master Lock Company.
b. Or equal.
2. Provide three keys for each padlock. Where more than one gate is required for same enclosure, padlocks shall be keyed identically.

E. Provide gate frames with intermediate horizontal rails. Gate frames shall be welded construction and shall be galvanized after fabrication. Provide single gates six feet or greater in width, and double gates 12 feet or greater in width, with diagonal bracing in one direction, extending from top to bottom rail.

F. Gate Stops: Provide gate stops for double gates consisting of mushroom-type flush plate with anchors, set in concrete and designed to engage a center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, using one padlock for locking both gate leaves.

G. Fabricate gate perimeter frames of tubular members. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Space so that frame members are not more than eight feet apart. Fabricate as follows:
1. Over six feet high, or leaf width exceeding eight feet:
a. 1.900-inch OD pipe weighing 2.72 pounds per linear foot.

H. Assemble gate frames by welding or with special malleable or pressed steel fittings and rivets for rigid connections. Use same fabric as provided for fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame at not more than 15 inches on centers. Attach hardware with rivets or by other means that will provide security against removal and breakage.

I. Install diagonal cross-bracing on gates consisting of 1/2-inch diameter adjustable length truss rods provided with turnbuckles to ensure frame rigidity without sag or twist.

J. Sliding Gates: Provide manufacturer's heavy-duty track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories as required.

2.5 AUXILIARY FENCING MATERIALS AND ACCESSORIES

A. Wire Ties:
   1. For tying fabric to line posts, use nine-gage, aluminum alloy 1100-H4, PVC-coated wire ties to match fence fabric, spaced 12 inches on centers.
   2. For tying fabric to rails and braces, use nine-gage, aluminum alloy 1100-H4, PVC-coated wire ties to match fence fabric, spaced two feet on centers.
   3. For tying fabric to tension wire, use 11-gage, aluminum alloy 1100-H4, PVC-coated wire hog ring ties to match fence fabric, spaced two feet on centers.

B. Tension Wire: Provide tension wire consisting of aluminized, seven-gage, coiled spring steel wire coated with 0.40-ounces of aluminum per square foot of wire surface, minimum, in compliance with ASTM F1664.
   1. Locate at bottom and top of fabric.

C. Barbed Wire Supporting Arms: Pressed steel for three rows of barbed wire attached to each arm, complete with provisions for anchorage to posts. Supporting arms shall be integral with post-top weather cap. Provide following type:
   1. Single 45-degree arm, one for each post.

D. Barbed Wire: Commercial quality steel, two-strand, 11-gage line wire with 14-gage, four-point twisted aluminum alloy barbs spaced five inches on centers, as follows:
   1. PVC-coated, complying with ASTM F1665.

E. Post Caps: Pressed steel, wrought iron, or cast aluminum alloy, designed as weather-tight closure cap, for tubular posts. Provide one cap for each post unless equal protection is afforded by combination post-top cap and barbed wire supporting arm, where barbed wire is required.
   1. Provide caps with openings to allow through-passage of top rail.
   2. Provide cone-type caps for terminal posts and loop-type caps for line posts.

F. Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16-inch by 3/4-inch. Provide one stretcher bar for each gate and end-post, and two for each corner- and pull-post, except where fabric is integrally woven into the post.

G. Stretcher Bar Bands: Pressed steel, galvanized, 0.078-inch to 0.108-inch thick depending on post diameter, spaced not greater than 15 inches on centers to secure stretcher bars to end-, corner-, pull-, and gate-posts.
   1. Bands may also be used with special fittings for securing rails to end-, corner-, pull-, and gate-posts.

H. Truss Rods: Steel rods, 3/8-inch diameter, merchant quality with turnbuckle.

I. Concrete: In accordance with Section 03 30 00, Concrete.

2.6 FINISHING

A. Chain-Link Fence Fabric:
   1. Aluminized finish with not less than 0.40 ounces aluminum per square foot, complying with ASTM A491, Class II.

B. Framework and Appurtenances: Provide the following finishes for steel framework, auxiliary system components, and miscellaneous accessories:
   1. Galvanizing: Zinc for galvanizing shall be of High Grade or Special High Grade conforming to ASTM B6 with maximum aluminum content of 0.01 percent. Galvanize metal using hot-dip process in accordance with the following:
      a. Structural Iron and Steel Shapes: ASTM A123
      b. Rolled-Form Sheet Steel: ASTM A653
      c. Hardware and Accessories: ASTM A153
      d. Fittings: ASTM F626
      e. Pipe: ASTM A53
   2. Provide minimum weights of zinc as follows:
      a. Pipe: 1.8-ounces of zinc per square foot. Apply Type A coating both inside and outside according to ASTM F1043, as determined by ASTM A90.
      b. Rolled-Form Sheet Steel: 4.0-ounces of zinc per square foot of surface area.
      c. Hardware and Accessories: Zinc weights in compliance with Table 1 of ASTM A153.

C. PVC Finish for All Fencing Components: Provide PVC epoxy-modified plastic resin finish, fusion bonded to heated metal, minimum 10-mil thickness.
   1. Provide the following physical properties for PVC coating:
      a. Specific Gravity, ASTM D792: 1.30 to 1.38, maximum.
      b. Ultimate Tensile Strength, ASTM D412: 2,600 pounds per square inch plus-or-minus five percent.

c. Hardness, ASTM D2240: Durometer A (10 Second) 93 plus-or minus three.
d. Ultimate Elongation, ASTM D412: 275 percent plus-or-minus five percent.
e. Compression Cut Resistance, Bell Laboratories: 2,000 pounds per square inch.
f. Low Temperature Brittleness, ASTM D746: -20 degrees C.
g. Low Temperature Flexibility, (Mandrel Wrap): -40 degrees C.
h. Weatherometer Exposure: No change after 1,000 hours.

2. Provide PVC plastic resin finish over aluminized steel wire by thermal extrusion method, in compliance with ASTM F668, Class 2b.
3. Color:
   a. As selected by Engineer from manufacturer's complete range of standard and custom colors.
   b. Provide fencing with all components, including framework and accessories completely protected with color coating, in compliance with CLFMI CLF 2445.

D. Welded Joints:
1. Repair zinc coatings at welded joints by applying zinc-rich paint, as specified in Section 09 91 00, Painting, and ASTM A780.
2. Repair polymer-coated steel by applying an epoxy primer, intermediate coat and urethane topcoat, as specified in Section 09 91 00, Painting, matching color and reflectivity of adjacent PVC finish.

2.7 SOURCE QUALITY CONTROL

A. Fabrication Tolerances:
1. Fabric, posts, rails, and other supports shall be straight or uniformly curved to provide the profiles shown, to dimensional tolerance of 1/16-inch in 10 feet without warp or rack in the finished Work.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be erected and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 ERECTION

A. Comply with CLFMI Step-by-Step Installation Guide and ASTM F567. Do not begin installation and erection of fencing until final grading is completed.

B. Excavation: Drill holes of diameters specified, for post footings in firm, undisturbed or compacted soil.
   1. For posts set in cast-in-place concrete, provide hole diameters dug or drilled a minimum of four times the largest cross section of post.
      a. Unless otherwise shown or indicated, excavate hole depths approximately three inches lower than bottom of post, with bottom of posts set not less than two feet below the surface of finished grade when in firm, undisturbed soil, plus an additional three inches for each foot increase in the fence height over four feet.
   2. Spread soil from excavations uniformly adjacent to fence line, or on adjacent areas of the Site, as directed by Engineer.
   3. When solid rock is encountered at ground surface, drill into rock at least 12 inches for line-posts and at least 1.5 feet for end-, pull-, corner-, and gate-posts. Drill hole at least one inch greater diameter than largest dimension of post to be placed.
      a. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed the minimum depths specified above for rock encountered at ground surface.

C. Setting Posts: Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.
   1. Center and align posts in holes 3-inches above bottom of excavation.
   2. Posts shall be set in concrete footings, except as otherwise shown or specified. Place concrete around posts in continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
   3. Extend concrete to two inches above ground surface, or to two inches below ground surface if cover of sod, bituminous asphalt paving, or other material is shown or indicated to conceal concrete. Crown to shed water away from posts.
   4. Extend footings for gate posts to underside of bottom hinge. Set keeps, stops, sleeves, and other accessories into concrete as required.
   5. Keep exposed concrete surfaces moist for at least seven days after placement, or cure with membrane curing materials, or other acceptable curing method.

D. Concrete Strength: Allow concrete to attain at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than seven days after placement, before installing rails, tension wires, barbed wire, or chain-link fabric.
   1. Do not stretch and tension fabric and wires, and do not hang gates, until concrete has attained its full design strength.

E. Posts and Rails:
   1. Line Posts: Set posts in cast-in-place concrete footings as specified, spaced not more than ten feet on centers. Provide caps on top of each post to exclude moisture and to receive top rail, unless equal protection is afforded

by combination post-top cap and barbed wire supporting arm, where barbed wire is required.

2. Top Rails: Run rail continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer to form continuous rail between terminal posts.
3. Center Rails: Provide center rails, where shown or specified, erected in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.
4. Brace Assemblies: Install braces so posts are plumb when diagonal rod are under proper tension. Install brace assemblies at end-posts and at both sides of corner- and pull-post panels. Panels adjacent to gates shall have intermediate horizontal rails and diagonal bracing. Diagonal bracing shall run from center of first line-post to bottom of terminal-post.

F. Chain-Link Fabric:
1. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released. Fasten to terminal posts and gate posts with tension bars threaded through mesh and secured with tension bands at maximum intervals of 14 inches.
2. Tie to line-posts, gate frames and top and bottom rails with tie wires spaced at maximum 12 inches on posts and two feet on rails.
3. Connect tension bars to posts and frames by means of adjustable bolts and bands spaced not more than 14 inches apart.
4. Leave approximately two inches between finish ground surface and bottom selvage, except where bottom of fabric extends into concrete.
5. Join roll of chain-link fabric by weaving a single picket into the ends of roll to form continuous mesh.

H. Barbed Wire:
1. Install three parallel wires on each extension arm; on security side of fence, unless otherwise shown or indicated
2. Pull wire taut to remove sag and firmly install in slots of extension arms to prevent movement or displacement.
3. Secure wire to terminal posts utilizing terminal post band arms or brace bands.
4. Extend vertical members of gates to receive barbed wire.

I. Stretcher Bars: Thread through or clamp to fabric four inches on centers, and secure to posts with metal bands spaced 15 inches on centers.

J. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage, as shown on approved Shop Drawings. Adjust hardware for smooth operation and lubricate where necessary.

L. Tie Wires: Use U-shaped wires conforming to diameter of pipe. Clasp pipe and fabric firmly with ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons and clothing.

M. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 ADJUSTMENT AND CLEANING

A. Repair coatings damaged in the shop or at the Site by recoating with manufacturer's recommended repair compound, applied in accordance with manufacturer's directions. Repair hot-dip galvanized coatings in accordance with ASTM A780.

B. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, and malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

C. Lubricate operating equipment and clean exposed surfaces.

D. Repair and replace broken or bent components.

+ + END OF SECTION + +

SECTION 32 92 00

TURF AND GRASSES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified and required to furnish and install all turf and grasses.
   2. Extent of turf and grasses is shown.
   3. Types of products required include the following.
      a. Topsoil.
      b. Turf grass seed.
      c. Grass seed mixture.
      d. Sod.
      e. Organic soil amendments.
      f. Fertilizers.
      g. Mulches.
      h. Erosion-control materials.
      i. Accessories.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or before, turf and grasses.

C. Related Sections:
   1. Section 32 16 13, Concrete Curbs and Gutters.
   2. Section 32 31 00, Fences.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. Association of Official Analytic Chemists, (AOAC).
      a. Official Methods of Analysis of AOAC International.
   2. Association of Official Seed Analysts, (AOSA).
      a. Journal of Seed Technology; Rules for Testing Seeds.
   3. American Society of Agronomy, (ASA).
      a. Reference No. 1 - Methods of Soils Analysis, Soil Science Society of America, Incorporated.
   4. American Society for Testing and Materials, (ASTM).
      a. ASTM B 221, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

b. ASTM C 602, Specification for Agricultural Liming Materials.
c. ASTM D 75, Practice for Sampling Aggregates.
d. ASTM D 422, Test Method for Particle Size Analysis of Soil.
e. ASTM D 977, Specification for Emulsified Asphalt.
f. ASTM D 2487, Practice for Classification of Soils for Engineering Purposes (United Soil Classification System).
g. ASTM D 5268, Specification for Topsoil Used for Landscape Purposes.
h. ASTM E 329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
i. ASTM E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.

5. Turfgrass Producers International, (TPI).
   a. Guideline Specifications to Turfgrass Sodding.

1.3 DEFINITIONS

A. The term "finish grade" shall be used to describe the finished surface elevation of planting soil.

B. The term "manufactured topsoil" shall be used to describe soil produced off-Site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil acceptable as a component of loam.

C. The term "loam" shall be used to describe topsoil that has been mixed with additional organic and inorganic additives, as specified.

D. The term "percentage pure live seed" shall be defined as the percent (%) purity multiplied by percent (%) germination divided by 100 to equal the percent pure live seed (PLS) and shall be calculated for all seed lots using each seed lots own unique purity and germination test results. A PLS pound shall be defined as the bulk weight of seed required to equal one pound of 100 percent pure, germinated seed.

E. The term "subgrade" shall be used to describe the surface of subsoil remaining after completing excavation; or the top surface of a fill or backfill immediately beneath topsoil and which has not been tested for acceptable use as topsoil.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Engage a single landscape installer skilled, trained and with successful and documented experience in the planting of turf and grasses and with specific skill and successful experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and successful experience in this type of Work. Submit names and

qualifications to Engineer along with the following information on a minimum of three successful projects:
   a. Names and telephone numbers of owner, architects, or engineers responsible for projects.
   b. Approximate contract cost of the turf and grasses.
   c. Amount of area installed.
2. Installer's Site Supervisor: Require installer to maintain an experienced full-time landscape supervisor on-Site during the time of preparation for, and planting of, turf and grasses. Supervisor shall have achieved landscape or horticultural certification acceptable to governing authorities having jurisdiction at the Site.
3. Ratio of laborers to certified landscape supervisors shall not exceed 12 to one. Certified landscape supervisor shall be on-Site throughout the day-to-day performance of the Work of this Section.
4. Application of herbicides, chemicals and insecticides shall be done by personnel licensed to perform such applications by governing authorities having jurisdiction at the Site and in accordance with each manufacturer's instructions provided on each product label.

E. Source Quality Control:
1. Analysis and Standards: Package all products with manufacturer's certified analysis performed in accordance with methods established by AOAC, wherever applicable, or as specified.
3. Provide sod procured from areas having growing conditions similar to location of Site.
4. Machine-cut sod into rectangular sections, exercising care to retain the native soil on the roots of the sod, during stripping, transportation and planting.
5. Cut and move sod only when soil moisture conditions are such that favorable results can be expected.
6. Rectangular sections of sod may vary in length but shall be equal in width and of a size that permits the sod to be lifted and rolled without breaking.
8. Seed that has been stored at temperatures, or under conditions not recommended by the seed supplier, or has become wet, moldy, or otherwise damaged, shall not be acceptable. The PLS for each seed lot shall be 75 percent, minimum.
9. Certify that all seed has been stored under conditions recommended by the seed supplier and has not been subjected to conditions damaging to PLS percentages.
10. Seed may be mixed by an approved method on-Site or at the seed supplier's facilities. If the seed is mixed on-Site, each variety shall be delivered in the original containers and shall bear the supplier's certified analysis. Where seed is mixed by the seed supplier, provide Engineer with the seed supplier's certified statement as to the composition of the mixture.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Schedule for turf and grass-planting showing anticipated planting dates for each type of Work.
   2. Product Data:
      a. Manufacturer's product data, specifications, and installation instructions for all required materials.
      b. Composition and analysis of commercial fertilizers and all purchase receipts showing the total quantity purchased for this Project.
      d. PLS for each type of seed and each seed lot. Include bulk weight of seed required to equal one pound of 100 percent pure, germinated seed.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Certification of Grass and Wildflower Seed: For each grass-seed monostand and seed mixture, furnish seed supplier’s certification stating the botanical and common name, and percentage by weight of each species and variety, and percentage of purity, germination and weed seed. Include the year of production and date of packaging. Certify that seed has been stored in compliance with all recommendations of the seed supplier.
      b. Verify that sod contains no noxious weeds or other material that might be detrimental to the proposed planting.
      c. Certificates of inspection as may be required by governmental authorities to accompany shipments, and manufacturer's certified analysis for soil amendments and fertilizer materials. For standard products submit other data substantiating that materials comply with specified requirements.
   2. Test Reports: Submit the following:
      a. Soil analysis reports for existing soil and imported manufactured topsoil, as specified. Include recommendations for remediating existing soil into acceptable topsoil.
   3. Qualifications Data: Submit qualifications data for the following:
      a. Landscape installer.
      b. Landscape supervisor.
      c. Testing agency.

C. Closeout Submittals: Submit the following:
   1. Operations and Maintenance Data:
      a. Submit recommended procedures to be established by Owner for the maintenance of turf and grasses for one full year. Submit prior to expiration of required maintenance period.
   2. Warranty Documentation:
      a. Submit written warranty, signed by Contractor and landscape installer, as specified.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:
   1. Do not deliver seed, sprigs, plugs or sod until Site conditions are ready for installation.
   2. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery.
   3. Deliver seed in undamaged, original containers, sealed by the supplier and indicating compliance with approved Shop Drawings.
   4. Sod: Time delivery so that sod will be placed within 24 hours after stripping. Comply with requirements of TPI for harvesting, delivery, storage, and handling of sod.
   5. Sprigs: Time delivery so that sprigs are planted within 24 hours after being harvested.
   6. Inspect turf and grass materials upon arrival at Site. Immediately and permanently remove unacceptable materials from Site.

B. Storage of Materials:
   1. Store and cover materials to prevent deterioration. Remove packaged materials that become wet or show deterioration or water marks from the Site.
   2. Seed that becomes wet, moldy, or damaged during the time of storage on-Site or that has been damaged during transit is not acceptable.
   3. Protect sod against drying and breaking of rolled strips.
   4. If sod is stacked, place roots to roots or grass to grass.
   5. Protect sod from exposure to wind and sun and from freezing.

C. Handling of Materials: Do not dump sod from vehicles.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Proceed with and complete turf and grass planting as rapidly as portions of the Site become available, working within the seasonal limitations for each type of turf, grass and wildflower planting required.
   2. Proceed with planting only when current and forecasted weather conditions are favorable to successful planting and establishment of turf and grasses.
      a. Do not spread seed when wind velocity exceeds five miles per hour.
      b. Do not plant when drought, or excessive moisture, or other unsatisfactory conditions prevail.
   3. Herbicides, chemicals, and insecticides shall not be used on areas bordering wetlands.

B. Scheduling:

1. Coordinate planting with specified extended service periods to provide required service from date of Substantial Completion. Plant during one of the following periods:
   a. Spring Planting: March 15 to June 1.
   b. Fall Planting: September 1 to October 30.
2. Do not begin turf and grass planting until water, acceptable for use and adequate in supply, is available on-Site and can be successfully transported to the areas of Work. Coordinate provision of adequate and acceptable water supply with Project Schedule.
3. Do not proceed with installation of loam until all subgrade utility services have been installed, are operating successfully and have been approved by Engineer.

C. Pre-installation Conference:
   1. Prior to commencement of turf and grass planting and associated Work, Contractor shall schedule and meet at the Site with the landscape installer, the installers of other Work in and around turf and grass areas that follows the turf and grass Work, including fencing Work specified in Section 32 31 00, Fences; and Engineer and other representatives directly concerned with performance of the Work. Review foreseeable methods and procedures related to the turf and grass Work, including the following:
      a. Review Project requirements and the Contract Documents.
      b. Review required submittals, both completed and yet to be completed.
      c. Review availability of water and methods of delivery.
      d. Review status of below-grade work and required access during turf and grass planting and establishment.
      e. Review Project Schedule and availability of materials, tradesmen, equipment, and facilities needed to make progress and avoid delays.
      f. Review environmental conditions, other Project conditions, and procedures for coping with unfavorable conditions.
      g. Review procedures required for protection of turf and grasses during the remainder of the construction period.
      h. Review required inspection, testing, and certifying procedures.
   2. Record the discussions of the Pre-installation Conference and the decisions and agreements or disagreements reached and furnish a copy of the record to each party attending.
   3. Record all revisions or changes agreed upon, reasons therefor, and parties agreeing or disagreeing with them.
   4. Reconvene the meeting at the earliest opportunity if additional information must be developed to conclude the subjects under consideration.

1.8 WARRANTY

A. General Warranty: The special warranties specified in this Article shall not deprive Owner of other rights or remedies Owner may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under the Contract Documents.

B. Special Warranties: Warranty turf and grasses through the specified extended service period.

1.9 EXTENDED SERVICE

A. Extended Turf and Grass Service:
   1. Begin extended service immediately after each turf and grass area are acceptably established. Provide extended service for not less than the following periods:
   2. Seeded turf or grass: Sixty days from date after grass areas are acceptably established.
      a. When full-service period has not elapsed before end of planting season, or if turf and grass is not acceptably established, continue service during next planting season.
   3. Sodded turfs or grasses: Thirty days from date after turf and grass areas are acceptably established.
   4. Plugged turf or grass: Thirty days from date after turf and grass areas are acceptably established.
   5. Sprigged turf or grass: Thirty days from date after turf and grass areas are acceptably established.
   6. Service turf and grasses by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas to produce a uniformly smooth turf or grass.
      c. During first week, water sod daily or more frequently as necessary to maintain moist loam to a minimum depth of 4-inches below bottom of sod blanket.
      d. Water sprigs immediately after planting and keep moist by frequent watering until well rooted.
   8. Mow turf or grass as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass-leaf height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowing to maintain the grass height as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:
   1. All soil accepted as topsoil, whether obtained from on-Site or off-Site sources, shall comply with specified topsoil analysis.
   2. Provide fertile, friable, natural loam, surface soil, capable of sustaining vigorous plant growth; free of any admixture of subsoil, clods of hard earth, plants or roots, sticks, stones larger than 1-inch in diameter, or other

extraneous material harmful to plant growth, in compliance with ASTM D 5268. Provide topsoil with the following analysis:

a. 3/4-inch mesh: 100 percent passing.
b. No. 4-sieve: 90 to 100 percent passing.
c. No. 200-sieve: 0 to 10 percent passing.
d. Clay content of material passing No. 200-sieve not greater than 60 percent, as determined by hydrometer tests.
e. pH-adjusted with ferrous sulphate or ground limestone to provide pH 5.5 to pH 7.0 at time of installation of turf and grass areas, unless particular species of grass or wildflower stand requires a different pH to meet its growing needs.
f. Electrical conductivity of a 1:2 soil-water suspension shall not exceed 1.0 milliohm per centimeter and with less than 200 parts per million of extractable aluminum.
g. Cation Exchange Capacity: 5, minimum.
h. Organic content not less than five percent, as determined by ignition loss of oven-dried samples passing No. 10-sieve (Muffle Furnace Temperature: 110 plus or minus five degrees C for eight hours).
i. Free of pests and pest larvae.

3. Topsoil Source: Reuse surface soil stockpiled on-Site, where possible. Verify suitability of stockpiled surface soil to produce topsoil, as specified. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
   a. Supplement acceptable on-Site soil with manufactured topsoil from off-Site sources, when quantities available on-Site are insufficient to complete the Work.

B. Grass Seed:
   1. Grass Seed Mixture: Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by AOSA. Provide seed of the grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, specified.
   2. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 80 percent pure seed, and not more than 0.25 percent weed seed by weight:
      a. Full Sun: Bermuda grass (Cynodon dactylon).

E. Turf grass Sod:
   1. Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes and insects, complying with TPI specifications and guidelines.
   2. Provide strongly rooted machine-cut sod, not less than two years old of uniform density, color, and texture. Provide only sod capable of vigorous growth and development when planted (viable, not dormant) and in strips not more than 18-inches wide by 14 feet-0 inches long by 3/4-inch thick (excluding top growth and thatch). Provide sod composed principally of the following:

b. Bermuda grass (Cynodon dactylon).
c. Carpetgrass (Axonopus affinis).
d. Centipedegrass (Eremochloa ophiuroides).
e. St. Augustine grass (Stenotaphrum secundatum).
f. Zoysia grass (Zoysia japonica or Zoysia matrella).

F. Sod Plugs:
1. Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes and insects, complying with TPI specifications and guidelines.
2. Provide strongly rooted machine-cut sod, not less than two years old of uniform density, color and texture. Provide only sod plugs capable of vigorous growth and development when planted (viable, not dormant). Provide the following turf grass species, cut into not less than 4-inch square or round plugs:
a. Bermuda grass (Cynodon dactylon).
b. Carpetgrass (Axonopus affinis).
c. Centipedegrass (Eremochloa ophiuroides).
d. St. Augustine grass (Stenotaphrum secundatum).
e. Zoysia grass (Zoysia japonica or Zoysia matrella).

G. Sod Sprigs:
1. Provide healthy living stems, rhizomes, or stolons with any attached roots free of soil, of the following grasses:
a. Bermuda grass (Cynodon dactylon).
b. Carpetgrass (Axonopus affinis).
c. Centipedegrass (Eremochloa ophiuroides).
d. St. Augustine grass (Stenotaphrum secundatum).
e. Zoysia grass (Zoysia japonica or Zoysia matrella).

K. Mulches:
1. Straw Mulch: Provide air-dry, clean, mildew- and certified seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

L. Erosion-Control Materials:
1. Erosion-Control Blankets: 100 percent biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended 6-inches long steel wire staples.
2. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 pounds per cubic yard, with 50 to 65 percent open area. Include manufacturer's recommended 6-inches long steel wire staples.

M. Accessories:
1. Provide herbicides, chemicals and insecticides as needed for disease, fungus or pest control. All herbicides, chemicals and insecticides shall be bear approval labels indicating they are approved by the United States Department of Agriculture for the intended uses and application rates.

2. Post Emergent Crab Grass and Plantain Chemical: Provide recommended post emergent crab grass and plantain control throughout the maintenance period to ensure germinated and established grasses free of crab grass and other undesirable grasses and forbs.

N. Water: Acceptable for turf and grass application and containing no material harmful to plant growth and establishment.

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor shall examine the areas and conditions under which turf and grass Work is to be performed, and notify Engineer, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.2 PREPARATION

A. Thoroughly blend and mix loam before spreading. Incorporate fertilizers, and ground limestone or acidulant, after spreading, as specified, and at rates recommended by soil-testing laboratory.

B. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Perform percolation tests on existing subgrade and placed fills prior to fine grading.
   1. Perform percolation testing of subgrades and placed fills to determine whether the subgrade will drain properly. Perform percolation tests in accordance with the following procedure:
      a. Dig a hole in the subgrade that is 4-inches in diameter and 12-inches deep.
      b. Fill the hole with water and wait for the water to completely drain from the hole.
      c. Immediately refill the hole with water and measure the rate of fall in the water level.
   2. If water drains at a rate less than 1-inch in one hour, excavate soil to a minimum depth of 24-inches, and deeper, as necessary to break the compaction. Backfill, recompact and retest each area so prepared to confirm drainage rates exceed one inch in one hour.

3. Perform minimum of one soil percolation test for every 10,000 square feet of turf and grass area.

E. Excavate or fill subgrade, as required, to bring subgrade to elevations shown. Maintain all angles of repose. Confirm that subgrade is at proper elevations and that no further earthwork is required to bring the subgrade to proper elevations. Provide subgrade elevations that slope parallel to finished grade and towards subsurface drains shown.

F. Remove all construction debris, trash, rubble, and all extraneous materials from subgrade. If fuels, oils, concrete washout, or other material harmful to plant growth or germination have been spilled into the subgrade, excavate the subgrade sufficiently to remove all such harmful materials and fill with approved fill, compacted to the required subgrade compaction level.

3.3 FINE GRADING

A. Immediately prior to dumping and spreading loam, clean subgrade of all stones greater than 2-inches and all other extraneous matter. Remove all such material from Site. Notify Engineer that subgrade has been cleaned and obtain approval prior to spreading loam.

B. Do not attempt to spread excessively wet, muddy, or frozen loam. Do not spread loam more than five days before seeding or planting.

C. Spread loam to a depth of 6-inches but not less than required to meet finish grades after light rolling and natural settlement.
   1. Spread approximately one-half the thickness of required loam depth. After spreading loam, rototill, disk or harrow loam and subgrade to bring top 2-inches of subgrade upward into loam layer, so that there is a transitional layer between loam and subgrade.
   2. Spread remainder of loam to required finish grades.
   3. Compact each lift sufficiently to reduce settling, but not enough to prevent the movement of water and feeder roots through loam. After compaction spread loam should offer firm, even resistance when a soil sampling tube is inserted.
   4. Phase the placement of the final lift so that wheeled vehicles do not have to travel over areas where final lifts are already in-place.
   5. Spread and compact to a smooth, uniform surface plane, to within plus or minus 1/2-inch of finish elevations. Roll and rake and remove all ridges, and fill depressions, as required. Remove all stones larger than 1-inch in any dimension and all sticks, roots, trash and other extraneous matter.
   6. Perform percolation tests as for subgrades, except limit depth of holes to 2/3 the depth of loam layer.

D. Spread ground limestone or acidulant and fertilizer, as specified. Mix ground limestone with dry loam before spreading fertilizer and work lightly into the top

4-inches of loam by harrowing or tilling at least three days before applying commercial fertilizers.

E. Grade planting areas to smooth, even surface with loose, uniformly fine texture. Remove all stones and extraneous material more than 1-inch diameter. Roll, rake and remove ridges and fill depressions, as required to meet finish grades.

F. Moisten prepared areas before seeding, sodding, sprigging or plugging. Water thoroughly and allow surface moisture to dry before planting. Do not create a muddy loam condition.

G. Prior to seeding or planting, restore loam to specified condition, if eroded or otherwise disturbed.

3.4 CONVENTIONAL SEEDING

A. General: Maintain grade stakes until removal is mutually agreed upon by all parties concerned.

B. Rake or harrow all seedbeds immediately prior to seeding to produce a rough, grooved surface, no deeper than 1-inch. Seed only when seedbed is in a friable condition and not muddy or hard.

C. Sow seed using a spreader or seeding machine.

D. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other.

H. Cultipacker, or approved similar equipment, may be used to cover the seed and to firm the seedbed in one operation. In areas inaccessible to cultipacker:
   1. Rake the seed lightly into top 1/8-inch of loam, roll in two directions with a water ballast roller, weighing not less than 100 pounds per linear foot.
   2. Take care during raking that seed is not raked from one spot to another.
   3. Protect seeded areas against erosion by spreading specified mulch after completion of seeding operations.
      a. Protect seeded areas against hot, dry weather or drying winds by applying peat moss mulch not more than 24 hours after completion of seeding operations. Presoak and scatter evenly to a depth of from 1/8-inch to 3/16-inches thick and roll to a smooth surface. Do not mound.
      b. Spread straw mulch to form a continuous loose blanket not less than 1-1/2-inch deep over seeded areas at the approximately rate of two tons-per acre.
         1) Anchor mulch by spraying with asphalt emulsion at the rate of ten to 13-gallons per 1000 square feet.

2) Place mulch with equipment that will blow or eject, by means of a constant air stream, controlled quantities of the mulch and asphalt in a uniform pattern over the specified area. If the mulch is excessively cut or broken, take measures to reduce the cutting or breakage. Introduce the asphalt into the air stream by means of a spray arranged so that it will partially coat the mulch with a spotty asphalt tack prior to the depositing of the mulch covering. Rate of application not less than 75-gallons per ton of mulch.

c. Protect seeded areas, with slopes exceeding one on six, by providing erosion-control fiber mesh and where slopes exceed one on four, by providing erosion-control blankets. Install erosion-control materials according to manufacturer's written instructions and as follows:
   1) Vertically down slope without stretching fabric.
   2) Install hold down staples three per square yard minimum in center of fabric or as required to hold and shape the fabric to the contours of the slope. Install hold down staples along edges and overlaps of fabric at 9 inches on centers minimum, or as required to hold and shape the fabric to the contours of the slope.
   3) Lap fabric 4-inches minimum and turn edges of fabric into 8-inch deep by 16-inch wide earth trench and fill trench with earth.

I. Using a uniform fine spray, thoroughly and evenly water seeded areas. Provide adequate water to moisten seedbed to a depth of 2-inches.
   1. Repeat this process when peat mulch color lightens. Maintain all seedbeds in a uniformly moist condition, conducive to seed germination and plant establishment, as specified.

J. Reseed areas that remain without mulch for longer than three days.

K. Take precautions to prevent damage or staining of construction or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

L. Prevent foot or vehicular traffic, or the movement of equipment, over the mulched areas. Reseed areas damaged as a result of such activity.

3.6 SODDING TURF AND GRASS

A. Do not lay sod on ground that is frozen, dust dry or that has not been uniformly prepared, as specified. Do not lay dormant sod.
   1. Lay sod within 24 hours of harvesting.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod.
   1. Place sod strips in straight lines parallel to one another.
   2. Lay sod across angle of slopes exceeding one on three.

3. Anchor sod with wooden pegs, or steel staples, on slopes exceeding one on six, spaced as recommended by sod supplier, but not less than two anchors for each sod strip to prevent slippage.

C. Immediately upon completion of a section of sodding, tamp, roll lightly and water, to ensure contact with subgrade and elimination of air pockets.

D. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.

E. Immediately after planting, water sod thoroughly with a fine spray. Water sufficiently to ensure penetration of moisture to bottom of prepared loam layer, not just to bottom of sod blanket.

3.7 PLUG-SODDING OF TURF AND GRASS

A. Cut plugs 2-inches to 4-inches square, retaining maximum amount of soil on roots. Do not tear or rip plug from sod mass. Keep roots moist and plant plugs immediately after cutting.

B. Plant plugs in holes or furrows. On slopes, contour furrows to near-level to prevent washing in heavy rains.
   1. Space plugs 12-inches apart in both directions.
   2. Space plugs 18-inches apart in both directions.

3.8 RECONDITIONING EXISTING TURF AND GRASSES

A. Recondition existing turf or grass damaged by Contractor's operations, including areas used for storage of materials or equipment and areas damaged by movement of vehicles. Recondition existing turf or grass areas where minor regrading is required.

B. Recondition other existing turf or grass areas shown.

C. Provide fertilizer, seed or sod and soil amendments, as specified for new turf and grasses, and as required to provide satisfactorily reconditioned turf and grasses. Provide new loam as required to fill low spots and meet new finish grades.

D. Till stripped, bare, and compacted areas thoroughly to a depth of 12-inches.

E. Remove diseased or unsatisfactory turf and grass areas; do not bury into soil. Remove topsoil containing extraneous materials resulting from Contractor's operations including oil drippings, stone, gravel, and other construction materials.

F. Water newly planted areas and keep moist until new turf and grasses are established, as specified.

3.9 ACCEPTANCE CRITERIA FOR TURF AND GRASS

A. Turf and grass Work will be considered acceptable when:
   1. Seeded Turf: When a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 square feet and bare spots not exceeding 5-inches by 5-inches.
   2. Seeded Grasses: When a healthy, uniform, close stand of meadow grass and forbs has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 20 square feet and bare spots not exceeding 12-inches by 12-inches.
   3. Sodded Grasses: When a healthy, well-rooted, even-colored, viable grass has been established, free of weeds, open joints, bare areas, and surface irregularities.
   4. Plugged Grasses: When the required number of plugs has been established as well-rooted, viable patches of grass; and areas between plugs are free of weeds and other undesirable vegetation.
   5. Sprigged Grass: When the required number of sprigs has been established as well-rooted, viable plants and areas between sprigs are free of weeds and other undesirable vegetation.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris, created by turf and grass Work, from paved areas. Clean wheels of vehicles before leaving Site to avoid tracking soil and loam onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout extended service period and remove when service period ends. Treat, repair or replace damaged turf and grasses.

C. Remove erosion-control measures after turf and grass extended service period ends.

3.11 INSPECTION AND ACCEPTANCE

A. Where turf and grasses do not comply with specified acceptance criteria, reestablish turf and grasses and continue extended service period until turf and grasses comply with criteria for acceptance.

3.12 DEMONSTRATION

A. Engage installer’s Site supervisor to train and instruct Owner’s personnel in the proper maintenance of turf and grass and procedures to be performed throughout the year for proper care and maintenance of turf and grasses.
   1. Include instructions and training on reconditioning established turf and grass and sources of turf and grass materials.

2. Schedule training with Owner, through Engineer, with at least seven days' advance notice.

B. Review Operation and Maintenance information and be sure all instructions are clearly understood by Owner’s personnel and are supplemented with additional information, clarifications, and instructions, as required.

C. Provide minimum of two, nonconsecutive, full days on-Site training time during day shift normal working hours.

+ + END OF SECTION + +

DIVISION 33 - UTILITIES

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SECTION 33 05 05

BURIED PIPING INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to install and test all buried piping, fittings, and specials. The Work includes the following:
      a. All types and sizes of buried piping, except where buried piping installations are specified under other Sections.
      b. Unless otherwise shown or specified, this Section includes all buried piping Work required, beginning at the outside face of structures or structure foundations, including piping beneath structures, and extending away from structures.
      c. Work on or affecting existing buried piping.
      d. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, cathodic protection, and other Work required for a complete, buried piping installation.
      e. Supports, restraints, and thrust blocks.
      f. Pipe encasements, with the exception of piping embedded in concrete within a structure or foundation specified under Section 40 05 05, Exposed Piping Installation.
      g. Field quality control, including testing.
      h. Cleaning and disinfecting.
      i. Incorporation of valves, meters, and special items shown or specified into piping systems in accordance with the Contract Documents and as required.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before buried piping Work.
   2. Coordinate with appropriate piping Sections of Division 40, Process Integration.

C. Related Sections:
   1. Section 31 20 00, Earth Moving.
   2. Section 03 30 05, Cast-In-Place Concrete.
   3. Section 09 91 00, Painting.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASME Boiler and Pressure Vessel Code.
   2. ASME B31.3, Process Piping.
   3. American Society for Non-Destructive Testing (ASNT), ASNT-TC-1A, Recommended Practice, Personnel Qualification, and Certification in Non-destructive Testing.
   4. ASTM B32, Specification for Solder Metal.
   5. ASTM C12, Practice for Installing Vitrified Clay Pipe Lines.
   6. ASTM C425, Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
   7. ASTM C828, Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.
   8. ASTM C924, Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Test Method.
   9. ASTM D2321, Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.
   10. ASTM D2774, Practice for Underground Installation of Thermoplastic Pressure Piping.
   11. ASTM D4174, Practice for Cleaning, Flushing and Purification of Petroleum Fluid Hydraulic Systems.
   12. ASTM F1417, Test Method for Installation Acceptance of Plastic Gravity Sewer Lines using Low-Pressure Air.
   13. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
   14. ANSI/AWWA C105, Polyethylene Encasement for Ductile-Iron Pipe Systems.
   15. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   16. ANSI/AWWA C206, Field Welding of Steel Water Pipe.
   17. ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
   18. ANSI/AWWA C603, Installation of Asbestos-Cement Pressure Pipe.
   19. ANSI/AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
   20. ANSI/AWWA C606, Grooved and Shouldered Joints.
   21. ANSI/AWWA C651, Disinfecting Water Mains.
   22. AWWA M9, Concrete Pressure Pipe.
   23. AWWA M11, Steel Water Pipe - A Guide for Design and Installation.
   24. AWWA M23, PVC Pipe - Design and Installation.
   25. AWWA M41, Ductile-Iron Pipe and Fittings.
   26. AWWA M45, Fiberglass Pipe Design.
   27. AWWA M55, PE Pipe - Design and Installation.
   28. ASCE 37, Design and Construction of Sanitary and Storm Sewers.
   29. American Concrete Pipe Association, Concrete Pipe Handbook.
   30. Chlorine Institute, Inc., Piping Systems for Dry Chlorine, Pamphlet No. 6.
   31. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements and recommendations of authorities having jurisdiction over the Work, including.
      a. Fayette County Water System.
   2. Obtain required permits for Work in roads, rights-of-way, railroads, and other areas of the Work.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Laying schedules for concrete pipe and piping with restrained joints.
      b. Details of piping, specials, joints, harnessing and thrust blocks, and connections to piping, structures, equipment, and appurtenances.
   2. Product Data:
      a. Manufacturer's literature and specifications, as applicable, for products specified in this Section.
   3. Testing Procedures:
      a. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER's approval prior to commencing testing.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Certificate signed by manufacturer of each product certifying that product conforms to applicable referenced standards.
   2. Field Quality Control Submittals:
      a. Results of each specified field quality control test.

C. Closeout Submittals: Submit the following:
   1. Record Documentation:
      a. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work. Submittal shall show actual location of all piping Work and appurtenances at same scale as the Drawings.
      b. Show piping with elevations referenced to Project datum and dimensions from permanent structures. For each horizontal bend in piping, include dimensions to at least three permanent structures, when possible. For straight runs of piping provide offset dimensions as required to document piping location.
      c. Include profile drawings with buried piping record documents when the Contract Documents include piping profile drawings.
      d. Conform to Section 01 78 39, Project Record Documents.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
   2. Upon delivery inspect pipe and appurtenances for cracking, gouging, chipping, denting, and other damage and immediately remove from Site and replace with acceptable material.

B. Storage:
   1. Store materials to allow convenient access for inspection and identification. Store material off ground using pallets, platforms, or other supports. Protect packaged materials from corrosion and deterioration.
   2. Pipe and fittings other than PVC and CPVC may be stored outdoors without cover.

C. Handling:
   1. Handle pipe, fittings, specials, and accessories carefully in accordance with pipe manufacturer's recommendations. Do not drop or roll material off trucks. Do not drop, roll or skid piping.
   2. Avoid unnecessary handling of pipe.
   3. Keep pipe interiors free from dirt and foreign matter.
   4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Piping materials are specified in the Buried Piping Schedule at end of this Section. Piping materials shall conform to Specifications for each type of pipe and piping appurtenances in applicable Sections of Division 40, Process Integration.

B. General:
   1. Pipe Markings:
      a. Manufacturer shall cast or paint on each length of pipe and each fitting pipe material, diameter, and pressure or thickness class.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install piping as shown, specified, and as recommended by pipe and fittings manufacturer.
   2. In event of conflict between manufacturer's recommendations and the Contract Documents, request interpretation from ENGINEER before proceeding.

3. ENGINEER will observe excavations and bedding prior to laying pipe by CONTRACTOR. Notify ENGINEER in advance of excavating, bedding, pipe laying, and backfilling operations.
4. Minimum cover over buried piping shall be 4 feet, unless otherwise shown or approved by ENGINEER.
5. Earthwork is specified in Section 31 20 00, Earth Moving.
6. Excavation in excess of that required or shown, and that is not authorized by ENGINEER shall be filled at CONTRACTOR's expense with granular material furnished, placed, and compacted in accordance with Section 31 20 00, Earth Moving.

B. Separation of Sewers and Potable Water Piping:
   1. Horizontal Separation:
      a. Where possible, existing and proposed potable water mains and service lines, and sanitary, combined, and storm sewers shall be separated horizontally by clear distance of at least ten feet.
      b. If local conditions preclude the specified clear horizontal separation, installation will be allowed if potable water main is in separate trench or on undistributed earth shelf on one side of sewer and with bottom of potable water main at least 18 inches above top of sewer.
      c. Exception:
         1) Where it is not possible to provide minimum horizontal separation described above, construct potable water main of cement-lined ductile iron pipe with restrained push-on joint or restrained mechanical joint pipe complying with public water supply design standards of authority having jurisdiction. Hydrostatically test water main and sewer as specified in this Section prior to backfilling. Hydrostatic test pressure at crossing shall be at least 200 psi.
   2. Vertical Separation:
      a. Provide minimum vertical distance of 18 inches between outside of potable water main and outside of sewer when sewer crosses over potable water main.
      b. Center a section of potable water main pipe at least 17.5 feet long over sewer so that sewer joints are equidistant from potable water main joints.
      c. Provide adequate structural support where potable water main crosses under sewer. At minimum, provide compacted select backfill for ten feet on each side of crossing.
      d. Exceptions:
         1) Where it is not possible to provide minimum vertical separation described above, construct potable water main of cement-lined ductile iron pipe with restrained push-on joint or restrained mechanical joint pipe. Hydrostatically test water main and sewer as specified in this Section, prior to backfilling. Hydrostatic test pressure at crossing shall be at least 200 psi.
         2) Encase either potable water main or sewer in watertight carrier pipe extending ten feet on each side of crossing, measured perpendicular to potable water main.

D. Plugs:
   1. Temporarily plug installed pipe at end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.
   2. Install standard plugs in bells at dead ends, tees, and crosses. Cap spigot and plain ends.
   3. Fully secure and block plugs, caps, and bulkheads installed for testing to withstand specified test pressure.
   4. Where plugging is required for phasing of the Work or subsequent connection of piping, install watertight, permanent type plugs, caps, or bulkhead acceptable to ENGINEER.

E. Bedding Pipe: Bed pipe as specified and in accordance with details on the Drawings.
   1. Trench excavation and backfill, and bedding materials shall conform to Section 31 20 00, Earth Moving, as applicable.
   2. Where ENGINEER deems existing bedding material unsuitable, remove and replace existing bedding with approved granular material furnished, placed, and compacted in accordance with 31 20 00, Earth Moving. Payment for additional excavation and providing granular material will be made under the unit price payment items in the Contract.
   3. Where pipe is installed in rock excavation, provide minimum of three inches of granular bedding material underneath pipe smaller than four-inch nominal diameter, and minimum of six inches of granular bedding material underneath pipes four-inch nominal diameter and larger.
   4. Excavate trenches below bottom of pipe by amount shown and indicated in the Contract Documents. Remove loose and unsuitable material from bottom of trench.
   5. Carefully and thoroughly compact pipe bedding with hand held pneumatic compactors.
   6. Do not lay pipe until ENGINEER approves bedding condition.
   7. Do not bring pipe into position until preceding length of pipe has been bedded and secured in its final position.

F. Laying Pipe:
   1. Conform to manufacturer's instructions and requirements of standards and manuals listed below, as applicable:
      a. Ductile Iron Pipe: ANSI/AWWA C600, ANSI/AWWA C105, AWWA M41.
   2. Install pipe accurately to line and grade shown and indicated in the Contract Documents, unless otherwise approved by ENGINEER. Remove and reinstall pipes that are not installed correctly.
   3. Slope piping uniformly between elevations shown.
   4. Keep groundwater level in trench at least 24 inches below bottom of pipe before laying pipe. Do not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete. Keep clean and protect interiors of pipe, fittings, valves, and appurtenances.

5. Start laying pipe at lowest point and proceed towards higher elevations, unless otherwise approved by ENGINEER.
6. Place bell and spigot-type pipe so that bells face the direction of laying, unless otherwise approved by ENGINEER.
7. Place concrete pipe containing elliptical reinforcement with minor axis of reinforcement in vertical position.
8. Excavate around joints in bedding and lay pipe so that pipe barrel bears uniformly on trench bottom.
9. Deflections at joints shall not exceed 75 percent of amount allowed by pipe manufacturer, unless otherwise approved by ENGINEER.
10. For PVC and CPVC piping with solvent welded joints, 2.5-nch diameter and smaller, and copper tubing, snake piping in trench to compensate for thermal expansion and contraction.
11. Carefully examine pipe, fittings, valves, and specials for cracks, damage, and other defects while suspended above trench before installation. Immediately remove defective materials from the Site and replace with acceptable products.
12. Inspect interior of all pipe, fittings, valves, and specials and completely remove all dirt, gravel, sand, debris, and other foreign material from pipe interior and joint recesses before pipe and appurtenances are moved into excavation. Bell and spigot-type mating surfaces shall be thoroughly wire brushed, and wiped clean and dry immediately before pipe is laid.
13. Field cut pipe, where required, with machine specially designed for cutting the type of pipe being installed. Make cuts carefully, without damage to pipe, coating or lining, and with smooth end at right angles to axis of pipe. Cut ends on push-on joint type pipe shall be tapered and sharp edges filed off smooth. Do not flame-cut pipe.
14. Do not place blocking under pipe, unless specifically approved by ENGINEER for special conditions.
15. Touch up protective coatings in manner satisfactory to ENGINEER prior to backfilling.
16. Notify ENGINEER in advance of backfilling operations.
17. On steep slopes, take measures acceptable to ENGINEER to prevent movement of pipe during installation.
18. Thrust Restraint: Where required, provide thrust restraint conforming to Article 3.3 of this Section.
19. Exercise care to avoid flotation when installing pipe in cast-in-place concrete, and in locations with high groundwater.

G. Jointing Pipe:
   1. Ductile Iron Mechanical Joint Pipe:
      a. Immediately before making joint, wipe clean the socket, plain end, and adjacent areas. Taper cut ends and file off sharp edges to provide smooth surface.
      b. Lubricate plain ends and gasket with soapy water or manufacturer's recommended pipe lubricant, in accordance with ANSI/AWWA C111, just prior to slipping gasket onto plain end of the joint assembly.

c. Place gland on plain end with lip extension toward the plain end, followed by gasket with narrow edge of gasket toward plain end.
d. Insert plain end of pipe into socket and press gasket firmly and evenly into gasket recess. Keep joint straight during assembly.
e. Push gland toward socket and center gland around pipe with gland lip against gasket.
f. Insert bolts and hand-tighten nuts.
g. If deflection is required, make deflection after joint assembly and prior to tightening bolts. Alternately tighten bolts approximately 180 degrees apart to seat gasket evenly. Bolt torque shall be as follows:

Pipe Diameter (inches)	Bolt Diameter (inches)	Range of Torque (ft-lbs)
3	5/8	45 to 60
4 to 24	3/4	75 to 90
30 to 36	1	100 to 120
42 to 48	1.25	120 to 150

h. Bolts and nuts, except those of stainless steel, shall be coated with two coats, minimum dry film thickness of eight mils each, of high build solids epoxy or bituminous coating manufactured by Tnemec, or equal.
i. Restrained mechanical joints shall be in accordance with Section 40 05 19, Ductile Iron Process Pipe.

2. Ductile Iron Push-On Joint Pipe:
   a. Prior to assembling joints, thoroughly clean with wire brush the last eight inches of exterior surface of spigot and interior surface of bell, except where joints are lined or coated with a protective lining or coating.
   b. Wipe clean rubber gaskets and flex gaskets until resilient. Conform to manufacturer's instructions for procedures to ensure gasket resiliency when assembling joints in cold weather.
   c. Insert gasket into joint recess and smooth out entire circumference of gasket to remove bulges and to prevent interference with proper entry of spigot of entering pipe.
   d. Immediately prior to joint assembly, apply thin film of pipe manufacturer's recommended lubricant to surface of gasket that will come in contact with entering spigot end of pipe, or apply a thin film of lubricant to outside of spigot of entering pipe.
   e. For assembly, center spigot in pipe bell and push pipe forward until spigot just makes contact with rubber gasket. After gasket is compressed and before pipe is pushed or pulled in the rest of the way, carefully check gasket for proper position around the full circumference of joint. Final assembly shall be made by forcing spigot end of entering pipe past gasket until spigot makes contact with base of the bell. When more than a reasonable amount of force is required to assemble the joint, remove spigot end of pipe to verify proper positioning of gasket. Do not use gaskets that have been scored or otherwise damaged.

f. Maintain an adequate supply of gaskets and joint lubricant at the Site when pipe jointing operations are in progress.

3. Ductile Iron Proprietary Joints:
   a. Install pipe that utilizes proprietary joints for restraint specified in Section 40 05 19, Ductile Iron Process Pipe, or other such joints, in accordance with manufacturer's instructions.

I. Backfilling:
   1. Conform to applicable requirements of Section 31 20 00, Earth Moving.
   2. Place backfill as Work progresses. Backfill by hand and use power tampers until pipe is covered by at least one foot of backfill.

J. Connections to Valves and Hydrants:
   1. Install valves and hydrants as shown and indicated in the Contract Documents.
   2. Provide suitable adapters when valves or hydrants and piping have different joint types.
   3. Provide thrust restraint at all hydrants and at valves located at pipeline terminations.

K. Transitions from One Type of Pipe to Another:
   1. Provide necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

L. Closures:
   1. Provide closure pieces shown or required to complete the Work.

3.2 TRACER TAPE INSTALLATION

A. Polyethylene Underground Warning Tape for Metallic Pipelines:
   1. Provide polyethylene tracer tape for buried metallic piping, which includes pipe that is steel, ductile iron, cast iron, concrete, copper, and corrugated metal.
   2. Provide 6-in. wide tracer tape 12 to 18 inches below finished grade, above and parallel to buried pipe.
   3. For pipelines buried eight feet or greater below finished grade, provide second line of magnetic tracer tape 2.5 feet above crown of buried pipe, aligned along pipe centerline.
   4. Tape shall be spread flat with message side up before backfilling.

3.3 BURIED INFRASTRUCTURE MARKERS

A. Install 54-inch thermoplastic vertical posts as specified.
   1. Provide marker above each buried valve. Valve markers shall be yellow.
   2. Provide marker every 50 linear feet along buried forcemain installed in easement. Piping markers shall be blue.

B. Posts shall be TriView as manufactured by Rhino Markers and Protection Systems, Inc.

3.4 THRUST RESTRAINT

A. Provide thrust restraint on all piping systems where shown or indicated in the Contract Documents with the exception of storm drains.

B. Thrust restraint may be accomplished by using restrained pipe joints, concrete thrust blocks, or harnessing buried pipe. Thrust restraints shall be designed for axial thrust exerted by test pressure specified in the Buried Piping Schedule at the end of this Section.

C. Place concrete thrust blocks against undisturbed soil. Where undisturbed soil does not exist, or for projects where the Site consists of backfill material, thrust restraint shall be provided by restrained pipe joints.

D. Restrained Pipe Joints:
   1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.
      a. Ductile Iron, Push-on Joints and Mechanical Joints: Restrain with proprietary restrained joint system as specified in Section 40 05 19, Ductile Iron Process Pipe; lugs and tie rods; or other joint restraint systems approved by ENGINEER.
      b. Steel Pipe Joints: Provide butt-welded joints, lap welded joints, flanged joints, or mechanical coupling connections as shown and specified in Buried Piping Schedule in this Section. Provide tie rods connected to lugs welded to the steel pipe for restraint at mechanical couplings.
      c. Thermoplastic and HDPE Joints: Where bell and spigot-type or other non-restrained joints are utilized, provide tie rods across joint or other suitable joint restraint system, subject to the approval of ENGINEER.
      d. Prestressed Concrete Cylinder Pipe Joints: Restrain utilizing clamp type restrained joint, snap ring-type restrained joint, or by welding. Concrete pipe requiring restraint shall have sufficient longitudinal steel reinforcement provided to handle thrust forces at maximum design stress of 12,500 psi. Thrust forces in longitudinal must be transmitted directly to steel joint bands using welded connections sufficient to carry stresses involved. No allowance for the concrete to handle tensile forces is allowed. Thrust restraint shall be in accordance with ANSI/AWWA Manual M9.
      e. Joints for Concrete Pipe Other than Prestressed Concrete Cylinder Pipe: Restrain joints utilizing clamp type restrained joint or snap ring-type restrained joint.

E. Concrete Thrust Blocks:
   1. Provide concrete thrust blocks on pressure piping at changes in alignment of 15 degrees or more, at tees, plugs and caps, and where shown or indicated in the Contract Documents. Construct thrust blocks of Class B concrete, conforming to 03 30 05, Cast-In-Place Concrete.

2. Install thrust blocks against undisturbed soil. Place concrete so that pipe and fitting joints are accessible for repair.
3. Concrete thrust block size shall be as shown on the Drawings or as approved by ENGINEER.

3.5 WORK AFFECTING EXISTING PIPING

A. Location of Existing Underground Facilities:
1. Locations of existing Underground Facilities shown on the Drawings should be considered approximate.
2. Determine the true location of existing Underground Facilities to which connections are to be made, crossed, and that could be disturbed, and determine location of Underground Facilities that could be disturbed during excavation and backfilling operations, or that may be affected by the Work.

B. Taking Existing Pipelines and Underground Facilities Out of Service:
1. Conform to Section 01 14 16, Coordination with Owner's Operations.
2. Do not take pipelines or Underground Facilities out of service unless specifically listed in Section 01 14 16, Coordination with Owner's Operations, or approved by ENGINEER.
3. Notify ENGINEER in writing prior to taking pipeline or Underground Facilities out of service. Shutdown notification shall be provided in advance of the shutdown in accordance with the General Conditions and Section 01 14 16, Coordination with Owner's Operations.

C. Work on Existing Pipelines or Underground Facilities:
1. Cut or tap piping or Underground Facilities as shown or required with machines specifically designed for cutting or tapping pipelines or Underground Facilities, as applicable.
2. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.
3. Provide necessary adapters, sleeves, fittings, pipe, and appurtenances required to complete the Work.
4. Conform to applicable requirements of Section 01 14 16, Coordination with Owner's Operations, Section 01 73 29, Cutting and Patching, and Section 01 73 24, Connections to Existing Facilities.

3.6 FIELD QUALITY CONTROL

A. General:
1. Test all piping, except as exempted in the Buried Piping Schedule in this Section.
2. When authorities having jurisdiction are to witness tests, notify ENGINEER and authorities having jurisdiction in writing at least 48 hours in advance of testing.
3. Conduct all tests in presence of ENGINEER.
4. Remove or protect pipeline-mounted devices that could be damaged by testing.

5. Provide all apparatus and services required for testing, including:
    a. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain OWNER's operations.
    b. Temporary bulkheads, bracing, blocking, and thrust restraints.
6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.
7. Unless otherwise specified, OWNER will provide fluid required for hydrostatic testing. CONTRACTOR shall provide means to convey fluid for hydrostatic testing into piping being tested. CONTRACTOR shall provide fluid for other types of testing required.
8. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.
9. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. Piping not installed by CONTRACTOR and that fails the test shall be repaired upon authorization of OWNER. Unless otherwise included in the Work, repair of existing piping or Underground Facilities will be paid as extra Work.

B. Test Schedule:
1. Refer to the Buried Piping Schedule in this Section for type of test required and required test pressure.
2. Unless otherwise specified, required test pressures are at lowest elevation of pipeline segment being tested.
3. For piping not listed in Buried Piping Schedule in this Section:
    a. Hydrostatically test pipe that will convey liquid at a pressure greater than five psig. Provide process air pipe test for pipe that will convey air or gas under pressure or vacuum, except chlorine gas, which requires separate test.
    b. Use exfiltration testing, low-pressure air testing, or vacuum testing for other piping.
    c. Disinfect for bacteriological testing piping that conveys potable water.
4. Test Pressure:
    a. Use test pressures listed in Buried Piping Schedule in this Section.
    b. If test pressure is not listed in Buried Piping Schedule, or if test is required for piping not listed in the Buried Piping Schedule, test pressure will be determined by ENGINEER based on maximum anticipated sustained operating pressure and methods described in applicable ANSI/AWWA manual or standard that applies to the piping system.

C. Hydrostatic Testing:
1. Preparation for Testing:
    a. Follow procedures described in ANSI/AWWA Manual M9.
    e. Prior to testing, ensure that adequate thrust protection is in place and joints are properly installed.
2. Test Procedure:

a. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.
b. Expel air from pipe as required. Obtain approval of ENGINEER prior to tapping pipe for expelling air.
c. Examine exposed joints and valves, and make repairs to eliminate visible leakage.
d. After specified wetting period, add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.
e. Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
f. Timed Test Period: After stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure. For HDPE pipe, after three hour expansion phase, reduce test pressure by ten psig and do not add liquid. Test pressure shall then remain steady for one hour, indicating no leakage.
g. Pump from test container to maintain test pressure. Measure volume of fluid pumped from test container and record on test report. Record pressure at test pump at 15 minute intervals for duration of test.

3. Allowable Leakage Rates: Leakage is defined as the quantity of fluid supplied to pipe segment being tested to maintain pressure within five psi of test pressure during timed test period. Allowable leakage rates for piping are:
   a. No Leakage: Pipe with flanged, welded, fused, threaded, soldered, or brazed joints.
   b. Rates based on formula or table in ANSI/AWWA Manual M41:
      1) Metal and fiberglass pipe joined with rubber gaskets as sealing members, including the following joint types:
         a) Bell and spigot and push-on joints.
         b) Mechanical joints.
         c) Bolted sleeve type couplings.
         d) Grooved and shouldered couplings.

D. Bacteriological Testing:
   1. Bacteriological testing for potable water lines, finished water lines, and other piping in accordance with the Buried Piping Schedule, is specified in Article 3.6 of this Section.

3.7 CLEANING AND DISINFECTION

A. Cleaning, General: Clean pipe systems as follows:
   1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in manner approved by ENGINEER, prior to placing in service. Flush chlorine solution and sodium hypochlorite piping with water.
   2. Piping 24-inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.

3. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with five percent sodium hypochlorite solution.

B. Disinfection:
   1. Disinfect all potable and finished water piping.
   2. Suggested procedure for accomplishing complete and satisfactory disinfection is specified below. Other procedures may be considered for acceptance by ENGINEER.
      a. Prior to disinfection, clean piping as specified and flush thoroughly.
      b. Conform to procedures described in ANSI/AWWA C651. Use continuous feed method of disinfecting, unless alternative method is acceptable to ENGINEER.
   3. Water for initial flushing, testing, and disinfection will be furnished by OWNER. CONTRACTOR shall provide all temporary piping, hose, valves, appurtenances, and services required. Cost of water required for redisinfection will be paid by CONTRACTOR to OWNER at water utility's standard rates.
   4. Chlorine shall be provided by CONTRACTOR.
   5. Bacteriologic tests will be performed by OWNER. Certified test laboratory report will be provided to CONTRACTOR, if requested.
   6. Chlorine concentration in water entering the piping shall be between 50 and 100 ppm, such that minimum residual concentration of 25 mg/L remains after 24-hour retention period. Disinfect piping and all related components. Repeat as necessary to provide complete disinfection.
   7. After required retention period, flush chlorinated water to closed drain line, unless otherwise acceptable to ENGINEER. Properly dispose of chlorinated water in accordance with Laws and Regulations. Do not discharge chlorinated water to storm sewers, ditches, or overland.

3.8 SCHEDULES

A. Schedules listed below, following the "End of Section" designation, are part of this Specification section.
   1. Table 33 05 05-A, Buried Piping Schedule.

+ + END OF SECTION + +

TABLE 33 05 05-A, BURIED PIPING SCHEDULE

Service	Diameter (inch)	Material	Interior Lining	Exterior Coating	Pressure Class/ Thickness	Joint	Test	Remarks
POT	8, 12	DIP	CL	AC	350	RMJ	HYD(150) DBT	Transmission Main to Tank
POT	12	DIP	CL	AC	350	RMJ	HYD(150) DBT	Tank to Booster Pump Station
POT	12	DIP	CL	AC	350	RMJ	HYD(150) DBT	Booster Pump Station to Transmission Main
DR	2	PVC	--	--	Sch80	NR	HYD(100)	Sump Pump Discharges
DR	8-18	PVC	--	--	SDR35	NR	EX/AIR/V AC and VD	PVC Sewer Pipe
DR	12	DIP	CL	AC	350	RMJ	EX/AIR/V AC and VD	Tank Drain

The following abbreviations are used in the Buried Piping Schedule.

A. Service Abbreviations

Service	Abbrev		Service	Abbrev.
Sanitary Sewer	SAN		Potable Water	POT
Storm Sewer	ST		Overflow	OF
Drain	DR			

B. Material Abbreviations

Material	Abbrev		Material	Abbrev.
Ductile Iron	DI		Polyvinyl Chloride	PVC
Cast Iron	CI		Chlorinated Polyvinyl Chloride	CPVC
Carbon Steel	CS		Polyethylene	PE
Stainless Steel	SS		High Density Polyethylene	HDPE
Copper	C		Fiberglass Reinforced Plastic	FRP
Corrugated Metal Pipe	CMP		Acrylonitrile Butadiene Styrene	ABS
Reinforced Concrete Pipe	RCP		Vitrified Clay	VC
Prestressed Concrete Cylinder Pipe	PCCP			
Non-Prestressed Concrete Cylinder Pipe	CCP			
Steel Cylinder Pipe	SCP			

C. Lining/Coating Abbreviations

Lining	Abbrev		Coating	Abbrev.
Cement Mortar Lined	CL		Asphaltic Coated	AC
Glass Lined	GL		Polyethylene Wrapped	PEW
Ceramic Epoxy	CE		Painted	P
Fusion Bonded Epoxy Lined	FBEL		Fusion Bonded Epoxy Coated	FBEC
Plastic Lined	PL		Insulated	I
			Galvanized	Galv

D. Joint Abbreviations

Joint Type	Abbrev		Joint Type	Abbrev.
Bell and Spigot	BS		Butt Weld	BW
Restrained Bell and Spigot	RBS		Lap Weld	LW
Push-on Joint	POJ		Butt Fusion Weld	BFW
Restrained Push-on Joint	RPOJ		Solvent Weld	SW
Mechanical Joint	MJ		Sleeve-type Flexible Coupling	SLFC
Restrained Mech. Joint	RMJ		Split Flexible Coupling	SPFC
Soldered	Sd		Plasticized PVC Coupling	PPVC
Brazed	Bz		Grooved or Shouldered End Coupling	GSEC
Threaded	Thd		Flanged	Flg
Compression Sleeve Coupling	CSC		Compression Flange Adapter	CFA

E. Test Abbreviations

Test	Abbrev		Test	Abbrev.
Hydrostatic Test (test pressure in psig)	HYD ( )		Process Air Pipe Test (test pressure in psig)	PA ( )
Exfiltration	EX		Chlorine Pipe Test	CL
Low-pressure Air Sewer Test	AIR		Disinfection and Bacteriological Testing	DBT
Vacuum Test	VAC		Examination of Welds	EW
Vertical Deflection	VD		No Test Required	NR
Televised Inspection	TV			

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all precast, cast-in-place and masonry manholes and structures.

B. General:
   1. Manholes and structures shall conform in shape, size, dimensions, material, and other respects to the details shown or as directed by ENGINEER.
   2. Cast-iron frames, grates and covers shall be the standard frame and grate or cover unless otherwise shown and shall be as specified in Section 05 56 00, Metal Castings.
   3. Concrete for cast-in-place manholes and structures and for inverts in precast and masonry manholes and structures shall be Class “A” and shall conform to the requirements specified under Section 03 30 05, Concrete.
   4. All manholes and structures shall be precast construction, unless otherwise shown.

C. Related Sections:
   1. Section 03 30 00, Concrete.
   2. Section 05 50 13, Miscellaneous Metal Fabrications.
   3. Section 05 56 00, Metal Castings.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American Society for Testing and Materials, (ASTM).
      a. ASTM C 32, Specification for Sewer and Manhole Brick (made from Clay or Shale).
      b. ASTM C 139, Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
      c. ASTM C 140, Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
      d. ASTM C 207, Specification for Hydrated Lime for Masonry Purposes.
      e. ASTM C 478, Specification for Precast Reinforced Concrete Manhole Sections.
   2. American Water Works Association, (AWWA).
      a. AWWA C302, Reinforced Concrete Pressure Pipe, Non-cylinder Type, for Water and Other Liquids.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Submit drawings showing design and construction details of all precast concrete and cast-in-place manholes and structures, including details of joints between the manhole bases and riser sections and stubs or openings for the connections.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE MANHOLES AND STRUCTURES

A. Precast manholes and structures shall conform to the details shown. Provide cast-in-place concrete bases where shown.

B. Except where otherwise specified precast manhole components shall consist of reinforced concrete pipe sections especially designed for manhole construction and manufactured in accordance with ASTM C 478, except as modified herein.

C. Precast, reinforced concrete manhole bases, riser sections, flat slabs and other components shall be manufactured by wet cast methods only, using forms which will provide smooth surfaces free from irregularities, honeycombing or other imperfections.

D. Joints between manhole components shall be the tongue and groove type employing a single, continuous rubber O-ring gasket and shall conform to AWWA C302. The circumferential and longitudinal steel reinforcement shall extend into the bell and spigot ends of the joint without breaking the continuity of the steel. Joints between the base sections, riser sections and top slabs of manholes 72-inches in diameter and less shall be rubber and concrete joints. Joints for manhole components greater than 72-inches in diameter shall be provided with steel bell and spigot rings.

E. All precast manhole components shall be of approved design and of sufficient strength to withstand the loads imposed upon them. They shall be designed for a minimum earth cover loading of 130 pounds per cubic foot, an H-20 wheel loading, and an allowance of 30 percent in roadways and 15 percent in rights-of-way for impact. Manhole bases shall have two cages of reinforcing steel in their walls, each of the area equal to that required in the riser sections. Wall thickness shall not be less than 5-inches. Concrete top slabs shall not be less than 8-inches thick.

F. Lifting holes, if used in manhole components, shall be tapered, and no more than two shall be cast in each section. Tapered, solid rubber plugs shall be furnished to seal the lifting holes. The lifting holes shall be made to be sealed by plugs driven from the outside face of the section only.

G. The point of intersection (P.I.) of the sewer pipe centerlines shall be marked with 1/4-inch diameter steel pin firmly enclosed in the floor of each manhole base and protruding approximately 1-inch above the finished floor of the base.

H. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

I. The barrel of the manhole shall be constructed of various lengths of riser pipe manufactured in increments of one foot to provide the correct height with the fewest joints. Openings in the barrel of the manholes for sewers or drop connections will not be permitted closer than one foot from the nearest joint. Special manhole base or riser sections shall be furnished as necessary to meet this requirement.

J. A precast or cast-in-place slab or precast eccentric cone, as shown or approved, shall be provided at the top of the manhole barrel to receive the cast iron frame and cover.

2.3 MISCELLANEOUS METALS

A. Metal frames and covers and similar required items shall be provided as shown and in accordance with Division 05, Metals.

2.4 DROP CONNECTIONS

A. Drop connections for manholes and structures shall be constructed where shown or directed by the ENGINEER and shall conform to the design and details shown. Pipe and fittings shall be ductile iron, reinforced concrete, or vitrified clay as shown or otherwise approved. Concrete for pipe encasement shall be Class “B” as specified under Section 03 00 05, Concrete. Concrete shall be bonded to manhole in the manner shown or otherwise approved by ENGINEER.

PART 3 - EXECUTION

3.1 LAYING MASONRY

A. Brick shall be satisfactorily wet when being laid and each brick shall be laid in mortar so as to form full bed, end and side joints in one operation. The joints shall not be wider than 3/8-inch, except when the bricks are laid radially, in which case the narrowest part of the joint shall not exceed 1/4-inch. Masonry work shall be kept moist for a period of three days after completion, and precautions shall be taken to prevent freezing during cold weather.

B. For concrete block, the vertical keyways shall be completely filled with mortar.

C. Each grading ring shall be laid in a full bed of mortar and shall be thoroughly bonded.

3.2 PLASTERING

A. The outside of brick manholes and structures, brick stacks and grading rings shall be neatly plastered with 1/2-inch of cement mortar as the Work progresses.

3.3 MANHOLE BASES

A. Cast-in-place bases shall be placed on suitable foundations after the pipes are laid. They shall be cast monolithically to an elevation at least 12-inches above the top of the highest pipe entering the manhole, except where a drop connection is to be installed. Base, walls and bottom shall be at least of the thickness shown and reinforced to withstand the loads to be expected. Connections for sewer pipes shall conform to the details shown.

B. Precast bases shall be set on a crushed stone, crushed gravel, or concrete foundation as shown. Precast bases shall be set at the proper grade and carefully leveled and aligned.

3.4 PRECAST MANHOLE SECTIONS

A. Set sections vertical with steps and sections in true alignment. The base of the bell or groove end at joints between components shall be buttered with 1:2 cement-sand mortar to provide a uniform bearing between components. All joints shall be sealed with cement mortar inside and out and troweled smooth to the contour of the wall surface. Raised or rough joint finishes will not be accepted.

B. Install sections, joints and gaskets in accordance with manufacturers recommendations.

C. Lifting holes shall be sealed tight with a solid rubber plug driven into the hole from the outside of the barrel and the remaining void filled with 1 to 2 cement-sand mortar.

3.5 MANHOLE CHANNELS

A. All invert channels through manholes and structures shall be constructed of Class "A" concrete. Channels shall be properly formed to the sizes, cross sections, grades and shapes shown or as ordered. Benches shall be built up to the heights shown or as directed by the ENGINEER and given a uniform wood float finish. Care shall be taken to slope all benches for proper drainage to the invert channel.

3.6 GRADING RINGS

A. Grading rings or brick stacks shall be used for all precast and masonry manholes and structures, where required. Stacks or grade rings shall be a maximum of 12-inches in height, constructed on the roof slab or cone section on which the manhole frame and cover shall be placed. The height of the stack or grade rings shall be such as required to bring the manhole frame to the proper grade.

B. Each grade ring shall be laid in a full bed of mortar and shall be thoroughly bonded.

C. Brick work shall be as specified in Article 2.2 and Article 3.1, above.

3.7 STUBS FOR FUTURE CONNECTIONS

A. As shown or required for connections, cast iron sleeves, bell end tile, ductile iron or reinforced concrete pipe stubs with approved watertight plugs shall be installed in manholes and structures. Where pipe stubs, sleeves or couplings for future connections are shown or directed by the ENGINEER, CONTRACTOR shall provide all materials and labor in order to complete the Work.

3.8 GRADING AT MANHOLES AND STRUCTURES

A. All manholes and structures in unpaved areas shall be built, as shown or directed by the ENGINEER, to an elevation higher than the original ground. The ground surface shall be graded to drain away from the manhole. Fill shall be placed around manholes to the level of the upper rim of the manhole frame, and the surface evenly graded on a 1 to 5 slope to the existing surrounding ground, unless otherwise shown or directed by the ENGINEER. The slope shall be covered with 4-inches of topsoil, seeded and maintained until a satisfactory growth of grass is obtained.

B. Manholes and structures in paved areas shall be constructed to meet the final surface grade. In paved areas on State Highways, all manholes and structures shall be 1/2-inch below final wearing surfaces. Manholes and structures shall not project above finished roadway pavements to prevent damage from snowplows.

C. CONTRACTOR shall be solely responsible for the proper height of all manholes and structures necessary to reach the final grade at all locations. CONTRACTOR is cautioned that ENGINEER'S review of Shop Drawings for manhole components will be general in nature and CONTRACTOR shall provide an adequate supply of random length precast manhole riser sections to adjust any manhole to meet field conditions for final grading.

3.9 MANHOLE WATERTIGHTNESS

A. All manholes and structures shall be free of visible leakage. Each manhole shall be tested for leaks and inspected, and all leaks shall be repaired in a manner subject to ENGINEER'S approval. Manhole testing shall conform to the requirements of Section 33 05 05, Buried Piping Installation.

3.10 FLEXIBLE PIPE JOINT AT MANHOLE BASE

A. An approved flexible joint shall be provided between each pipe entering and exiting the manhole. This may be accomplished by the installation in the manhole base of the bell end of a pipe or by other means subject to approval of ENGINEER. Joints shall be similar to the approved pipe joints. The joint into the manhole base shall be completely watertight.

++ END OF SECTION ++

DIVISION 40 - PROCESS INTERCONNECTIONS

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SECTION 40 05 05

EXPOSED PIPING INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to install and test all exposed piping, fittings, and specials. The Work includes the following:

   a. All types and sizes of exposed piping, except where exposed piping installations are specified under other Sections.

   b. Unless otherwise shown or specified, this Section includes all piping beginning at the outside face of structures or structure foundations and extending into the structure. Piping embedded in concrete within a structure or foundation shall be considered as exposed and is included herein. Piping that is permanently or intermittently submerged, or installed in sub-aqueous environments, is considered as exposed and is included in this Section.

   c. Work on or affecting existing exposed piping.

   d. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all Work required for a complete exposed piping installation.

   e. Supports, restraints, and other anchors.

   f. Field quality control, including testing.

   g. Cleaning and disinfecting.

   h. Incorporation of valves, meters, and special items shown or specified into the piping systems per the Contract Documents and as required

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before exposed piping Work.

2. Coordinate with appropriate piping Sections of Division 40, Mechanical.

C. Related Sections:

1. Section 09 91 00, Painting.
2. Section 10 14 00, Signage.
3. Section 40 05 07, Pipe Hangers and Supports.
4. Section 40 05 08, Wall Pipes, Floor Pipes and Pipe Sleeves.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings
3. ASME B31.3, Process Piping.
4. American Society for Non-Destructive Testing (ASNT), ASNT-TC-1A, Recommended Practice, Personnel Qualification, and Certification in Non-destructive Testing.
5.
11. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
13. ANSI/AWWA C600, Installation of Ductile Iron Water Mains and Their Appurtenances.
15. ANSI/AWWA C651, Disinfecting Water Mains.
18. AWWA M23, PVC Piping - Design and Installation.
19. AWWA M41, Ductile-Iron Pipe and Fittings.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements and recommendations of authorities having jurisdiction over the Work, including:
    a. International Building Code as supplemented by the local authority having jurisdiction.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
    a. Detailed drawings in plan and, as applicable, section.
    b. Details of piping, valves, supports, accessories, specials, joints, harnessing, and main anchor supports, and connections to existing piping, structures, equipment, and appurtenances.
2. Testing Plans, Procedures, and Testing Limitations

a. Submit description of proposed testing methods, procedures, and apparatus, and obtain ENGINEER's approval prior to testing.

B. Informational Submittals: Submit the following:

1. Certificates:

a. Submit a certificate, signed by manufacturer of each product, certifying that product complies with applicable referenced standards.

2. Source Quality Control Submittals:

a. Submit copies of testing report for each test.

3. Site Quality Control Reports:

a. Submit copies of testing report for each test.

C. Closeout Submittals: Submit the following:

1. Record Documentation:

a. Maintain accurate and up-to-date record documents showing field and Shop Drawing modifications. Record documents for exposed piping Work shall show actual location of all piping and appurtenances on a copy of the Drawings, unless otherwise approved by ENGINEER.

b. Record documents shall show piping with elevations referenced to the project datum and dimensions from permanent structures. For straight runs of pipe provide offset dimensions as required to document pipe location.

c. Include section drawings with exposed piping record documents when the Contract Documents include section Drawings.

d. Conform to Section 01 78 39, Project Record Documents.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver products to Site to ensure uninterrupted progress of the Work.

2. Upon delivery, inspect pipe and appurtenances for cracked, gouged, chipped, dented, and other damage and immediately remove damaged products from Site.

3. Conform to requirements of Section 01 65 00, Product Delivery Requirements.

B. Storage:

1. Store products for convenient access for inspection and identification. Store products off the ground using pallets, platforms, or other supports. Protect packaged products from corrosion and deterioration.
2. Pipe and fittings other than thermoplastic materials may be stored outdoors without cover. Thermoplastic pipe and fittings stored outdoors shall be covered.
3. Conform to requirements of Section 01 66 00, Product Storage and Handling Requirements.

C. Handling:

1. Handle pipe, fittings, specials, and accessories carefully with approved handling devices. Do not drop or roll material of delivery vehicles. Do not otherwise drop, roll, or skid piping.
2. Avoid unnecessary handling of pipe.
3. Keep pipe interiors free of dirt and foreign matter.
4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage. Repair damaged coatings.
5. Conform to requirements of Section 01 65 00, Product Delivery Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Piping materials are specified in the Exposed Piping Schedule at the end of this Section. Piping materials shall conform to Specification for each type of pipe and piping appurtenances in applicable sections of Division 40, Process Integration.

B. Markings and Identification:

1. Pipe Markings:
   a. Clearly mark each piece of pipe or fitting with a designation conforming to that shown on the approved Shop Drawings.
   b. Manufacturer shall cast or paint on each length of pipe and each fitting the pipe material, diameter, and pressure or thickness class.
2. Pipe Identification Markers and Arrows: Refer to Section 10 14 00, Signage.

C. Appurtenances: Provide products that comply with:

1. Section 40 05 07, Pipe Hangers and Supports.
2. Section 40 05 06, Couplings, Adapters, and Specials for Process Piping
3. Section 40 05 08, Wall Pipes, Floor Pipes and Pipe Sleeves

2.2 LINK SEALS

A. Link type mechanical seals will be required where indicated on the drawings.

B. Provide link type mechanical seals suitable for 20 psi working pressure, corrosive service and accessible from one side, with glass-reinforced nylon pressure plate and stainless-steel bolts and nuts.

1. Products and Manufacturers: Provide one of the following:

a. Link-Seal, as manufactured by Thunderline Corporation.

b. Or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Install piping as shown, specified and as recommended by the pipe and fittings manufacturer.
2. If there is a conflict between manufacturer's recommendations and the Contract Documents, request in writing instructions from ENGINEER before proceeding.
3. Provide pipe manufacturer’s installation specialist at Site as specified on this Section.

B. Temporary Blind Flanges, Plugs, Caps, and Bulkheads:

1. Temporarily plug installed pipe at the end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.
2. Install standard plugs in all bells at dead ends, tees, and crosses. Cap all spigot and plain ends.

3. Fully secure and block blind flanges, plugs, caps, and bulkheads installed for testing, designed to withstand specified test pressure.

4. Where plugging is required for phasing of Work or subsequent connection of piping, install watertight, permanent type blind flanges, plugs, caps, or bulkhead acceptable to ENGINEER.

C. Piping Installation:

1. Conform to manufacturer's instructions and requirements of standards and manuals listed in this Section, as applicable:

a. Ductile Iron Pipe: ANSI/AWWA C600, AWWA M41.

db. Thermoplastic Pipe: AWWA M23

2. Install straight runs true to line and elevation.

3. Install vertical pipe truly plumb in all directions.

4. Install piping parallel or perpendicular to walls of structures. Piping at angles and 45 degree runs across corners of structures will not be accepted unless specifically shown on the Contract Documents or approved by the ENGINEER.

5. Install small diameter piping generally as shown when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, and other obstructions.

6. Install piping to leave all corridors, walkways, work areas, and similar spaces unobstructed. Unless otherwise approved by ENGINEER provide a minimum headroom clearance under piping and pipe supports of 7.5 feet. Clearances beneath piping shall be measured from the outermost edge of piping, flanges or other type of joint that extends beyond the nominal outside diameter of piping.

7. Protect and keep clean interiors, fittings, and valves of pipe that will convey potable water, chemicals, and other pipe designated by ENGINEER.

8. Cutting: Cut pipe from measurements verified at Site. Field cut pipe, where required, with a machine specially designed for cutting type of pipe being installed. Make cuts carefully without damage to pipe, coating, or lining, and with a smooth end at right angles to axis of pipe. Do not flame-cut pipe.

10. Additional General Requirements for Thermoplastic Piping:

a. Utilize wide band supports as recommended by pipe manufacturer and approved by ENGINEER to minimize localized stresses.

b. Provide piping passing through walls with a sleeve of wearing material to prevent abrasion damage to piping.

c. Provide anchored supports at elbows, valves, bends in piping, and at connections to equipment and tanks.

d. Spacing of supports shall be in accordance with contract drawings and the manufacturer's published recommendations at maximum design operating temperature of pipe.

e. Provide U-clamps with wide band circumferential contact.

f. Provide guides on long runs of piping to maintain alignment and reduce chance of elastic failure of pipe. Space guides as recommended by pipe manufacturer.

g. Provide devices that will reduce hydraulic pulsation in piping, together with shut-off and drain valve on all discharge lines of positive displacement pumps to reduce hydraulic hammer, and provide flexible connectors to absorb vibration. Submit details for ENGINEER to review.

D. Jointing Pipe:

1. General:

a. Make joints in accordance with pipe manufacturer’s recommendations and Contract Documents.

b. Cut piping accurately and squarely and install without forcing or springing.

c. Ream out pipes and tubing to full inside diameter after cutting. Remove all sharp edges on end cuts.

d. Remove all cuttings and foreign matter from inside of pipe and tubing before installation. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing.

2. Ductile Iron Flanged Joints:

a. Assemble flanged joints using ring-type gaskets, with thickness as recommended by pipe manufacturer but not less than 1/8-inch thick, for raised-face flanges. Use full-face gaskets for flat-face flanges, unless otherwise approved by ENGINEER or recommended by pipe manufacturer. Gaskets shall be suitable for the service intended in accordance with the manufacturer's ratings and instructions. Gaskets shall be properly centered.

b. Tighten bolts in a sequence that provides equal distribution of bolt loads.

c. Length of bolts shall be uniform. Bolts shall not project beyond the nut more than 1/4-inch or fall short of the nut when fully taken up. Machine-cut ends of bolts to be neatly rounded. Do not use washers.

d. Prior to assembly of flanged joints, lubricate bolt threads and gasket faces.

e. Alternately tighten bolts 180 degrees apart to compress the gasket evenly.

f. After assembly, coat all bolts and nuts, except stainless steel bolts and nuts, with same coating specified in Section 09 90 00, Painting, for material of pipe and fittings being joined.

3. Thermoplastic Pipe Joints:

a. Solvent Cement Welded Joints:

1) Bevel pipe ends and remove all burrs before making joint. Clean pipe and fittings thoroughly. Do not make solvent cement joints if temperature is below 40 degrees F. Do not make solvent cement welded joints in wet conditions.

2) Use solvent cement supplied or recommended by pipe manufacturer.

3) Apply joint primer and solvent cement and assemble joints in accordance with recommendations and instructions of manufacturer of joint materials and pipe manufacturer.

4) Implement appropriate safety precautions when using joint primers and solvent cements. Allow air to circulate freely through pipelines to allow solvent vapors to escape. Slowly admit fluid when flushing or filling pipelines to prevent compression of gases within pipes.

12. Mechanical Coupling Joints:

a. Mechanical couplings include: sleeve-type flexible couplings, split flexible couplings, ANSI/AWWA C606 grooved or shouldered end couplings, plasticized PVC couplings, and other mechanical couplings used.

b. Prior to installing and assembling mechanical couplings, thoroughly clean joint ends with a wire brush to remove foreign matter.

c. For mechanical couplings that incorporate gaskets, after cleaning apply lubricant to rubber gasket or inside of coupling housing and to joint ends. After lubrication, install gasket around joint end of previously installed piece and mate joint end of subsequent piece to installed piece. Position gasket and place coupling housing around gasket and over grooved

or shouldered joint ends. Insert bolts and install nuts tightly by hand. Tighten bolts uniformly to produce an equal pressure on all parts of housing. When housing clamps meet metal to metal, joint is complete and further tightening is not required.

d. For plasticized PVC couplings, loosen the stainless steel clamping bands and remove the clamps from the coupling. Slide the coupling over the plain ends of the pipes to be joined without using lubricants. Place clamps over each end of coupling at grooved section and tighten with a torque wrench to torque recommended by manufacturer.

E. Installing Valves and Accessories:

1. Provide supports for large valves, flow meters, and other heavy items as shown or required to prevent strain on adjoining piping.

2. Position flow measuring devices in pipe lines so that they have the amount of straight upstream and downstream runs recommended by the flow measuring device manufacturer, unless specific location dimensions are shown.

3. Position swing check valves and butterfly valves so that they do not conflict with upstream and downstream elements of the piping system.

F. Unions:

1. Install dielectric unions as specified in Section 40 05 06, Couplings, Adapters, and Specials for Process Piping**,** where dissimilar metals are connected, except for bronze or brass valves in ferrous piping.

2. Provide a union downstream of each valve with screwed connections.

3. Provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.

G. Transitions from One Type of Pipe to Another:

1. Provide all necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

H. Closures:

1. Provide closure pieces, such as blind flanges and caps, shown or required to complete the Work.

3.2 THRUST RESTRAINT

A. Provide thrust restraint on all pressure piping systems and where otherwise shown or specified.

B. Thrust restraints shall be designed for axial thrust exerted by test pressure specified in the Exposed Piping Schedule at end of this Section.

C. Restrained Pipe Joints:
1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.
. Ductile Iron, Push-on Joints and Mechanical Joints: Restrain with a proprietary restrained joint system as specified in Section 40 05 19. Ductile iron pipe, lugs, and tie rods, or other joint restraint systems approved by ENGINEER. Restrain ductile iron pipe connected by flexible couplings or flanged coupling adapters by harnessing across the coupling or adapter using tie rods or extended bolts connecting between flanges.
d. Steel Pipe Joints: Provide butt-welded joints, lap welded joints, flanged joints, or mechanical coupling connections as shown and specified in Exposed Piping Schedule. Provide tie rods connected to lugs welded to the steel pipe for restraint at mechanical couplings.
e. Thermoplastic, FRP and HDPE Joints: Where bell and spigot-type or other non-restrained joints are utilized, provide tie rods across the joint or other suitable joint restraint system, subject to approval of ENGINEER.

3.3 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:

1. Locations of existing piping shown on Drawings is approximate.

2. Determine the true location of existing piping to which connections are to be made, crossed, and that could be disturbed, and determine location of other facilities that could be affected by the Work.

B. Taking Existing Pipelines Out of Service:

1. Conform to Section 01 14 16, Coordination with Owner's Operations.

C. Work on Existing Pipelines:

1. Cut or tap pipes as shown or required with machines and tools specifically designed for cutting or tapping pipelines.

2. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.

3. Provide necessary adapters, sleeves, fittings, pipe, and appurtenances required to complete the Work.

4. Conform to applicable requirements of Section 01 14 16, Coordination with Owner's Operations and Section 01 73 24, Connections to Existing Facilities.

3.4 PAINTING

A. Field painting shall conform to Section 09 91 00, Painting.

3.5 FIELD QUALITY CONTROL

A. Testing, General:

1. Test all piping, except as exempted in the Exposed Piping Schedule.
2. Notification:
    a. Notify ENGINEER at least 48 hours prior to testing.
    b. When authorities having jurisdiction are to witness tests, notify ENGINEER and authorities having jurisdiction in writing at least 48 hours in advance of testing.
3. Conduct all tests in presence of ENGINEER.
4. Remove or protect pipeline-mounted devices that could be damaged by testing.
5. Provide all apparatus and services required for testing, including:
    a. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain OWNER's operations.
    b. Temporary bulkheads, bracing, blocking, and thrust restraints.
6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.
7. Unless otherwise specified, OWNER will provide fluid required for hydrostatic testing. CONTRACTOR shall provide means to convey fluid for hydrostatic testing into the pipe being tested. CONTRACTOR shall provide fluid for other types of testing required.
8. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.
9. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. Piping not installed by CONTRACTOR and that fails the test shall be repaired upon authorization of ENGINEER or OWNER. Repair of existing piping will be paid as extra work unless otherwise specified.

B. Test Schedule:

1. Refer to the Exposed Piping Schedule for type of test required and required test pressure.

2. Unless otherwise specified, the required test pressures are at lowest elevation of pipeline segment being tested.

3. For piping not listed in Exposed Piping Schedule:

   a. Hydrostatically test pipe that will convey liquid at a pressure greater than five psig. Provide process air pipe test for pipe that will convey air or gas under pressure or vacuum, except chlorine gas, which requires a separate test.

   b. Disinfect for bacteriological testing piping that conveys potable water.

4. Test Pressure:

   a. Use test pressures listed in Exposed Piping Schedule.

   b. If test pressure is not listed in Exposed Piping Schedule, or if a test is required for piping not listed in the Exposed Piping Schedule, test pressure will be determined by the ENGINEER based on the maximum anticipated sustained operating pressure and the methods described in the applicable ANSI/AWWA manual or standard that applies to the piping system.

C. Hydrostatic Testing:

1. Preparation for Testing:

   a. For thermoplastic pipe, follow procedures described in Section 7 of ANSI/AWWA Standard C605.b. For other piping follow procedures described in AWWA Manual M9. A wetting period is not required for pipe that is not cement mortar-lined.

   c. Prior to testing, ensure that adequate thrust protection is in place and all joints are properly installed.

2. Test Procedure:

   a. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in the pipe being tested.

   b. Expel air from pipe as required. Obtain approval of ENGINEER prior to tapping pipe for expelling air.

   c. Examine joints and valves, and make repairs to eliminate visible leakage.

   d. After specified wetting period, add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.

f. Timed test period shall not begin until after the pipe has been filled, exposed to the required wetting period, air has been expelled, and pressure stabilized.

g. Timed Test Period: After the stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure. The test pressure shall then remain steady for one hour, indicating no leakage.

h. Pump from a test container to maintain test pressure. Measure volume of fluid pumped from test container and record on test report. Record pressure at test pump at fifteen minute intervals for duration of test.

3. Allowable Leakage Rates: Leakage is defined as the quantity of fluid supplied to pipe segment being tested to maintain pressure within five psi of the test pressure during timed test period. Allowable leakage rates for piping are:

a. No Leakage: Pipe with flanged, welded, fused, threaded, soldered, or brazed joints.

c. Rates based on make-up allowance in AWWA Manual M9:

1) Prestressed concrete cylinder pipe and other types of concrete pipe joined with O-ring rubber gasket sealing members.

d. Rates based on formula or table in ANSI/AWWA C605:

1) Plastic pipe joined with O-ring gasket sealing members.

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E. Bacteriological Testing:

1. Bacteriological testing for potable water lines, finished water lines, and other piping per Exposed Piping Schedule, is specified in Article 3.6 of this Section.

3.6 CLEANING AND DISINFECTION

A. Cleaning, General: Clean pipe systems as follows:

1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in a manner approved by ENGINEER, prior to placing in service. Flush chlorine solution piping with water.

2. Piping 24-inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.

3. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with a five percent hypochlorite solution.

B. Cleaning of Chlorine Gas and Liquid Chlorine Systems:

1. General: All portions of system shall be cleaned free of oil and grease.

2. Clean chlorine piping per procedures in Chlorine Institute Pamphlet No. 6.

3. Plastic Pipe: Clean vacuum and liquid piping with a detergent and water and thoroughly rinse to remove all detergent, after which a cleaning ball or swab shall be drawn through the pipe.

C. Disinfection:

1. Disinfect all potable and finished water piping.

2. A suggested procedure for accomplishing complete and satisfactory disinfection is specified below. Other procedures may be considered for acceptance by ENGINEER.

a. Prior to disinfection, clean piping as specified and flush thoroughly.

b. Conform to procedures described in ANSI/AWWA C651. Continuous feed method of disinfecting shall be used, unless alternative method is acceptable to ENGINEER.

3. Water for initial flushing, testing, and disinfection will be furnished by OWNER. CONTRACTOR shall provide all temporary piping, hose, valves, appurtenances, and services required. Cost of water required for re-disinfection will be paid by CONTRACTOR to OWNER at the water utility's standard rates.

4. Chlorine shall be provided by OWNER.

5. Bacteriologic tests will be performed by OWNER. A certified test laboratory report will be provided to CONTRACTOR, if requested.

6. Chlorine concentration in the water entering the piping shall be between 50 and 100 ppm, such that a minimum residual concentration of 25 mg/l remains after a 24-hour retention period. Disinfect the piping and all related components. Repeat as necessary to provide complete disinfection.

7. After required retention period, the chlorinated water shall be flushed to a closed drain line, unless otherwise directed by ENGINEER. Properly dispose of chlorinated water in accordance with applicable regulations. Do not discharge chlorinated water to storm sewers, ditches, or overland.

3.7 EXPOSED PIPING SCHEDULE

A. The schedules listed below, following the "End of Section" designation, are a part of this Specification section.

1. Table 40 05 05-A, Exposed Piping Schedule.

+ + END OF SECTION + +

TABLE
40 05 05-A, EXPOSED PIPING SCHEDULE

Service	Diameter (inch)	Material	Interior Lining	Exterior Coating	Pressure Class/ Thickness	Joint	Test	Remarks
POT	8-12	DI	CL	P	Class 53	Flg	HYD (150), DBT	Pump Suction and Discharge, Valve Vault
OF	12	DI	CL	P	Class 53	Flg	HYD (15)	Elevated Tank Overflow
DR	8	DI	CL	P	Class 53	Flg	HYD (150)	Elevated Tank Drain
DR	2	PVC	--	--	Schedule 80	SW	HYD (100)	Sump Pump Discharge

The following abbreviations are used in the Exposed Piping Schedule.

A. Service Abbreviations

Service	Abbrev.		Service	Abbrev.
Potable Water	POT		Overflow	OF
Drain	DR			

B. Material Abbreviations

Material	Abbrev		Material	Abbrev.
Ductile Iron	DI		Polyvinyl Chloride	PVC
Cast Iron	CI		Chlorinated Polyvinyl Chloride	CPVC
Carbon Steel	CS		Polyethylene	PE
Stainless Steel	SS		High Density Polyethylene	HDPE
Copper	CU		Fiberglass Reinforced Plastic	FRP

C. Lining/Coating Abbreviations

Lining	Abbrev		Coating	Abbrev.
Cement Mortar Lined	CL		Painted	P
Glass Lined	GL		Insulated	I
Ceramic Epoxy	CE		Galvanized	Galv
Fusion Bonded Epoxy Lined	FBEL			
Plastic Lined	PL			

D. Joint Abbreviations

Joint Type	Abbrev		Joint Type	Abbrev.
Bell and Spigot	BS		Flanged	Flg
Restrained Bell and Spigot	RBS		Butt Weld	BW
Push-on Joint	POJ		Lap Weld	LW
Restrained Push-on Joint	RPOJ		Butt Fusion Weld	BFW
Mechanical Joint	MJ		Solvent Weld	SW
Restrained Mech. Joint	RMJ		Sleeve-type Flexible Coupling	SLFC
Soldered	Sd		Split Flexible Coupling	SPFC
Brazed	Bz		Plasticized PVC Coupling	PPVC
Threaded	Thd		Grooved or Shouldered End Coupling	GSEC
			Flanged Adapter	FA

E. Test Abbreviations

Test	Abbrev		Test	Abbrev.
Hydrostatic Test (test pressure in psig)	HYD ( )		Disinfection and Bacteriological Testing	DBT
Process Air Pipe Test (test pressure in psig)	PA ( )		Examination of Welds	EW
Chlorine Pipe Test	CL		Exfiltration Test	EX
			No Test Required	NR

SECTION 40 05 06

COUPLINGS, ADAPTERS, AND SPECIALS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install all couplings, adapters, and specials for process piping.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before couplings, adapters, and specials for process piping Work.

C. Related Sections:
   1. Section 09 91 00, Painting.
   2. Section 33 05 05, Buried Piping Installation
   3. Section 40 05 05, Exposed Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
   2. ANSI B16.39, Malleable Iron Threaded Pipe Unions.
   3. ASME B31, Standards of Pressure Piping.
   4. ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-dipped, Zinc-Coated, Welded and Seamless.
   5. ASTM A105/A105M, Specification for Carbon Steel Forgings and Piping Applications.
   6. ASTM B169/B169M Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar.
   7. ASTM B650, Specification for Electro-Deposited Engineering Chromium Coatings of Ferrous Substrates.
   8. ASTM F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer shall have at least five years experience producing substantial similar products to those specified and shall be able to provide documentation of at least five installations in satisfactory operation for at least five years each.

B. Component Supply and Compatibility:
   1. Obtain each type of coupling, adapter, and special for process piping product included in this Section, regardless of component manufacturer, from a single couplings, adapters, and specials manufacturer.
   2. Supplier shall prepare, or review, and approve all submittals for components furnished under this Section.
   3. Components shall be suitable for specified service conditions and be integrated into overall assembly by the Supplier.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Submit piping layout Shop Drawings in accordance with Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
   2. Product Data:
      a. Submit product data on each type of coupling, expansion joint, and other piping specialties and accessories, including gaskets, hardware, and appurtenances sufficient to demonstrate compliance with the Contract Documents.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. When requested by ENGINEER submit certificate attesting to compliance with standards referenced in this Section, signed by manufacturer.
   2. Manufacturer's Instructions:
      a. Provide instructions for handling, storing, installing, and adjusting of products.
   3. Source Quality Control:
      a. When requested by ENGINEER, submit results of source quality control tests.
   4. Qualifications Statements:
      a. Submit qualifications of manufacturer when requested by ENGINEER.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

PART 2 – PRODUCTS

2.1 COUPLINGS

A. Flanged Coupling Adapters:
   1. Description: One end of adapter shall be flanged and opposite end shall have sleeve-type flexible coupling.
   2. Products and Manufacturers: Provide one of the following:
      a. Style 227, as manufactured by Dresser Piping Specialties, part of Dresser, Inc.
      b. Style 912, by Smith Blair, Inc.
      c. Or equal.
   3. Pressure and Service: Same as connected piping.
   4. Material: Ductile iron.
   5. Gasket: Recommended by the manufacturer.
   6. Bolts and Nuts: Alloy steel, corrosion-resistant, primer-coated. For buried or submerged applications, provide stainless steel bolts complete with washers complying with ASTM F593, AISI Type 316 and nitrided stainless nuts.
   7. Harnessing:
      a. Harness adapters to restrain pressure piping. For pressure pipelines, test pressures are included in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
      b. For flanged adapters 12-inch diameter and smaller, provide 1/2-inch diameter (minimum) Type 316 stainless steel anchor studs installed in pressure-tight anchor boss. For buried or submerged applications, provide external bolting and other hardware of Type 316 stainless steel, including tie bolts, bolt plates, lugs, nuts, and washers. Provide number of studs required to restrain test pressure and service conditions. Harness shall be as designed and recommended by flanged adapter manufacturer. Provide the following minimum anchor studs unless otherwise approved by ENGINEER.
         1) Six-inch Diameter and Smaller: Two
         2) Eight-inch Diameter and Smaller: Four
         3) Ten-inch Diameter and Smaller: Six
         4) Twelve-inch Diameter and Smaller: Eight
      c. For adapters larger than 12-inch diameter, provide split-ring harness clamps with minimum of four corrosion-resistant alloy steel bolts. For buried or submerged applications, provide external bolting and other hardware of Type 316 stainless steel, including tie bolts, bolt plates, lugs, nuts, and washers. Harness assembly shall be as designed and recommended by flanged adapter manufacturer. Dimensions, sizes, spacing and materials shall be suitable for service and conditions encountered and shall be approved by ENGINEER.

2.2 MISCELLANEOUS SPECIALTIES AND ACCESSORIES

A. Dielectric Connections:
   1. General: Where copper pipe connects to steel pipe, cast-iron pipe, or ductile iron pipe, provide either dielectric union or an insulating section of rubber or

plastic pipe. When used, insulating section shall have minimum length of 12 pipe diameters.

2. Manufacturers: Provide products of one of the following:
   a. Epco Sales, Inc.
   b. Watts Regulator Company.
   c. Capitol Manufacturing Company.
   d. Or equal.
3. Dielectric Unions: Rated for 250 psi, ANSI B16.39.
4. Insulating Sections: Rated for same pressure as associated piping test pressure. Material shall be suitable for the application and service.

2.4 PAINTING

A. Shop Painting:
   1. Clean and prime-coat ferrous metal surfaces of products in the manufacturer's shop in accordance with Section 09 91 00, Painting, unless otherwise specified in this Section
   2. Coat machined, polished and non-ferrous surfaces bearing surfaces and similar unpainted surfaces with corrosion prevention compound that shall be maintained during storage and until products are placed into operation.

B. Field painting shall conform to Section 09 91 00, Painting.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect materials for defects in material and workmanship. Verify compatibility of products with pipe, fittings, valves, and appurtenances.

3.2 INSTALLATION

A. Installation:
   1. Install piping specialties in accordance with the Contract Documents and manufacturer's instructions.
   2. For buried installations, refer to Section 33 05 05, Buried Piping Installation.
   3. For exposed installations, refer to Section 40 05 05, Exposed Piping Installation.

B. Adjust expansion joints as required to ensure that expansion joints will be fully extended when ambient temperature is at minimum operating temperature, and fully compressed at maximum operating temperature for the system in which expansion joints are installed.

+ + END OF SECTION + +

SECTION 40 05 07

PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified and required to design, furnish, and install all hangers, supports and appurtenances necessary to complete the Work.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the pipe hangers and supports Work.

C. Related Sections:

1. Section 03 00 05, Concrete.
2. Section 05 50 13, Miscellaneous Metal Fabrications.
3. Section 09 91 00, Painting.
4. Section 40 05 06, Couplers, Adapters, and Specials for Process Piping.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:

1. American Society for Testing and Materials, (ASTM).
   a. ASTM A 575, Specification for Steel Bars Carbon, Merchant Quality, M-Grades.
   b. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.
2. Manufacturers Standardization Society of the Valve and Fittings Industry, (MSS).
   a. MSS SP 58, Pipe Hangers and Supports-Materials, Design and Manufacture.
   b. MSS SP 69, Pipe Hangers and Supports - Selection and Application.

1.3 QUALITY ASSURANCE

A. Each type of pipe hanger or support shall be the product of one manufacturer.

B. Component Supply and Compatibility:

1. Obtain all equipment included in this Section regardless of the component manufacturer from a single pipe hangers and supports manufacturer.

2. The pipe hangers and supports equipment manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.

3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the pipe hangers and supports equipment manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Detailed drawings showing all hangers and supports for each piping system specified. Shop Drawings shall show location, installation, material, loads or forces, and deflection of all hangers and supports.

b. Submit and coordinate these with Shop Drawings required for all piping systems.

2. Product Data:

a. Submit manufacturers' catalogs, literature, and engineering data on all hangers and supports. Load ratings, materials and installation shall be consistent with the recommendations of the MSS SP 58 and MSS SP 69.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.

B. Storage and Protection:

1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

2. Store materials in covered storage off the ground and prevent condensation.

C. Acceptance at Site:

1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Hangers and supports shall meet with the following requirements:

1. Standard and fabricated hangers and supports shall be furnished complete with necessary inserts, bolts, nuts, rods, washers, and other accessories.

2. Generally, run piping in groups where practicable and parallel to building wall. Provide minimum clearance of 1-inch between pipe and other work.

3. Install hangers or supports at all locations where pipe changes direction.

4. All hangers and supports shall be capable of adjustment after placement of piping.

5. Different types of hangers or supports shall be kept to a minimum.

6. All suspended or supported ductile iron pipe shall have a hanger or support adjacent to each hub.

7. Support vertical piping at each floor and between floors by stays or braces to prevent rattling and vibration.

8. Hanger rods shall be straight and vertical. Chain, wire, strap or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.

9. Maximum support spacing unless otherwise shown or approved for standard weight pipe shall be as follows:

Pipe Size (inches)	Maximum Pipe Span [1] (feet)			
	Steel	Copper	Plastic [2]	Cast/Ductile Iron [4]
3/8 to 3/4	5	6	Cont. [3]	-
1	6	6	5	-
1-1/4	6	6	5	-
1-1/2	6	6	5	-
2	10	10	5	-
2-1/2	10	10	5	-
3	10	10	5	-
4	12	12	5	12 feet for pressure pipe
6	12	12	5	
8	12	12	5	
10	12	-	5	
12	12	-	10	
14	12	-	-	
16	12	-	-	
18	12	-	-	10 feet for soil pipe
20	12	-	-	
24	12	-	-	

[1]Pipe shall not have pockets formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.

[2]Span shown is for Schedule 80 CPVC pipe at 100°F. Spans for other plastics, other CPVC pipe Schedules and pipes at higher temperatures shall be shortened in accordance with the pipe manufacturer's recommendations.

[3]Continuous means pipe shall be in unistrut or similar channel.

[4] Pipe hanger and support selection shall be as shown and in this Section.

10. Maximum support spacing, unless otherwise shown for plastic pipe at ambient temperature, shall be one-half of the values specified for steel pipe.

11. Plastic pipe at temperature greater than 130ºF shall be continuously supported in a metal cradle or tray.

12. Where proper hanger or support spacing does not correspond with joist or rib spacing, structural steel channels may be attached to joists or ribs and pipes suspended there from.

13. Prevent contact between dissimilar metals when supporting copper tubing, by use of copper plated, rubber or vinyl coated, or stainless steel hangers or supports.

14. Isolate thin walled stainless steel piping from carbon steel by use of plastic coated hangers or supports or by taping at points of contact with PVC or vinyl.

15. Supports and hangers shall be of a material that is compatible with the fluid being conveyed in such pipe being supported.

16. Anchors for pipe support systems shall be compatible or protected by a coating system which is compatible with the fluid being conveyed in such pipe being supported.

B. Expansion compensation shall be designed for individual exposed piping systems with the following Design Criteria:

1. $\Delta L = L \times \Delta T \times \alpha$

a. Where ΔL = pipe length change (inches).

b. L = pipe length between anchors (inches).

c. $\Delta T = 100$ (F).

d. α = coefficient of thermal expansion (inches/inches/F).

2. Expansion compensation shall be designed as an integral part of the piping hanger, support and anchorage system.

2.2 HANGERS AND SUPPORTS

A. Hangers and supports where shown shall be in accordance with detail drawings. Hangers and supports not shown shall be in accordance with MSS SP 58.

B. Manufacturers: Provide products of one of the following:

1. Anvil International, Inc.

2. Elcen.

3. B-Line.

4. Unistrut Corporation.

5. Or approved equal.

2.3 ACCESSORIES

A. Hanger rods shall be made from ASTM A 575, with square head nut on top and running thread on bottom end.

B. Concrete Inserts:

1. Concrete inserts shall be MSS SP 58 malleable Type 18.

2. Manufacturers: Provide products of one of the following:

a. Unistrut Corporation, Wayne, Michigan.

b. Elcan Metal Products, Company, Franklin Park, Illinois.

c. B-Line.

d. Anvil International, Inc.

e. Or approved equal.

C. Steel Beam Clamps:

1. Steel beam clamps shall be of malleable iron and conform to MSS SP 58 Type 21.

D. Inserts for Pipe Insulation:

1. Insulated pipe, larger than 1-1/2-inches in diameter, shall be supported by a rigid insert to protect the insulation. A steel metal saddle of sufficient gauge to carry the weight of the pipe and its fluid without deforming shall extend 2-inches minimum on each side of the rigid insert. The joints between insert and insulation shall be sealed before saddle is installed. Sizes up to 6-inches IPS shall be MSS SP 58, Type 40, and for sizes over 10-inches shall be MSS SP 58, Type 39.

E. Brackets:

1. Brackets for wall mounting shall conform to MSS SP 58 Type 32 or 33 based on load supported.

2.4 PAINTING

A. Clean and prime ferrous metal surfaces in the shop in accordance with the requirements of Section 09 91 00, Painting.

B. Field painting shall conform to the requirements of Section 09 91 00, Painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate hangers, supports, and accessories to support piping, valves, and at all concentrated loads.

B. Locate hangers, supports, and accessories within maximum span lengths specified to support continuous pipeline runs unaffected by concentrated loadings.

C. Locate hanger, supports to prevent vibration or swaying and to provide for expansion and contraction.

1. Temperature differential specified in this Section.

2. Support piping independently so that equipment is not stressed by piping weight or expansion.

3. For Uninsulated Copper Pipe or Tubing: Clamps and supports, electroplated copper finish. Instrumentation tubing shall be supported in steel or aluminum troughs with covers. All tubing layout and connections shall be as approved by the manufacturer of the equipment.

4. Uncoated Hangers, Rods and Supports: Dip in zinc chromate primer before installation.

5. Hanger types for horizontal piping, except as noted and shown:

   a. Forged steel adjustable clevis type, rod support for all services.

   b. Slide Bases:

      1) Pipe stand, brackets, trapeze or other equivalent structural support.

      2) For piping 2-inches or larger.

   c. For pipe and covering provide:

      1) Saddles for rollers or slide bases.

      2) Protective shields or saddles for all other types of supports.

   d. Threaded Steel Rods:

      1) Two inch vertical adjustment with two nuts each end for positioning and locking.

      2) Size hanger rods according to the schedule below, unless otherwise noted:

Nominal Pipe (Inches)	Rod Diameter (Inches)
2 and less	3/8
2-1/2 to 3-1/2	1/2
4	5/8
6	3/4
8 through 12	7/8
14 through 18	1
20 through 30	1-1/4

      3) For Double Rod Hangers: One size smaller than above.

      4) Connection to Structure for Piping to 2-Inches: Concrete inserts, or expansion shields in shear into sides of beams.

5) Connection to Structure for Piping 2-1/2-Inch or Larger: Concrete inserts, beam clamps or suitable bridging.

6. Vertical Piping:
   a. Base Support: Base elbow or welded equivalent.
      1) Bearing plate on structural support.
   b. Guides not to exceed:
      1) 25 feet for piping to 2-inches.
      2) 36 feet for piping 2-1/2-inches or larger.
   c. Top Support:
      1) Special hanger or saddle in horizontal connection.
      2) Provisions for expansion.
   d. Intermediate Supports: Steel pipe clamp at floor.
      1) Bolted and welded to pipe.
      2) Extension ends bearing on structural steel or bearing plates.
   e. For Multiple Pipes: Coordinate guides, bearing plates and accessory steel.
7. Insulated Piping:
   a. Horizontal Pipe Shields at Supports:
      1) Minimum 120 degree arc.
      2) Length equal to diameter of insulation 12-inch minimum.
      3) To 6-Inch Pipe Size: No. 18 USSG galvanized steel.
   b. Vertical Pipe Shields at Guides:
      1) Full 360 degree arc, securely banded.
      2) Length equal to diameter of insulation, 12-inch minimum.
      3) To 6-Inch Pipe Size: No. 18 USSG galvanized steel.

D. Install items to be embedded before concrete placement.

E. Fasten embedded items securely to prevent movement during concrete placement.

F. Install hangers and support units on piping systems in accordance with manufacturer's recommendations.

G. Adjust hangers and supports and place grout for concrete supports to bring pipelines to specified elevations.

H. Bring all pipe systems up to operating pressures and temperatures. Cycle systems to duplicate operating conditions. Correct all support malfunctions.

+ + END OF SECTION + +

SECTION 40 05 08

WALL PIPES, FLOOR PIPES, AND PIPE SLEEVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all floor pipes, pipe sleeves, wall pipes, other wall pieces, and escutcheons to complete the Work.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate with the installation of floor pipes, pipe sleeves, wall pipes, other wall pieces and escutcheons that must be installed with or within formwork, walls, partitions, ceilings and panels.

C. Related Sections:
   1. Section 03 30 00, Cast-In-Place Concrete.
   2. Section 07 92 00, Joint Sealants.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American National Standards Institute, (ANSI).
      a. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
      b. ANSI B16.4, Gray-Iron Threaded Fittings.
   2. American Water Works Association, (AWWA).
      a. AWWA C104 (ANSI A21.4), Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
      b. AWWA C110 (ANSI A21.10), Ductile-Iron and Gray-Iron Fittings, for Water.
      c. AWWA C111 (ANSI A21.11), Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
      d. AWWA C115 (ANSI A21.15), Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
      e. AWWA C151 (ANSI A21.51), Ductile-Iron Pipe, Centrifugally Cast, for Water.
      f. AWWA C200, Steel Water Pipe 6-Inches and Larger.

1.3 QUALITY ASSURANCE

A. Component Supply and Compatibility:

1. Obtain all equipment included in this Section regardless of the component manufacturer from a single wall pipes, floor pipes and pipe sleeves manufacturer.
2. The wall pipes, floor pipes and pipe sleeves manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the wall pipes, floor pipes and pipe sleeves manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Detailed drawings and data on all wall and floor pipe, and pipe sleeves. Submit and coordinate these with Shop Drawings required for all piping systems.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wall and Floor Pipes:
   1. Material: Same as specified for the piping connected to wall or floor pipe, unless otherwise approved by ENGINEER.
   2. End Connections: As shown.
   3. Thickness: Same as specified for the piping connected to wall or floor pipe.
   4. Collars: Provide collars at mid-point of wall for anchorage and watertightness.
   5. Pipes ends shall be flush with wall face, unless otherwise shown.
   6. Drill and tap flanged ends and mechanical joint bells for studs. Provide studs of same material as connected piping, except submerged and buried studs shall be of Type 316 stainless steel.

B. Pipe Sleeves:
   1. Ferrous and Plastic Pipe: Use standard weight galvanized steel pipe, unless otherwise shown.
   2. Copper Pipe: Use Type K hard drawn copper pipe, unless otherwise shown.

C. Cast Wall Sleeves:
   1. Material: Ductile iron furnished with integral wall collar.

2. Dimensions: As required for mechanical joint pipe to pass through sleeve. Length as required.

D. Link Seals: Provide link type mechanical seals suitable for 20 psi working pressure, corrosive service and accessible from one side, with glass-reinforced nylon pressure plate and stainless steel bolts and nuts.
   1. Products and Manufacturers: Provide one of the following:
      a. Link-Seal, as manufactured by Thunderline Corporation.
      b. Or equal.

E. Wall and Ceiling Plates:
   1. Bare pipes passing through walls and ceilings in finished rooms: Provide escutcheon plates of cast brass or cast-iron nickel plated, clevis or split ring and hinged with set screws.
   2. Provide plated escutcheon plates of 18-gauge steel for insulated pipes passing through walls and ceilings in finished rooms.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wall and Floor Pipes: Install as shown and in accordance with approved Shop Drawings.

B. Pipe Sleeves:
   1. Use sleeves wherever pipes pass through walls, partitions, floors, and roofs, unless otherwise shown.
   2. Extend all sleeves through floor slabs a minimum of 2-inches above finished floor.
   3. Anchor sleeves to concrete and masonry walls as shown or otherwise approved.
   4. All sleeves through walls shall be flush with wall face.
   5. All pipe joints and annular spaces in exterior walls or walls subjected to hydrostatic pressure shall be completely watertight.
   6. Use link type seals to seal sleeve against hydrostatic pressure. Size sleeves to provide annular space required to suit the link type mechanical seals that are used.
   7. Do not install sleeves and pipes through structural members, unless specifically shown and approved by ENGINEER.
   8. Size sleeves to provide annular space as follows:

Pipe Size	Sleeve ID Minus Pipe Or Insulation OD
Less than 2-inches	1/2-inches to 3/4-inches
2-inches to 4-inches	3/4 inches to 1-1/4-inches.

6-inches to 12-inches	1-1/4 inches to 2-inches
Over 12-inches	2-inches to 3-inches

C. Install wall and ceiling plates in accordance with the manufacturer's recommendations and approved Shop Drawings.

+ + END OF SECTION + +

SECTION 40 05 19

DUCTILE IRON PROCESS PIPE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish ductile iron pipe and fittings.
   2. Extent of piping is shown on the Drawings. Piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, specify pipe service, diameter, material, lining, coating, pressure rating, joint type, and testing required.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before ductile iron pipe Work.

C. Related Sections:
   1. Section 31 20 00, Earth Moving.
   2. Section 09 91 00, Painting.
   3. Section 33 05 05, Buried Piping Installation.
   4. Section 40 05 05, Exposed Piping Installation.
   5. Section 40 05 06, Couplers, Adapters, and Specials for Process Piping.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series.
   2. ANSI B18.2.2, Square and Hex Nuts. (Inch Series).
   3. ASTM A193, Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service.
   4. ASTM A194, Specification for Carbon Steel and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
   5. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
   6. ASTM A354, Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners.
   7. ASTM A563, Specification for Carbon and Alloy Steel Nuts.
   8. ASTM B117, Practice for Operating Salt Spray (Fog) Apparatus.
   9. ASTM C283, Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
   10. ASTM D714, Test Method for Evaluating Degree of Blistering of Paints.

11. ASTM D792, Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
12. ASTM D5162, Discontinuity (Holiday) Testing of Non-Conductive Protective Coating on Metallic Substrates.
13. ASTM E96, Test Methods for Water Vapor Transmission of Materials.
14. ASTM G14, Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).
15. ASTM G62, Test Methods for Holiday Detection in Pipeline Coatings.
16. ASTM G95, Test Methods for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method).
17. ANSI/AWWA C104, Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
18. ANSI/AWWA C110, Ductile Iron and Gray Iron Fittings for Water.
19. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
20. ANSI/AWWA C115, Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.
21. ANSI/AWWA C116, Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings for Water Service.
22. ANSI/AWWA C151, Ductile Iron Pipe, Centrifugally Cast, for Water.
23. ANSI/AWWA C153, Ductile Iron Compact Fittings, 3 inch through 24 inch and 54 inch through 64 inch for Water Service.
24. ANSI/AWWA C606, Grooved and Shouldered Type Joints.
25. European Standard (EN), EN 598: Ductile Iron Pipe, Fittings, Accessories and Their Joints for Sewerage Applications.
26. MSS-SP 60, Connecting Flange Joint Between Tapping Sleeves and Tapping Valves.
27. NACE RP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
28. NAPF 500-03, Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.
29. NSF/ANSI 61, Drinking Water System Components - Health Effects.
30. SSPC PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
31. SSPC Painting Manual, Volume 1, Para. XIV.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Manufacturer shall have a minimum of five years successful experience producing ductile iron pipe and fittings and shall be able to show evidence of at least five installations in satisfactory operation in the United States that are similar applications to the specified service.
      b. Lining and coating products shall be manufactured by a firm with a minimum of five years successful experience in protecting pipelines exposed to the specified service conditions, and shall be able to show

evidence of at least five installations in satisfactory operation in the United States that are similar applications to the specified service.

c. When not applied by the manufacturer, lining and coating Subcontractor shall have a minimum of five years successful experience in the application of the specified linings and coatings for similar applications for the specified service, and shall be able to show evidence of at least five installations in satisfactory operation in the United States.

B. Supply and Compatibility:
1. Unless otherwise approved, obtain all pipe, fittings, and appurtenances included in this Section from a single ductile iron pipe manufacturer.
2. Ductile iron pipe manufacturer shall review and approve or prepare all Shop Drawings and other submittals for pipe, fittings, and appurtenances furnished under this Section.
3. Pipe, fittings, and appurtenances shall be suitable for the specified service and shall be integrated into overall piping system by ductile iron pipe manufacturer.
4. Ductile iron pipe manufacturer shall be responsible for all products and all factory-applied linings and coatings, whether installed at pipe manufacturer's facility or at manufacturer's Supplier's facility.

C. Regulatory Requirements:
1. Pipe and fittings, including linings and coatings, that will convey potable water or water that will be treated to become potable, shall be certified by an accredited organization in accordance with NSF/ANSI 61 as being suitable for contact with potable water, and shall comply with requirements of authorities having jurisdiction at Site.

1.4 SUBMITTALS

A. Action Submittals: Submit the following with Shop Drawings required under Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation:
1. Shop Drawings:
a. Detailed drawings and data for pipe, fittings, gaskets, appurtenances, linings, and coatings.
2. Samples:
a. Submit Sample of pipe and fitting with each type of lining, for use at the Site to verify continuity, surface gloss, and color, as applicable, via visual inspection.
3. Test Procedures: For linings and coatings in pipe and fittings.

B. Informational Submittals: Submit the following:
1. Certificates:
a. Submit certificate signed by manufacturer of each product that product conforms to applicable referenced standards and the Contract Documents.
2. Source Quality Control Submittals:

a. Submit results of specified shop tests for pipe, fittings, linings, and coatings.
b. Lining and coating test coupons.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General:
1. Piping systems shall be suitable for their intended use.
2. Joints shall be as specified in Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation. If not specified, provide flanged joints for exposed piping and push-on or mechanical joints for buried piping. Provide couplings on pipe with plain or grooved ends where shown or where approved by ENGINEER.

B. Ductile Iron Pipe, Joints, and Fittings:
1. Flanged Pipe: Fabricate in accordance with ANSI/AWWA C115.
a. Pressure Rating: As specified in piping schedule in Section 40 05 05, Exposed Piping Installation. If not otherwise specified, use Special Thickness Class 53 for three-inch to 54-inch diameter pipe and Pressure Class 350 for 60-inch and 64-inch diameter pipe.
2. Non-Flanged Pipe: Conform to ANSI/AWWA C151 for material, pressure, dimensions, tolerances, tests, markings, and other requirements.
a. Pressure Class: As specified in piping schedules in Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation.
b. Special Thickness Class: As specified in piping schedules in Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation.
3. Pipe Joints:
a. Flanged Joints: Conform to ANSI/AWWA C110 and ANSI/AWWA C111 capable of meeting the pressure rating or special thickness class, and test pressure specified in piping schedule in Section 40 05 05, Exposed Piping Installation.
1) Gaskets: Unless otherwise specified, gaskets shall be at least 1/8-inch thick, ring or full-face as required for the pipe, of synthetic rubber compound containing not less than 50 percent by volume nitrile or neoprene, and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall be suitable for the service conditions specified, specifically designed for use with ductile iron pipe and fittings.

2) Bolts: Comply with ANSI B18.2.1.
   a) Exposed: ASTM A307, Grade B.
   b) Buried or Submerged: ASTM A193, Grade B8M, Class 2, Heavy hex, Type 316 stainless steel.
3) Nuts: Comply with ANSI B18.2.2.
   a) Exposed: ASTM A563, Grade A, Heavy hex.
   b) Buried or Submerged: ASTM A194, Grade B8M, Heavy hex, Type 316 stainless steel.

b. Mechanical Joints: Comply with ANSI/AWWA C111 and ANSI/AWWA C151, capable of meeting pressure rating or special thickness class, and test pressure specified in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
1) Glands: Ductile iron.
2) Gaskets: Plain tip.
3) Bolts and Nuts: High strength, low alloy steel.
4) Manufacturers: Provide products of one of the following:
   a) Clow Water Systems Company
   b) Atlantic States Cast Iron Pipe Company
   c) Canada Pipe Company, Ltd.
   d) McWane Cast Iron Pipe Company
   e) Pacific States Cast Iron Pipe Company
   f) Griffin Pipe Products Co.
   g) American Cast Iron Pipe Co.
   h) U.S. Pipe and Foundry Co.
   i) Or equal.

c. Push-On Joints: Comply with ANSI/AWWA C111 and ANSI/AWWA C151, capable of meeting pressure class or special thickness class, and test pressure specified in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
1) Gaskets: Vulcanized SBR, unless otherwise specified.
2) Stripes: Each plain end shall be painted with a circular stripe to provide a guide for visual check that joint is properly assembled.
3) Products and Manufacturers: Provide one of the following:
   a) Tyton or Fastite Joint by Clow Water Systems, Atlantic States Cast Iron Pipe Company, Canada Pipe Company, Ltd., McWane Cast Iron Pipe Company, Pacific States Cast Iron Pipe Company, and Griffin Pipe Products Company.
   b) Fastite Joint by American Cast Iron Pipe Company.
   c) Tyton Joint by U.S. Pipe and Foundry Company.
   d) Or equal.

d. Grooved End Joints: Comply with ANSI/AWWA C606.
1) Gaskets: Flush seal type designed for ductile iron that complies with or exceeds requirements of ASTM D2000
2) Bolts and nuts: As specified for flanged joints.
3) Unless otherwise specified, grooved end couplings shall be rigid joint for exposed service and flexible joint for buried service.
4) Products and Manufacturers: Provide one of the following:

a) Victaulic, Style 31.
b) Or equal.

e. Restrained Joints: Restrained push-on joints shall be capable of being deflected after full assembly. Field cuts of restrained pipe are not allowed without approval of ENGINEER.
1) Products and Manufacturers: Provide restrained joints for mechanical joint piping by one of the following:
a) Megalug, Series 1100, by EBBA Iron Sales, Inc.
b) MJ Coupled Joint, by American Cast Iron Pipe Co.
c) MJ Field Lok, by U.S. Pipe and Foundry Co.
d) Or equal.
2) Products and Manufacturers: Provide restrained joints for push-on joint piping by one of the following:
a) Super-Lock Joint Pipe, by Clow Water Systems, a division of McWane, Inc.
b) Lok-Ring Joint, or Flex-Ring Joint, by American Cast-Iron Pipe Company.
c) TR Flex Joint, by U.S. Pipe and Foundry Company.
d) Snap-Lok, by Griffin Pipe Products Company.
e) Or equal.

4. Flanged and Push-On Joint Fittings: Comply with ANSI/AWWA C110 and ANSI/AWWA C111.
a. Material: Ductile iron.
b. Pressure rating, gaskets, bolts, and nuts shall be as specified for flanged joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of the connected pipe.
5. Mechanical Joint Fittings: Comply with ANSI/AWWA C110 and ANSI/AWWA C111.
a. Material: Ductile iron.
b. Glands: Ductile iron.
c. Pressure rating, gaskets, bolts, and nuts shall be as specified for mechanical joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of connected pipe.

C. Cement-mortar Lining:
1. Where specified in piping schedules included with Section 33 05 05, Buried Piping Installation and Section 40 05 05, Exposed Piping Installation, pipe and fittings shall be lined with bituminous seal coated cement-mortar lining in accordance with ANSI/AWWA C104.

D. Couplings:
1. Refer to Section 40 05 06, Couplings, Adapters, and Specials for Process Piping.

E. Specials:
1. Transition Pieces:
a. Provide suitable transition pieces (adapters) for connecting to existing

piping.
b. Unless otherwise shown or indicated, expose existing piping to determine material, dimensions, and other data required for transition pieces.

2. Taps:
a. Provide taps where shown or required for small-diameter piping or instrumentation connections.
b. Provide corporation stops where shown or required.
c. Where pipe wall thickness or tap diameter will not allow engagement of 8 full threads, provide tapping saddle with outlet joints conforming to requirements of Paragraph 2.1.B.3.a of this Section for four-inch through 12-inch diameter pipe, and Paragraph 2.1.B.3.b. for 14-inch through 54-inch diameter pipe.
d. For flanged connections on tapping saddle outlet branch, counterbore flange in accordance with MSS SP-60 dimensions. Inside diameter of outlet shall be 1/4-inch greater than nominal diameter.

3. Tangential Outlets:
a. Provide tangential outlet fittings where shown or indicated.
b. Weld-on fittings are acceptable.
c. Flanged and grooved end joints are not allowed.

2.2 MARKING FOR IDENTIFICATION

A. In addition to identification markings specified in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, also stamp, mark, and identify push-on joint and mechanical joint pipe with:
1. Name or trademark of manufacturer.
2. Weight, class or nominal thickness, and casting period.
3. Country where cast.
4. Year the pipe was produced.
5. Letters “DI” or “Ductile” shall be cast or metal stamped

B. In addition to identification markings specified in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, also stamp, mark, and identify flanged pipe with:
1. Flange manufacturer’s mark, size, and letters “DI” cast or stamped on the flanges.
2. Fabricator’s mark if other than flange manufacturer.
3. Length and weight.

C. In addition to identification markings specified in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation, also stamp, mark, and identify fittings with:
1. Manufacturer’s identification.
2. Pressure rating.
3. Nominal diameters of openings.
4. Country where cast.
5. Number of degrees or fraction of the circle on bends.

6. Letters “DI” or “Ductile” cast on them.

2.3 EXTERIOR SURFACE PREPARATION AND COATINGS

A. General Coating Requirements:
   1. Coating types are specified in piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

B. Exposed Pipe and Fittings:
   1. Surface Preparation:
      a. Initial Surface Inspection: Pipe and fitting manufacturer and coating applicator shall inspect surface to be coated and mutually determine recommended NAPF 500-03 surface preparation method.
      b. Surface Preparation: Prepare surface in accordance with recommended NAPF 500-03 method.
      c. Finished Surface Inspection: Prepared surfaces shall be inspected by coating applicator prior to application to determine acceptability of finished surface. If surface is unacceptable, repeat surface preparation and re-application as necessary.
   2. After recommended surface preparation, prime coat exterior ferrous metal surfaces of pipe and fittings in the shop in accordance with Section 09 91 00, Painting.
   3. Field painting shall comply with Section 09 91 00, Painting.

C. Buried Pipe and Fittings:
   1. Asphaltic Coating: Where specified in piping schedule in Section 33 05 05, Buried Piping Installation, coat pipe and fittings with an asphaltic coating approximately one-mil thick, in accordance with ANSI/AWWA C151, ANSI/AWWA C115, ANSI/AWWA C110, and ANSI/AWWA C153, as applicable.

PART 3 – EXECUTION

3.1 INSPECTION

A. Inspect piping to assure that piping is free from defects in material and workmanship. Verify compatibility of pipe, fittings, gaskets, linings, and coatings.

B. Visually inspect at the Site coated or lined pipe and fittings with ENGINEER and compare to approved Samples to verify lining continuity, surface gloss, and color, as applicable. Notify pipe manufacturer of damaged or unacceptable products. Pipe manufacturer shall visit the Site and perform testing to verify conformance with the Contract Documents to determine if products require replacement or repair. Repair or replace unacceptable products at no cost to OWNER.

3.2 INSTALLATION AND FIELD QUALITY CONTROL

A. For buried piping installation and testing, refer to Section 33 05 05, Buried Piping Installation.

B. For exposed piping installation and testing, refer to Section 40 05 05, Exposed Piping Installation.

+ + END OF SECTION + +

SECTION 40 05 31

THERMOPLASTIC PROCESS PIPE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install thermoplastic piping and fittings.
   2. Extent of piping is shown and shall be in accordance with piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before thermoplastic piping Work.

C. Related Sections:
   1. Section 33 05 05, Buried Piping Installation.
   2. Section 40 05 05, Exposed Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. AASHTO, Standard Specifications for Highway Bridges.
   2. ASTM D1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   3. ASTM D1785, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
   4. ASTM D2464, Specification for Threaded Poly (Vinyl Chlorinated) (PVC) Plastic Pipe Fittings, Schedule 80.
   5. ASTM D2466, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   6. ASTM D2467, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
   7. ASTM D2513, Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
   8. ASTM D2564, Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
   9. ASTM D2665, Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

10. ASTM D683, Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
11. ASTM D3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
12. ASTM D3035, Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
13. ASTM D3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
14. ASTM D3212, Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
15. ASTM D3222, Unmodified Poly (Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
16. ASTM D3261, Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
17. ASTM D3311, Specification for Drain, Waste and Vent (DWV) Plastic Fittings Patterns.
18. ASTM D3350, Specification for Polyethylene Plastic Pipe and Fittings Materials.
19. ASTM D4101, Specification for Polypropylene Injection and Extrusion Materials.
20. ASTM F437, Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
21. ASTM F438, Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
22. ASTM F439, Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
23. ASTM F441/F441M, Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
24. ASTM F442/F442M, Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
25. ASTM F477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
26. ASTM F656, Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
27. ASTM F679, Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
28. ASTM F714, Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
29. ASTM F1055, Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
30. ASTM F1336, Specification for Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings.
31. ASTM F1674, Standard Test Method for Joint Restraint Products for Use with PVC Pipe.
32. ASTM F1760, Specification for Coextruded Poly (Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content.

33. AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In.-12 In. (100 mm-300 mm), for Water Transmission and Distribution
34. AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
35. AWWA C905, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In.-48 In. (350 mm-1,200 mm).
36. AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission.
37. AWWA C907, Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm).
38. NSF 14, Plastic Piping Systems Components and Related Material.
39. ANSI/NSF 61, Drinking Water System Components - Health Effects.
40. Standards of U.S. Food and Drug Administration.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Shall have a minimum of five years experience producing thermoplastic pipe and fittings substantively similar to the materials specified, and shall be able to submit documentation of satisfactory service in at least five completed installations in operation for at least five years each.
   2. Installer:
      a. Engage a single pipe installer who shall be responsible for all thermoplastic pipe Work, and who shall employ only tradesmen with specific skills and experience in the type of Work required.
      b. Installer shall have a minimum of five years experience installing thermoplastic pipe and fittings substantively similar to the materials specified and substantively similar to or larger than the scope of thermoplastic piping Work on the Project, and shall be able to submit documentation of satisfactory experience in at least five completed installations in operation for at least five years each.

B. Component Supply and Compatibility:
   1. Obtain all materials included in this Section, regardless of component Supplier, from a single thermoplastic pipe Supplier. All pipe of each material type shall be furnished by the same manufacturer.
   2. Thermoplastic pipe Supplier shall review and approve to prepare all Shop Drawings and other submittals for all materials furnished under this Section.
   3. Materials shall be suitable for specified service conditions and shall be integrated into overall assembly by thermoplastic pipe Supplier.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:

a. Submit piping layout Shop Drawings in accordance with Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

2. Product Data:
   a. Submit product data on pipe, fittings, gaskets, hardware, and appurtenances sufficient to demonstrate compliance with the Contract Documents.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Submit manufacturer's certificate of compliance standards referenced in this Section.
   2. Source Quality Control Submittals:
      a. When requested by Engineer, submit results of source quality control tests.
   3. Qualifications Statements:
      a. Submit qualifications of manufacturer when requested by Engineer.
      b. Submit qualifications of installer when requested by Engineer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

PART 2 – PRODUCTS

2.1 SERVICE CONDITIONS

A. General:
   1. Pipe materials shall be suitable for services intended. Refer to piping schedules in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.
   2. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, and other defects. Unless otherwise shown or indicated, pipe shall be uniform in color, opacity, density, and other physical properties.
   3. Comply with NSF 14.
   4. Buried pipe shall be capable of withstanding external live load, including impact, equal to AASHTO H-20 loading, with cover shown or indicated on the Drawings.
   5. Pipe, fittings, and appurtenances in contact with potable water or water that will be treated to become potable shall be listed in ANSI/NSF 61 as being suitable for contact with potable water, and shall comply with requirements of the authorities having jurisdiction at the Site.

2.2 POLYVINYL CHLORIDE (PVC) PIPING

A. PVC Pipe – General Applications: Unless otherwise shown or indicated, PVC pipe shall comply with the following:
   1. Manufacturers: Provide products of one of the following:
      a. Ipex, Inc.
      b. Spears Manufacturing Company.
      c. Or equal.
   2. Material: Unless otherwise specified, comply with the following:
      a. Type and Grade: Type 1, Grade 1.
      b. Wall Thickness: Schedule 80 complying with ASTM D1784 and ASTM D1785, and US Product Service PS 21-70 as having same outside diameter dimension as cast-iron pipe.
      c. Temperature Rating: Rated for temperature to 140 degrees F.
      d. Color: Gray.
   3. Fittings: Type, grade, schedule, and color of fitting shall match the associated pipe.
      a. Solvent Weld: Comply with ASTM D2467.
      b. Threaded: Threaded fittings shall comply with ASTM D2464.
      c. Flanged: Provide flanged fittings with EPDM gaskets.
   4. Joints:
      a. Solvent Weld: Use primer and solvent cement recommended by PVC pipe manufacturer for the application. Primer shall be in accordance with ASTM F656, and solvent cement shall be in accordance with ASTM D2564.
      b. Threaded: Use 100 percent virgin polytetrafluoroethylene (Teflon or PTFE) tape for threaded fittings. Pipe shall not be threaded.
      c. Flanged: Provide with backup flange minimum 1/8-inch thick. Backup flanges and connecting bolts shall be Type 304 stainless steel.

B. Buried PVC Gravity Sewer Pipe.
   1. Manufacturers: Provide products of one of the following:
      a. Ipex, Inc.
      b. Diamond Plastics Corp.
      c. Or equal.
   2. Material:
      a. Pipe shall comply with ASTM D3034 or ASTM F679 (as applicable).
      b. Wall Thickness and Pipe Stiffness: Pipe stiffness shall be determined in accordance with test methods in ASTM D3034 or ASTM F679 (as applicable).
         1) Main Line: SDR 35, with minimum ring stiffness of 46 psi.
         2) Service Laterals: SDR 28, with minimum ring stiffness of 90 psi.
   3. Fittings:
      a. Injection-molded, gasketed fittings shall comply with ASTM F1336, and ASTM D3034 or ASTM F679 (as applicable).
      b. Fabricated fittings shall comply with ASTM F1336.
      c. Unless otherwise shown or indicated, saddle wyes are unacceptable.
   4. Joints:

a. Provide bell and spigot joints. Bell shall consist of an integral wall section to hold securely in place (and prevent displacement during assembly of joint) elastomeric O-ring gasket.
b. Jointing lubricant shall be as recommended by pipe manufacturer.
c. Provide elastomeric gaskets complying with ASTM F477, and ASTM D3139 or ASTM D3212.

2.3 IDENTIFICATION

A. Pipe material identification requirements are in Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

2.4 SOURCE QUALITY CONTROL

A. Shop Tests:
1. Pipe manufacturer shall maintain continuous quality control program.
2. Where applicable and when requested by Engineer, submit results of source quality control tests specified in reference standards.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect pipe materials for defects in material and workmanship. Verify compatibility of pipe and fittings.

3.2 INSTALLATION

A. For buried piping installation, refer to Section 33 05 05, Buried Piping Installation.

B. For exposed piping installation, refer to Section 40 05 05, Exposed Piping Installation.

+ + END OF SECTION + +

SECTION 40 05 53

PROCESS VALVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install process valves and appurtenances, complete and operational.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before process valves Work.

C. Related Sections:
   1. Section 05 05 33, Anchor Systems.
   2. Section 09 91 00, Painting.
   3. Section 33 05 05, Buried Piping Installation.
   4. Section 40 05 05, Exposed Piping Installation.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American Bearing Manufacturers Association (ABMA).
   2. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
   3. ANSI B16.34, Valves-Flanged, Threaded and Welding end. (ASME B16.34).
   4. ANSI/NSF 61 Drinking Water Components – Health Effects.
   5. API STD 594, Check Valves, Flanged Lug, Wafer and Butt-Welding.
   6. API STD 598, Valve Inspection and Testing.
   7. API STD 609, Butterfly Valves: Double Flanged, Lug-Type and Wafer-Type.
   8. ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
   9. ASTM A193/A193M, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
   10. ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service, or Both.

11. ASTM A240/A240M, Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
12. ASTM A276, Specification for Stainless Steel Bars and Shapes.
13. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
14. ASTM A351/A351M, Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts.
15. ASTM A380, Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems.
16. ASTM A536, Specification for Ductile Iron Castings.
17. ASTM A564/A564M, Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
18. ASTM A743/A743 M, Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
21. ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
22. ASTM B98/B98M, Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
24. ASTM B138/B138M, Specification for Manganese Bronze Rod, Bar and Shapes.
25. ASTM B265, Specification for Titanium and Titanium Alloy Strip, Sheet and Plate.
26. ASTM B584, Specification for Copper Alloy Sand Castings for General Applications.
27. ASTM D429, Test Methods for Rubber Property - Adhesion to Rigid Substrates.
28. AWWA C500, Metal-Seated Gate Valves for Water Supply Service.
29. AWWA C501, Cast-Iron Sluice Gates.
30. AWWA C502, Dry-Barrel Fire Hydrants.
31. AWWA C504, Rubber-Seated Butterfly Valves.
32. AWWA C507, Ball Valves, 6-inch through 48-inch.
33. AWWA C508, Swing-Check Valves for Waterworks Service, 2-inch through 24-inch NPS.
34. AWWA C509, Resilient-Seated Gate Valves for Water Supply Service.
35. AWWA C540, Power-Actuating Devices for Valve and Slide Gates.
36. AWWA C550, Protective Interior Coatings for Valves and Hydrants.
37. AWWA Manual M49, Butterfly Valves: Torque, Head Loss, and Cavitation Analysis.
38. FS TT-C-494, Coating Compound, Bituminous, Solvent Type, Acid-Resistant.
39. NEMA MG 1, Motors and Generators.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:

1. Manufacturer shall have minimum of five years of experience producing substantially similar materials and equipment to that required and be able to provide evidence of at least five installations in satisfactory operation for at least five years.

B. Component Supply and Compatibility:
   1. Obtain each type of equipment and appurtenances included in this Section, regardless of the component manufacturer, from a single manufacturer of the type of process valve. For each type of valve, do not furnish valves of more than one manufacturer.
   2. Supplier of each type of equipment specified shall review and approve or prepare all Shop Drawings and other submittals for all components associated with the type of process valve Supplier is furnishing.
   3. Components shall be suitable for use in the specified service conditions. Components shall be integrated into the overall assembly by the process valve manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Installation drawings showing orientation of valve in both plan and elevation view. Drawings shall clearly identify valve and its appurtenances, including controls, actuators, valve stems, and other components. Show dimensions of valves and appurtenances in relation to piping and structural and architectural components, where applicable.
      b. Controls for and control characteristics of modulating valves.
      c. Power and control wiring diagrams, including terminals numbers for electric-motor actuators.
      d. Calculations for sizing of electric actuators.
      e. Calculations for sizing of operating mechanism with extension stems.
      f. Calculations for sizing of gear actuators.
   2. Product Data:
      a. Product data sheets.
      b. Complete catalog information, including dimensions, weight, specifications, and identification of materials of construction of all parts.
      c. Corrosion resistance information to confirm suitability of valve materials for the application. Furnish information on chemical resistance of elastomers from elastomer manufacturer.
      d. Cv values and hydraulic headloss curves.
   4. Testing Plans:
      a. Submit plan for shop testing of each valve for which shop testing is specified, including testing plan’s and test facility’s limitations proposed.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Certificates of compliance with referenced standards, where applicable, including those of AWWA, NSF, and others required by ENGINEER.
   2. Manufacturer Instructions:
      a. Submit manufacturer's instructions for handling, storing, and installing valves and appurtenances. Provide templates and setting drawings for valves and appurtenances that require anchor bolts or similar anchorages.
   4. Source Quality Control Submittals:
      a. Submit copies of shop test results and inspection data, certified by manufacturer.
   5. Field Quality Control Submittals:
      a. Submit results of field tests required.
   6. Supplier's Reports:
      a. When requested by ENGINEER, submit written report of results of each visit to Site by Supplier's serviceman, including purpose and time of visit, tasks performed and results obtained.
   7. Qualifications Statements:
      a. When requested by ENGINEER, submit manufacturer's qualifications demonstrating compliance with the Specifications, including list of existing installations with contact names and telephone number(s) for each.

C. Closeout Submittals: Submit the following:
   1. Operations and Maintenance Data:
      a. Furnish operation and maintenance manuals in accordance with Section 01 78 23, Operations and Maintenance Data.
      b. Furnish in operations and maintenance manuals complete nameplate data for each valve and electric actuator.

D. Maintenance Material Submittals: Submit the following:
   1. Spare Parts, Extra Stock Materials, and Tools:
      a. Spare Parts and Extra Stock Materials: Furnish as specified for each valve type.
      b. Tools: Furnish two sets of special tools (excluding metric tools, if applicable) for each size and type of valve furnished.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Deliver materials and equipment to Site to ensure uninterrupted progress of the Work. Deliver anchorage products that are to be embedded in concrete in ample time to prevent delaying the Work.
   2. Inspect boxes, crates, and packages upon delivery to Site and notify ENGINEER in writing of loss or damage to materials and equipment.

Promptly remedy loss and damage to new condition in accordance with manufacturer's instructions.

3. Conform to Section 01 65 00, Product Delivery Requirements.

B. Storage and Protection:
   1. Keep products off ground using pallets, platforms, or other supports. Store equipment in covered storage and prevent condensation and damage by extreme temperatures. Store in accordance with manufacturer's recommendations. Protect steel, packaged materials, and electronics from corrosion and deterioration.
   2. Conform to Section 01 66 00, Product Storage and Handling Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Valves, General:
   1. Provide each valve with manufacturer's name and rated pressure cast in raised letters on valve body.
   2. Provide valves with brass or Type 316 stainless steel nameplate attached with Type 316 stainless steel screws. Nameplates shall have engraved letters displaying the following minimum information:
      a. Valve size.
      b. Pressure and temperature ratings.
      c. Application (other than water and wastewater).
      d. Date of manufacture.
      e. Manufacturer's name.
   3. Provide valves to turn clockwise to close, unless otherwise specified.
   4. Provide valves with permanent markings for direction to open.
   5. Manually operated valves, with or without extension stems, shall require not more than 40-pound pull on manual operator to open or close valve against specified criteria. Gear actuator and valve components shall be able to withstand minimum pull of 200 pounds on manual operator and input torque of 300-foot pounds to actuator nut. Manual operators include handwheel, chainwheel, crank, lever, and T-handle wrench.

B. Valve Materials:
   1. Valve materials shall be suitable for the associated valve's service or application, as shown.
   2. Protect wetted parts from galvanic corrosion caused by contact of different metals.
   3. Wetted components and wetted surfaces of valves used with potable water or water that will be treated to become potable shall conform to ANSI/NSF 61.
   4. Clean and descale fabricated stainless steel items in accordance with ASTM A380 and the following:

a. Passivate all stainless steel welded fabricated items after manufacture by immersing in pickling solution of six percent nitric acid and three percent hydrofluoric acid. Temperature and detention time shall be sufficient for removing oxidation and ferrous contamination without etching surface. Perform complete neutralizing operation by immersing in trisodium phosphate rinse followed by clean water wash.
b. Scrub welds with same pickling solution or pickling paste and clean with stainless steel wire brushes or by grinding with non-metallic abrasive tools to remove weld discoloration, and then neutralize and wash clean.

C. Valve Joints:
1. Exposed Valves: Unless otherwise specified, provide with flanged ends conforming to ANSI B16.1. Pressure class of flanges shall be equal to or greater than specified pressure rating of the associated valve.
2. Buried Valves: Unless otherwise specified, provide with mechanical or push-on joints, restrained or unrestrained, as required by piping with which valve is installed.
3. For stainless steel bolting, except where nitrided nuts are required, use graphite-free anti-seize compound to prevent galling. Strength of joint shall not be affected by using anti-seize compound.

2.2 BRONZE BODY BALL VALVES

A. Manufacturers: Provide products of one of the following:
1. Nibco.
2. Apollo.
3. Watts.
4. Or equal.

B. General:
1. All bronze bodied ball valves shall meet NSF 61 standards for low lead materials in potable water applications.
2. Type: Non-blowout stem, adjustable packing gland, quarter turn, full port ball valve.
3. Materials:
a. Body: Cast bronze (copper-silicon alloy)
b. Ball: 300 series Stainless Steel.
c. Stem: 300 series Stainless Steel
c. Packing and Seats: Teflon.
d. Handle: 300 series Stainless Steel
4. Rating: 150 lb. SWP.
5. End Connection: Threaded. Provide screwed to sweat adapters, where required.
6. Use bronze valves for copper and ferrous metal piping.

2.3 PVC BALL VALVES

A. Manufacturers: Provide products of one of the following:
   1. Asahi-America
   2. Heyward, TBH Series.
   3. Or Equal.

B. General:
   1. All PVC bodied ball valves shall meet NSF 61 standards for low lead materials in potable water applications.
   2. Type: End entry design with dual union design, solvent-weld socket ends.
   3. Materials: ASTM D1784, Type 1, Grade 1 polyvinyl chloride full port body, ball, and stem. Teflon seat, Viton O-ring stem, face and carrier seals.
   4. Rating: 150 psi at 73 degrees F.
   7. Use PVC valves for PVC and CPVC piping.

2.4 RESILIENT-SEATED GATE VALVES

A. Manufacturers: Provide products of one of the following:
   1. M&H Valve Company
   2. US Pipe and Foundry.
   3. Or equal.

B. General:
   1. Provide valves conforming to AWWA C509 and as specified in this Section.
   2. Sizes: Four-inch through 12-inch diameter, 16-inch and 20-inch diameter.
   3. Type:
      a. Provide non-rising stem (NRS) valves for buried service.
      b. For interior and exposed service, provide outside screw and yoke (OS&Y) rising-stem valves, unless otherwise specified.
      c. Provide position indicators for NRS valves used in exposed service.
   4. Minimum Rated Working Pressure:
      a. Valves 12-inch Diameter and Smaller: 200 psig.
      b. Valves 16-inch and 20-inch Diameter: 150 psig.
   5. Maximum Fluid Temperature: 150 degrees F.
   6. Provide valves with fully encapsulated resilient wedges, unless otherwise specified.

C. Materials of Construction: Shall conform to AWWA C509 and shall be as follows:
   1. Valve Body, Bonnet, and Stuffing Box: Cast-iron.
   2. Wedge: Cast-iron, symmetrically and fully encapsulated with molded rubber having minimum 1/8-inch thickness.
   3. Stem: Manganese bronze.
   4. Rubber Items: Buna-N or other synthetic rubber suitable for the application.
   5. Internal and external bolting and other hardware including pins, set screws, plug, studs, bolts, nuts, and washers shall be Type 316 stainless steel.

D. Interior Coating:

1. Valves shall be coated inside. Steel, cast-iron and ductile iron surfaces, except machined surfaces, shall be epoxy coated in accordance with AWWA C550.

E. Testing:
1. Test valves in valve manufacturer's shop in accordance with AWWA C509.

F. Gear Actuators for Manually-operated Valves:
1. Provide valves with gear actuators conforming to AWWA C500.
2. Size gear actuators for the following maximum differential pressures:
a. Maximum Differential Pressure Across Closed Valve: 100 psig.

2.5 BUTTERFLY VALVES

A. Manufacturers: Provide products of one of the following:
1. DeZurik.
2 Henry Pratt Company.
3. Or equal.

B. General:
1. Provide butterfly valves conforming to AWWA C504 and as specified herein.
2. Sizes:
a. Flanged: 8-inch through 12-inch diameter.
3. Rated Working Pressure: 150 psig, Class 150B.
4. Maximum Fluid Temperature: 150 degrees F.
5. Type: Rubber seated.
6. Valves shall provide drip-tight bi-directional shutoff at rated pressures.
7. Mount valve seats in valve body.
8. Valves shall be capable of being maintained in open or partially open position for manual operation, and for automatic operation. When valve disc is maintained, there shall be no chatter or vibration of disc or operating mechanism.
9. Valve packing shall be replaceable without dismantling valve.
10. Disc shall be offset from shaft to provide uninterrupted 360-degree seat seal.

C. Materials of Construction: materials of construction shall conform to AWWA C504 and shall be as follows:
1. Body: Cast-iron, ductile iron, or alloy cast-iron.
2. Shaft: Type 316 stainless steel.
3. Discs: Cast-iron.
4. Seats: Buna-N or other synthetic rubber suitable for the application.
5. Seating Surfaces: Type 316 stainless steel.
6. Bearings: Nylon.
7. Shaft Seals: Externally adjustable, material same as for seats.
8. Tapered Pins for Attachment of Shaft to Disc: Type 316 stainless steel.

9. Internal and external bolting and other hardware; including pins, set screws, studs, bolts, nuts, and washers shall be Type 316 stainless steel.

D. Interior Coating:
1. Valves shall be coated inside. Steel, cast-iron, and ductile iron surfaces, except machined surfaces, shall be epoxy-coated in accordance with AWWA C550.

E. Testing:
1. Test each valve in the manufacturer's shop in accordance with AWWA C504.

F. Gear Actuators for Manual Valves:
1. Provide gear actuators conforming to AWWA C504.
2. Gear actuators shall be constructed for 150 psi differential pressure and 16 feet per second port velocity.

2.6 AUTOMATIC ELECTRIC CHECK VALVES

A. Manufacturers: Provide products of one of the following:
1. GA Industries, Inc.
2. Or equal.

B. General:
1. Application: Valve shall open and close at controlled rate during pump start and shutdown. During emergency pump shutdown caused by power failure or other malfunction, valve shall close quickly to minimize reverse flow through the pump.
2. Rated Working Pressure: 250 psig.
3. Opening or Closing Time of Valve: One to five minutes, adjustable.
4. Emergency Closing Time of Valve: 15 to 30 seconds, adjustable.

C. Valve Construction:
1. Type: Pilot operated globe valves.
2. Valves shall include one-piece piston and full-stroke length liner. Seating shall include replaceable resilient seat ring mounted on underside of piston and metal seat integral with liner or attached to valve body.
3. Provide V-ports for optimum surge control during normal pump start and shutdown.
4. Flow area when valve is fully open shall be equal to flow area of pipe of same nominal pipe diameter as valve.
5. Valves shall be drip-tight at rated pressure when closed.
6. Provide removable flanged cover to access valve's internals.
7. Provide indicator rod attached to piston for visual position indication of piston.
8. Pilot control piping shall include the following:

a. Solenoid-operated pilot valve for normal controlled opening and closing of check valve.
b. Emergency solenoid pilot valve for quick closing of check valve.
c. Manual separate needle valves for controlled normal opening and closing and for emergency closing of check valve.
d. Wye strainer with valved blow-off connection.
e. Isolation valves.

9. Provide single pole/double throw (SPDT) limit switches with NEMA 4 enclosure as shown.

D. Materials of Construction:
1. Body: Cast-iron, ASTM A126 Class B, or ductile iron, ASTM A536.
2. Piston, Liner, Seat Crown, Indicator Rod and Hardware, Vent Tube, and Glands: Bronze, ASTM B62.
3. Flexible Items: Buna-N, leather, or other synthetic rubber suitable for the application.
4. Internal and external bolting and other hardware; including pins, set screws, studs, bolts, nuts, and washers shall be Type 316 stainless steel.
5. Packing: Teflon.
6. Control Piping Components (including piping, tubing, fittings, valves, and wye strainer): Brass or bronze with stainless steel wetted trim. Small valves shall be manufacturer's standard.

E. Interior Coating:
1. Valves shall be coated inside. Steel, cast-iron and ductile iron surfaces shall be epoxy coated in accordance with AWWA C550.

F. Testing:
1. Test each assembled valve, except control piping, hydrostatically at 1.5 times the rated working pressure for minimum of five minutes per valve.
2. Test each valve for leakage at valve's rated working pressure against closed valve. Test duration shall be minimum 15 minutes per valve and allowable leakage shall be zero.
3. Perform functional test on each valve to verify proper operation at specified performance.

2.7 BACKPRESSURE SUSTAINING CONTROL VALVES

A. Manufacturers: Provide products of one of the following:
1. GA Industries, Inc, Figure 6700-DRS.
2. Or equal.

B. General:
1. Application: Maintain a minimum setpoint upstream pressure regardless of variations in flow demand and variations in downstream pressure. Valve shall open on an increase in upstream pressure and close on decrease in upstream pressure, to maintain required setpoint upstream pressure.

2. Rated Working Pressure:
   a. Smaller than 12-inch Diameter: 250 psig.
3. Sizing Data:
   a. Maximum Flow Rate: 2,500 gpm.
   b. Minimum Flow Rate: None.
   c. Maximum Upstream Pressure: 110 psig.
   d. Minimum Upstream Pressure: 85 psig.
   e. Setpoint Downstream Pressure: 63 psig.
   f. Setpoint downstream pressure shall be field-adjustable over range of near-zero to 110 percent.

C. Valve Construction:
1. Type: Pilot operated globe valves.
2. The valve body shall be a one-piece casting of cast iron ASTM A126 Class B including integrally cast ANSI B16.1 Class 250 flat-faced inlet and outlet flanges. Exposed interior and exterior surfaces shall be factory coated with NSF-61 certified fusion bond epoxy coating.
3. The valve piston shall be fully guided on its outside diameter. To minimize the consequences of throttling, throttling shall be by long, stationary vee-ports located downstream of the seat and not by the seat itself. Sawtooth attachments or other add-on devices are not permitted. The piston shall contain a replaceable resilient seat made from Buna-N rubber retained by a follower ring and stainless steel screws. The piston, liner and seat shall be made from Alloy C95400 lead free bronze.
4. Flow area shall be equal to nominal pipe area when valve is fully open.
5. Valves shall have an integral bottom pad or feet permitting support directly under the valve body
5. Valves shall provide drip-tight shut-off at the rated pressure when closed.
6. Provide a removable flanged cover to access valve's internals. The main valve cover shall be secured with 316 stainless steel cover fasteners.
7. Provide indicator rod attached to piston for visual position indication of piston.
8. Provide single pole/double throw (SPDT) limit switches with NEMA 4 enclosure as shown.

D. Controls:
1. Provide a system of pilots and controls to enable the valve to perform the functions listed below. All pilots, controls and control piping shall be non-corrosive and suitable for the working pressure and electrical conditions.
2. Controls shall consist of a direct acting, diaphragm operated, spring loaded pressure relief pilot with a lead-free bronze body, stainless steel trim and a rubber seat, a 120VAC ASCO watertight solenoid, a closing speed needle valve, wye-strainer, and pilot isolating valves. Solenoid shall be designed so that when the solenoid is de-energized, the main valve will close.
3. All pilot control piping, fittings and controls shall be lead free bronze, brass, or stainless steel

E. Function:
1. The valve shall open fully when the inlet pressure is higher than the setting of the sustaining pilot
2. The valve shall throttle as needed to sustain the inlet pressure to the setting on the pilot.
3. The valve shall close if the inlet pressure falls below the setting of the sustaining pilot.
4. The valve shall close, or be prevented from opening, anytime by means of electrical signals to the solenoid.

2.8 APPURTENANCES FOR EXPOSED METALLIC VALVES

A. General:
1. For valves located less than five feet above operating floor, provide levers on four-inch diameter quarter-turn valves, and provide handwheels on all other valves, unless otherwise shown or specified.
2. For valves located five feet or more above operating floor, provide chain operators.
3. Where indicated, provide extension stems and floorstands.

B. Handwheels:
1. Conform to applicable AWWA standards.
2. Material of Construction: Ductile iron or cast aluminum.
3. Arrow indicating direction of opening and word “OPEN” shall be cast on trim of handwheel.
4. Maximum Handwheel Diameter: 2.5 feet.

C. Chain Operators:
1. Chains shall extend to three feet above operating floor.
2. Provide 1/2-inch stainless steel hook bolt to keep chain out of walking area.
3. Materials of Construction:
   a. Chain: Type 316L stainless steel.
   b. Chainwheel: Recessed groove type made out of Type 316 stainless steel.
   c. Guards and Guides: Type 316L stainless steel.
4. Chain Construction:
   a. Chain shall be of welded link type with smooth finish. Chain that is crimped or has links with exposed ends is unacceptable.
5. Provide geared operators where required to position chainwheels in vertical position.

D. Crank Operator:
1. Crank operator shall be removable and fitted with rotating handle.
2. Maximum Radius of Crank: 15 inches.
3. Materials:
   a. Crank: Cast-iron or ductile iron.
   b. Handle: Type 304 stainless steel.

c. Hardware: Type 304 stainless steel.

E. Extension Stems and Floor Stands for Gate Valves:
1. Conform to the applicable requirements of AWWA C501 for sizing of complete lifting mechanism.
2. Bench and Pedestal Floor Stands:
   a. For valves requiring extension stems, provide bench or pedestal floor stands with handwheel or crank as indicated. Provide provisions for using portable electric actuator for opening and closing of valves.
   b. Type: Heavy-duty with tapered roller bearings enclosed in a weatherproof housing, provided with positive mechanical seals around lift nut and pinion shaft to prevent loss of lubrication and to prevent moisture from entering housing. Provide lubrication fitting for grease. For valves conveying water that is potable or that will be treated to become potable, grease shall be food-grade and ANSI/NSF 61-listed. Base shall be machined.
   c. Materials of Construction:
      1) Housing: Cast-iron, ASTM A126, Class B.
      2) Lift Nut: Cast bronze, ASTM B98/B98M.
      3) Grease Fitting: Stainless steel.
      4) Bolting: Type 316 stainless steel.
3. Wall brackets for floor stands shall be Type 316L stainless steel construction.
4. Extension Stems:
   a. Materials of Stems and Stem Couplings: Type 316 stainless steel.
   b. Maximum Slenderness Ratio (L/R): 100.
   c. Minimum Diameter: 1.5-inch.
   d. Threads: Acme.
   e. Provide stem couplings where stems are furnished in more than one piece. Couplings shall be threaded and keyed or threaded and bolted and shall be of greater strength than the stem.
   f. Weld to bottom of extension stem a Type 316 stainless steel cap suitable for square end of valve stem.
5. Bottom Couplings: Ductile iron with Type 316 stainless steel pin and set screw.
6. Stem Guides:
   a. Material: Type 316 cast stainless steel with bronze bushing for stem. For submerged service, Type 316 cast stainless steel with stainless steel bushing for stem.
   b. Maximum Stem Length Between Guides: Seven feet.
   c. Stem guides shall be adjustable in two directions.
7. Furnish stem cover of clear butyrate plastic or Grade 153 Lexan with cast adapter for mounting cover to bench and floor stands. Provide stem cover with gasketing and breathers to eliminate water intrusion into operator and condensation within cover. Provide stem cover with mylar tape with legible markings showing valve position at one-inch intervals and open and close limits of valve.

F. Floor Boxes: Provide cast-iron floor boxes for valves that are to be operated from floor above valve. Boxes shall be equal in depth to floor slab. Boxes shall have cast-iron covers and be fitted with bronze bushing.

2.9 APPURTENANCES FOR BURIED METALLIC VALVES

A. Wrench Nuts:
   1. Provide wrench nuts on buried valves of nominal two-inch size, in accordance with AWWA C500.
   2. Arrow indicating direction of opening the valve shall be cast on the nut along with the word “OPEN”.
   3. Material: Ductile iron or cast-iron.
   4. Secure nut to stem by mechanical means.

B. Extension Stems for Non-Rising Stem Gate Valves and Quarter-turn Buried Valves:
   1. Provide extension stems to bring operating nut to six inches below valve box cover.
   2. Materials of Stems and Stem Couplings: Type 316 stainless steel.
   3. Maximum Slenderness Ratio (L/R): 100
   4. Provide top nut and bottom coupling of ductile iron or cast-iron with pins and set screws of Type 316 stainless steel.

C. Valve Boxes:
   1. Valve boxes shall be as indicated and as required.
   2. Type: Heavy-duty, suitable for highway loading, two-piece telescopic, and adjustable. Lower section shall enclose valve operating nut and stuffing box and rest on valve bonnet.
   3. Material: Cast-iron or ductile iron.
   4. Coating: Two coats of asphalt varnish conforming to FS TT-C-494.
   5. Marking: As required for service.

2.10 ANCHORAGES AND MOUNTING HARDWARE

A. General:
   1. Comply with Section 05 05 33, Anchor Systems, except as modified in this Section.
   2. CONTRACTOR shall supply bolts, nuts, and washers for connection of valve and appurtenances to concrete structure or other structural members.
   3. Bolts, nuts, and washers shall be of ample size and strength for purpose intended. Anchorages in concrete shall be at least 5/8-inch diameter.
   4. Provide stem guide anchorages of required strength to prevent twisting and sagging of guides under load.
   5. Materials: Provide bolts and washers of Type 316 stainless steel and nitrided nuts. Bolts shall have rolled threads. Bolts and nuts shall be electropolished to remove burrs.

2.11 TOOLS, LUBRICANTS, AND SPARE PARTS

A. Provide the following T-handle operating wrenches for buried valves:
   1. Length of T-Handle Operating Wrench: 6 feet.
   2. Quantity: 2.

B. Lubricants: For valves, actuators, and appurtenances requiring lubricants, provide suitable lubricants for initial operation and for first year of use following Substantial Completion. Lubricants for equipment associated with conveying potable water or water that will be treated to become potable shall be food-grade and ANSI/NSF 61-listed.

C. Tools, spare parts, and maintenance materials shall conform with Section 01 78 43, Spare Parts and Extra Materials.

2.12 PAINTING OF EXPOSED VALVES, HYDRANTS, AND APPURTENANCES

A. Exterior steel, cast-iron, and ductile iron surfaces, except machined surfaces of exposed valves and appurtenances, shall be primed in manufacturer's shop. Surface preparation, priming, finish painting, and field touch-up painting shall conform to Section 09 91 00, Painting.

2.13 PAINTING OF BURIED VALVES

A. Exterior steel, cast-iron, and ductile iron surfaces, except machined or bearing surfaces of buried valves, shall be painted in valve manufacturer's shop with two coats of asphalt varnish conforming to FS TT-C 494.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials and equipment are to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Install valves and appurtenances in accordance with:
      a. Supplier's instructions and the Contract Documents.
      b. Requirements of applicable AWWA standards.
      c. Applicable requirements of Section 33 05 05, Buried Piping Installation, and Section 40 05 05, Exposed Piping Installation.

2. Install valves plumb and level. Install all valves to be free from distortion and strain caused by misaligned piping, equipment, and other causes.
3. Position butterfly valves so that, when valve is fully open, valve disc does not conflict with piping system elements upstream and downstream of valve.

B. Exposed Valves:
1. Provide supports for large or heavy valves and appurtenances as shown or required to prevent strain on adjoining piping.
2. Operators:
   a. Install valves so that operating handwheels or levers can be conveniently turned from operating floor without interfering with access to other valves, piping, structure, and equipment, and as approved by ENGINEER.
   b. Avoid placing operators at angles to floors or walls.
   c. Orient chain operators out of way of walking areas.
   d. Install valves so that indicator arrows are visible from floor level.
   e. For motor-operated valves located lower than five feet above operating floor, orient motor actuator to allow convenient access to pushbuttons and handwheel.
3. Floor Stands and Stems:
   a. Install floor stands as shown and as recommended by manufacturer.
   b. Provide lateral restraints for extension bonnets and extension stems as shown and as recommended by manufacturer.
   c. Provide sleeves where operating stems pass through floor. Extend sleeves two inches above floor.

C. Buried Valves:
1. Install valve boxes plumb and centered, with soil carefully tamped to a lateral distance of four feet on all sides of box, or to undisturbed trench face if less than four feet.
2. Provide flexible coupling next to each buried valve.

3.3 FIELD QUALITY CONTROL

A. Field Tests:
1. Adjust all parts and components as required to provide correct operation of valves.
2. Conduct functional field test on each valve in presence of ENGINEER to demonstrate that each valve operates correctly.
3. Verify satisfactory operation and controls of motor operated valves.
4. Demonstrate satisfactory opening and closing of valves at specified criteria requiring not more than 40 pounds effort on manual actuators.
5. Test ten percent of valves of each type by applying 200 pounds effort on manual operators. There shall be no damage to gear actuator or valve.

B. Supplier’s Services:

1. Manufacturer's representative shall make a minimum of 3 visits, with a minimum of 4 hours onsite for each visit. First visit shall be for instruction of CONTRACTOR in installing equipment; second visit shall be for checking completed installation and start-up of system; third visit shall be to instruct operations and maintenance personnel. Representative shall revisit the Site as often as necessary until installation is acceptable.
2. Training: Furnish services of Supplier's qualified factory trained specialists to instruct OWNER's operations and maintenance personnel in recommended operation and maintenance of equipment. Training requirements, duration of instruction and qualifications shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.
3. All costs, including expenses for travel, lodging, meals and incidentals, and cost of travel time, for visits to the Site shall be included in the Contract Price.

3.4 SUPPLEMENTS

A. The supplements listed below, following "End of Section" designation, are a part of this Specification Section:
   1. Table 40 05 53-A, Schedule of Valves.

+ + END OF SECTION + +

TABLE 40 05 53-A, SCHEDULE OF VALVES

Number of Valves	Location	Type	Service	Line Size (in)	Valve Size (in)	Class	Operator	Specification Paragraph
1	Tank Control Valve Vault	PSV	PW	8	8	250	None	2.7
2	Tank Control Valve Vault	GV-RS	PW	8	8	200	Gear	2.4
1	Storage Tank Riser Drain	GV-RS	DR	8	8	200	Gear	2.4
2	Split Case Pump Discharge	ECV	PW	8	8	250	None	2.6
4	Split Case Pump Suction and Discharge	BFV	PW	8	8	150	Gear	2.5
1	Yard Piping	GV-RS	PW	8	8	200	Gear	2.4
4	Yard Piping	GV-RS	PW	12	12	200	Gear	2.4

*Valves smaller than 4” are not included in valve schedule.

The following abbreviations are used in Table 40 05 53-A.

A. Valve Type Abbreviations

Valve Type	Abbrev		Valve Type	Abbrev.
Resilient-seated Gate Valve	GV-RS		Automatic Electric Check Valve	ECV
Bronze Body Ball Valve	BV		Backpressure Sustaining Control Valve	PSV
Butterfly Valve	BFV			

B. Service Abbreviations

Service	Abbrev		Service	Abbrev.
Potable Water	PW		Drain	DR

SECTION 40 05 93

COMMON MOTOR REQUIREMENTS FOR PROCESS EQUIPMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Electric motors and accessories to be furnished under other equipment Sections shall comply with this Section, unless specified otherwise in the Section for the associated driven equipment.
   2. Motor horsepower and voltage ratings, speed, enclosure type, and unusual service conditions (such as ambient temperatures above 40 degrees C, corrosive areas requiring severe duty motors, and variable frequency drive applications requiring inverter duty motors), and requirements for witnessing shop tests shall be as specified in the Sections for the associated driven equipment. Specific accessories and construction features may also be required by the Sections on the associated driven equipment.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ASTM A48/A48M, Specification for Gray Iron Castings.
   2. ASTM B117, Practice for Operating Salt Spray (Fog) Apparatus.
   3. IEEE 112, Test Procedure for Polyphase Induction Motors and Generators.
   4. IEEE 522, Guide for Testing Turn-to-Turn Insulation on Form-Wound Stator Coils for Alternating Current Electric Machines.
   5. IEEE 841, Petroleum and Chemical Industry - Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors – Up to and Including 370 KW (500 HP).
   6. IEEE 1043, Recommended Practice for Voltage Endurance Testing of Form-Wound Bars and Coils.
   7. NEMA MG 1, Motors and Generators. (This Section's references to NEMA MG 1 followed by a hyphen and number, such as “NEMA MG 1-20.14”, indicate the associated NEMA MG 1 paragraph reference.)
   8. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems
   9. UL 674, Electric Motors and Generators, for Use in Division 1 Hazardous (Classified) Locations.
   10. UL 1004, Electric Motors.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Manufacturer shall have not less than five years experience producing equipment substantially similar to that required and shall be able to submit documentation of at least five installations in satisfactory operation for at least five years each.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Data sheets indicating nameplate data for fractional-horsepower motors.
      b. Outline drawing or data sheet indicating complete motor dimensions for motors rated greater than 1/3-hp. Several motors of the same type and rating for the same application may be covered by an appropriate single drawing or data sheet. Drawings and data sheets shall have complete identifying data including frame size, speed, horsepower ratings, and application for each particular motor.
      c. Details of motor heaters, winding thermal protection, and other accessories.
      d. Copies of motor characteristic curves and data inputs when required for programming motor protection and management relays.
   2. Product Data:
      a. Submit motor test data sheets for each motor rated one horsepower or greater. Values indicated on test data sheets shall be from tests of a previously manufactured, electrically duplicate motor or calculated data. Mark each test data sheet to indicate the Project motor application location, manufacturer, type, frame size, horsepower, voltage, speed, bearing type, lubrication medium and enclosure type. Test data sheet shall also include:
         1) Winding resistances.
         2) Torques.
         3) Efficiencies.
         4) Power factors.
         5) Slip.
         6) Full load amperes.
         7) Locked rotor and no load amperes.
         8) Nameplate temperature and results of dielectric tests.
   3. Testing Plans and Procedures:
      a. When witnessed source quality control testing is required in the Section for associated driven equipment, submit description of proposed shop testing methods, procedures, and testing apparatus with calibration dates, together with proposed testing schedule and proposed travel and logistical plans for testing.

B. Informational Submittals: Submit the following:
   1. Manufacturer's Instructions:
      a. Instructions and recommendations for handling, storing, protecting the motors.
      b. Installation data for motors, including setting drawings, templates, and directions and tolerances for installing anchorage devices.
   2. Source Quality Control Submittals:
      a. Written reports presenting results of required shop testing. Shop test reports shall be dated and signed by motor manufacturer.
      b. When witnessed shop tests are required, shop test results shall be signed by and shall bear the seal of registered professional engineer. Name on seal, registration or license number, and jurisdiction or registration of license shall be legible.
   3. Field Quality Control Submittals:
      a. Written reports presenting results of required field testing and inspections. Field testing reports shall be dated and signed by CONTRACTOR.
   4. Supplier Reports:
      a. Submit written report of results of each visit to Site by Supplier's service personnel, including purpose and time of visit, persons contacted, problems encountered and resolved, tasks performed, results obtained, and other pertinent information. Submit within two days of completion of visit to the Site.
   5. Qualifications Statements:
      a. Submit manufacturer's qualifications data when requested by ENGINEER.

C. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data:
      a. Furnish operation and maintenance data for motors as part of the operations and maintenance data for the associated driven equipment.
      b. Comply with Section 01 78 23, Operations and Maintenance Data.

D. Maintenance Material Submittals: Submit the following:
   1. Spare Parts and Extra Stock Materials: For each motor size and type, furnish spare parts in accordance with motor manufacturer's recommendations, including the following for three-phase motors:
      a. One set of fans and guards for each set of three or fewer motors, for each size of totally-enclosed fan-cooled motor.
      b. One set of bearing liners, or renewable ball or roller bearings, for each set of three or fewer motors, for each type and size of motor.
      c. One set of oil rings, for each sleeve bearing motor.
      d. One set of bearing temperature detectors, for each set of three or fewer motors, of each type of motor.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Ship motors with openings sealed.

B. Storage and Protection:
   1. Protect materials and equipment from corrosion and deterioration.

PART 2 – PRODUCTS

2.1 EQUIPMENT PERFORMANCE

A. Equipment Description:
   1. Comply with motor requirements specified in the Sections for the associated driven equipment.
   2. Motors shall be suitable for continuous operation at an elevation of up to 3,300 feet above mean sea level, at ambient temperatures ranging from -25 degrees C to 40 degrees C, unless specified otherwise in the Section for the associated driven equipment.

2.2 CONSTRUCTION – GENERAL

A. Unless specified otherwise in Sections on the associated driven equipment, motors shall have the following features of construction and operation:
   1. Successfully operate under power supply variations in accordance with NEMA MG 1-14.30 and NEMA MG 1-20.14.
   2. NEMA Design B with torque and starting currents in accordance with NEMA MG 1, except in special high-torque applications, as specified in the Section for the associated driven equipment, which may require NEMA Design C.
   3. Motors shall operate within their full load rating without applying the service factor, unless specified otherwise in Section for the associated driven equipment.
   4. Speed and horsepower specified or required to properly operate the associated driven equipment and torque characteristics required by the drive load and suitable for direct coupling or V-belt drive, as specified in the Section for the associated driven equipment.
   5. Constructed for full-voltage starting.
   6. Fabricated steel or cast-iron frames with integrally cast feet or bases, cast-iron end bells, cast iron or steel conduit boxes and covers and bases with precision machined bearing fits, ASTM A48/A48M, Class 25 or better. For each TEFC motor, provide UL-approved automatic stainless steel breather drains in lowest part of front and back brackets to allow drainage of condensation.
   7. Stator core assembly shall consist of stacked lamination made from specially selected electrical sheet silicon steel.

8. Rotor cages shall be die-cast or fabricated aluminum or fabricated copper or copper alloy. Shafts shall be carbon steel unless specified otherwise in this Section or in the Section on the associated driven equipment.
9. Rotors on frames 213T and larger shall be keyed shrunk or welded to shaft and rotating assembly, dynamically balanced to NEMA limits. Use rivets to secure balance weights, if required, to rotor resistance ring or fan blades. Machine screws and nuts are unacceptable. Coat entire rotating assembly between bearing inner caps with corrosion-resistant epoxy.
10. Bolt and cap screws shall be high-strength, SAE Grade 5 zinc-plated and chromatic steel. Screwdriver slot fasteners are unacceptable.
11. Motors shall be shop-painted at the motor fabrication facility. Finish coat shall be the same color as the associated driven equipment. Final paint finish shall be corrosive resistant and capable of passing ASTM B117 250-hour salt spray test. Motors that will be located outdoors shall have coating resistant to degradation or chalking in sunlight.

2.3 SINGLE-PHASE AC MOTORS

A. Motors shall be rated 115-, 200-, or 230-volt, 60 Hertz.

B. Bearings shall be grease-lubricated ball type with grease fittings or with lubrication for 10 years of normal operation.

C. Motors shall be totally enclosed except fractional-horsepower motors may be open type if motor is suitably protected from moisture, dripping water, and airborne particulates accumulation. Motor features shall be in accordance with the following:
   1. Open motors shall be split-phase or capacitor start in accordance with torque requirements, with service factor of not less than 1.25, 40 degrees C ambient rating, and Class B insulation.
   2. Enclosed motors shall be capacitor start, with service factor of not less than 1.15, 40 degrees C ambient rating, and Class F insulation. Motors shall be fan-cooled or non-ventilated.
   3. Severe duty type motors shall be designed to withstand chemical corrosion and equipped with cast iron end shields, neoprene gaskets, stainless steel shaft, heavy pressed steel fan cover and provision for threaded conduit connection.
   4. Provide direct drive fan motors with conduit fittings and leads to allow external connection.
   5. Explosion-proof motors shall comply with UL 674.

2.4 THREE-PHASE AC MOTORS

A. General: Unless specified otherwise in the Sections for the associated driven equipment, provide three-phase motors with the following features:
   1. Premium, energy-efficient construction complying with NEMA MG 1.
   2. Motor efficiency determined in accordance with NEMA MG 1-12.58.

3. Minimum and nominal full-load efficiencies not less than those listed in: NEMA MG 1 Table 12-12 for motors rated 600 volts and smaller, and NEMA MG 1 Table 12-13 for motors rated larger than 600 volts and equal to or less than 5,000 volts.
4. Motors shall be constructed for operation on three-phase, 60 Hertz, alternating current system. Motor voltage and variable frequency operation, where required, shall be as specified in the Sections for the associated driven equipment. Voltage ratings shall be 200 volts for operation on 208-volt systems, 230 volts for 240-volt systems, 460 volts for 480-volt systems, 2300 volts for 2400-volt systems, and 4000 volts for 4160-volt systems.
5. Unless otherwise required by the load, motors shall be NEMA Design B, normal starting torque. Locked rotor KVA/HP shall not exceed NEMA Code Letter G for motors 20 hp and larger.
6. Motor frame shall be a rigid structure, constructed to maintain the lamination in correct alignment, and shall not depend on lamination or bolts for rigidity.
7. Severe-duty totally-enclosed motors shall comply with IEEE 841.

B. Bearings:
1. Provide horizontal motors with rolling element (anti-friction) or sliding element (sleeve) type bearings. Use anti-friction type bearings for NEMA frame motors. Use sleeve type bearings when specified in the Section for the associated driven equipment.
2. Insulate the bearings for motors larger than 200 hp and for inverter-duty motors 100 hp and larger, to prevent shaft currents and related bearing damage.
3. Bearings for open drip-proof, TEFC, and explosion-proof motors shall be grease lubricated, ball type, unless specified otherwise in the Section for the associated driven equipment. Bearings shall have inlet fittings and outlet plugs. Protect bearings and grease reservoirs from entry of contaminants. Provide suitable fittings to allow convenient positive purging of old grease during re-greasing.
4. For horizontal motors with ratings up to and including 500 hp, or for motors with speeds up to and including 3600 rpm, and where both conditions apply, anti-friction bearings furnished shall have a minimum L-10 bearing life of 100,000 hours, as defined by the ABMA, for direct-connected motors, and L-10 bearing life of 50,000 hours for belted motors.
5. Sleeve bearings shall be ring-oiled with adequate, integral self-cooled oil reservoir. Bearing sleeves shall be lined with high tin content babbitt to minimize oil contamination. Close running shaft seals shall prevent oil leakage as well as prevent entrance of foreign material such as water and dirt into the bearing area. Provide oil level sight gauges with permanently-marked easily-discernible oil level. Provide inspection openings to observe the oil rings.
6. When specified in Section for the associated driven equipment or required by motor speed and bearing size, provision shall be made for forced lubrication. Provide oil rings and an adequate oil reservoir in bearing housings to allow orderly shutdown of motor in the event of failure of forced feed lubrication system.

7. Provide vertical motors with thrust bearings adequate for all thrusts to which motor can be subjected. Rated minimum L-10 life of the thrust bearings shall be at least 15,000 hours when operated at rated speed and full load thrust. Manufacturers of the associated driven equipment shall furnish motor manufacturer with speed and thrust conditions required by the associated driven equipment.

C. Insulation:
1. Insulation systems shall be rated Class F, with a service factor of 1.15 times motor's nameplate horsepower rating when operated on a sine wave power supply, and a service factor of 1.00 on an adjustable frequency power supply. Temperature rise shall be limited to Class B insulation system when motor is operated continuously at rated horsepower with ambient temperature not exceeding 40 degrees C, unless specified otherwise in the Section for the associated driven equipment.
2. Windings shall be epoxy-coated. Treat windings with insulating compound suitable for protecting against moisture, salt air, and slightly acidic and alkaline conditions. Insulation system for enclosed motors shall be upgraded to increase moisture resistance.
3. Motors for outdoor service and all motors larger than 200 hp shall have vacuum/pressure-impregnated epoxy insulation (VPI) for moisture resistance. Motors shall be preheated before VPI and baked in temperature-controlled oven.
4. Stator windings and end turn connections shall be fully brazed to withstand full voltage starting, regardless of the starting method indicated in the Section for the associated driven equipment. Bracing system shall essentially eliminate coil vibration under the high-current conditions of starting as well as during normal operation. When a tied system is used, system shall be such that no tie depends on the integrity of another tie within the system.
5. Motors larger than 200 hp shall be form wound. Form wound coils with micaceous ground wall insulation shall have additional insulation and hot-pressed to provide sealed system. Complete stator shall be vacuum/ pressure-impregnated.

D. Enclosures:
1. Motor enclosure type shall be as specified in the Section for the associated driven equipment. Enclosure types shall comply with the following:
    a. Open Drip Proof: Motors shall have a steel or cast-iron frame, cast-iron end brackets, and steel conduit box. Provide vertical motors of the open type with drip hoods. When the drip hood is too heavy to be easily removed, provide access for testing. Provide stainless steel corrosion-resistant screens over air openings in accordance with NEMA requirements for guarded machines.
    b. Weather Protected Type I and Type II: Weather-protected motor shall be an open drip proof guarded machine with ventilating passages constructed to minimize entrance of rain, snow, and airborne particles to

motor's electric parts complying with NEMA MG 1-1.25.8

c. Totally enclosed fan cooled and non-ventilated motors shall have cast-iron frame, cast-iron end brackets, and cast-iron conduit box. Provide drain holes on each end of motor.

d. Explosion-proof motors shall comply with NEMA MG 1-1.26.10 and UL 674.

2. Motor conduit box shall be split from top to bottom, shall be capable of being rotated to four positions 90 degrees apart, and shall comply with the following:

a. Box shall be gasketed with rubber-like gaskets between frame and conduit box and between conduit box and conduit box cover.

b. Provide box or opening in motor housing with conduit hub type fitting to allow threaded conduit connections.

c. Box sizes shall be in accordance with code requirements and shall accommodate medium-voltage terminations or stress cones, when required.

d. Protective and auxiliary devices shall terminate in auxiliary conduit boxes.

e. Terminal leads shall be flexible and of sufficient length to extend for distance of not less than ten inches beyond face of terminal box. Terminal leads shall be fitted with solderless lugs suitable for attachment to lugs installed on external wiring. Leads shall be sealed with non-wicking, non-hygroscopic insulating material, or insulating “wrap-cap” as manufactured by Ideal Industries, or equal.

f. Provisions for terminal box size, length of leads, size of conduit openings, and type of terminal lugs shall be complied with irrespective of other standards or practice.

g. Provide motor frame grounding stud inside conduit box. Stud shall include a drilled and tapped hole.

E. Motors for Use with Variable Frequency Drives:

1. Motors shall be compatible with characteristics of the intended variable frequency inverters.

2. Motors shall comply with the performance standards of NEMA MG 1-31.

F. Vertical Motors:

1. Vertical motors shall have Type P base specifically constructed for vertical installation. Universal position motors are unacceptable.

2. Vertical motors shall have solid shafts, unless otherwise specified in Section for the associated driven equipment.

G. Lifting Eyes: Motors weighing more than 50 pounds shall include at least one lifting eye or lifting lug. Construct motor and lifting eyes or lifting lugs to bear motor's full weight.

2.5 ACCESSORIES

A. General:
   1. Provide motor accessories in accordance with this Section unless specified otherwise in the Section for the associated driven equipment.
   2. Provide space heaters in motors five horsepower and larger installed outdoors, and in enclosed motors five horsepower and larger installed indoors in unheated spaces.
   3. Provide thermostat type winding thermal protection for motors in accordance with the following:
      a. Variable speed motors up to and including 25 hp.
      b. Constant speed motors when specified in Section for the associated driven equipment.
   4. Provide thermistor type winding thermal protection for motors in accordance with the following:
      a. Constant speed motors 50 hp and larger up to and including 200 hp.
      b. Variable speed motors 30 hp and larger up to and including 200 hp.
   5. Provide resistance temperature detector (RTD) type winding thermal protection for all motors larger than 200 hp.
   6. Provide stator and bearing temperature detectors for each motor 250 hp and larger.

B. Space Heaters:
   1. Space heaters for condensation prevention shall operate at 120 volts and shall be sized to provide approximately 10 degrees C temperature rise above ambient.
   2. Heaters shall be low-density type for low surface temperature and long life.

C. Winding Thermal Protection:
   1. Thermostats shall be bi-metal disk or rod type embedded in the stator windings. Thermostat contacts shall be normally-closed, automatic-reset type, rated 120 vac, five amps minimum, opening on excessive temperature. Provide three thermostats, one in each phase, wired to motor junction box.
   2. Thermistors embedded in each stator phase winding shall be in direct contact with the winding conductors. Each thermistor circuit shall be factory-wired to 120-volt solid-state control module mounted at the motor in box rated NEMA 4X. Control module contacts shall be automatic-reset type, rated 120 vac, five amps minimum, opening on excessive temperature. Provide normally-closed isolated contact for motor shutdown.
   3. Resistance temperature detectors (RTD) shall be 100-ohm platinum three-lead type with calibrated resistance-temperature characteristics. Position detectors, two per phase for non-explosion proof motors and one per phase for explosion proof motors, to detect highest winding temperature and located between coil sides in stator slots. Detector leads shall be wired to a separate terminal box.

D. Bearing Temperature Protection: When specified in Section for the associated driven equipment, provide motor bearing temperature detectors, RTD type similar to the

winding detectors specified in this Article, on each bearing for horizontal motors and on the thrust bearing for vertical motors.

E. Vibration Protection: When specified in Section for associated driven equipment, provide accommodations for mounting sensors for monitoring bearing or casing vibration.

F. Moisture Protection: When specified in Section for associated driven equipment, provide accommodations for mounting sensors for monitoring moisture presence inside motor housing.

G. Single-Phase Motors: Single-phase motors requiring auxiliary starting resistors, capacitors or reactors and switching devices shall be provided as combination units with such auxiliaries either incorporated within motor housings or housed in suitable enclosures mounted on motor frames. Each combination unit shall be mounted on a single base and be provided with a single conduit box.

2.6 IDENTIFICATION

A. Nameplates:
   1. Nameplates shall be Type 316 stainless steel with embossed or pre-printed lettering and fastened to the motor frame with Type 316 stainless steel pins.
   2. Nameplates shall have stamped on them the motor manufacturer's name, voltage, number of Hertz and phases, horsepower rating, amperes and temperature rise at rated load, full load speed, locked rotor amperes or code letter, service factor, NEMA nominal efficiency, model number, insulation class, bearing number, serial number and maintenance manual number.
   3. Name plates for explosion proof motors shall indicate the Division, Class and Group of the hazardous location in which the motor is intended for use.
   4. Dual-voltage motor nameplates shall include connection diagrams.
   5. Nameplate markings shall be in accordance with NEMA MG 1-10.

2.7 SOURCE QUALITY CONTROL

A. Shop Tests:
   1. Perform shop testing on the motors at the manufacturer's facility. Shop test shall be in accordance with NEMA MG 1, UL 674, and UL 1004 and shall demonstrate that the motors tested comply with the Contract Documents.
   2. Submit shop test reports identifying tests performed and results obtained.
   3. Motors shall be given Routine Test in accordance with NEMA MG 1-12.55 and IEEE 112. Test shall include the following:
      a. Measurement of winding resistance.
      b. No-load readings of current and speed at normal voltage and frequency.
      c. Current input at rated frequency with rotor at standstill for squirrel-cage motors (locked rotor amperes).
      d. High-potential test.

e. Bearing inspection.

B. Witnessed Shop Testing:
1. When witnessed motor shop testing, which may also be referred to as witnessed source quality control motor testing, is specified in the Section for associated driven equipment, shop tests shall be witnessed at the motor manufacturer's testing and production facility. The number of attendees shall as indicated in the Sections for the associated driven equipment.
2. Dates of witnessed testing shall be acceptable to OWNER and ENGINEER and shall be agreed upon in writing at least 45 days prior to the actual test. Perform all witnessed tests at motor manufacturer's facility in one day or on consecutive days to minimize the time required to witness the tests.
3. OWNER will be responsible for cost of OWNER's and ENGINEER's time for first test on each motor, and for time to travel to and from motor manufacturer's facility once. Responsibility for cost of lodging, meals, and travel expenses shall be as indicated in the Section for the associated driven equipment.
4. If re-testing is required, all labor and expense costs incurred by OWNER and ENGINEER will be deducted from the Contract Price via a Change Order. If tests are not performed on agreed-upon date as a result of CONTRACTOR's or motor manufacturer's action or inaction and OWNER or ENGINEER incurs lost time or expense as a result of such action or inaction, the associated costs will be deducted from the Contract Price via a Change Order.
5. Not less than the number of days prior to the scheduled witnessed motor test specified in Paragraph B.2 of this Article, submit to ENGINEER the proposed witness testing plans and procedures.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:
1. Install motors in accordance with the Contract Documents and manufacturer's instructions and recommendations. Obtain written interpretation from ENGINEER in the event of conflict between manufacturer's instructions and recommendations and the Contract Documents.
2. Install in accordance with Laws and Regulations.
3. Do not modify structures to facilitate installation of motors, unless approved in writing by ENGINEER.
4. Carefully and properly align motors with the driven equipment.
5. Secure motors to mounting surfaces with anchorage devices complying with manufacturer's recommendations that are of sufficient size and quantity to secure motor to equipment.
6. Until start-up and operation, tightly cover and protect motors from dirt, water, and chemical and mechanical damage.

3.2 FIELD QUALITY CONTROL

A. Site Tests:
   1. Inspect motors prior to supplying electricity to (energizing) equipment. Do not energize equipment without ENGINEER's permission. Inspections shall include the following:
      a. Inspect motor and equipment for physical damage.
      b. Inspect motor for proper anchorage, mounting, grounding, connection, and lubrication.
      c. Check for unusual noise and indications of overheating during initial or test operation.
   2. Perform testing at the Site for motors larger than 200 hp, as follows:
      a. Testing shall be witnessed by ENGINEER.
      b. Initial inspections and testing shall include the following:
         1) Electrical and grounding connections.
         2) Shaft alignment, proper mounting and lubrication.
         3) Check ventilating air passageways for blockage.
         4) Excessive noise.
         5) Overheating.
         6) Correct rotation.
         7) Protective detectors operation.
         8) Excessive vibration.
         9) Space heater operation.
      c. Electrical testing shall include the following:
         1) Insulation resistance test.
         2) Surge comparison test.
         3) Vibration test.
         4) Bearing insulation resistance test on insulated bearings.
         5) Running current and voltage measurements and evaluations relative to load conditions over full range of operations and nameplate full-load amperes.
         6) High-potential test.
         7) For wound rotor motors, additional testing at minimum and normal operating load points and at ring short.
         8) Motor operation with the driven equipment for not less than 48 continuous hours per motor, with checks for overheating and vibration during operation.
      d. Tests and values shall be in accordance with motor manufacturer’s recommendations and ANSI/NETA ATS.
      e. Prepare and submit field testing report in accordance with ANSI/NETA ATS.

+ + END OF SECTION + +

SECTION 40 60 05

INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, start-up, and place in satisfactory operation a complete and operating instrumentation and control system. Scope of work includes:
      a. Furnishing all components required for the RTU including the enclosure, processor, modem, relays, and associated equipment.
      b. Field mounting of instrumentation.
      c. Integrating of new process control equipment into new control panel and control signals to/from RVSS. Configuration of RVSS for communication with RTU PLC.
      d. Communications to/from the new RTU enclosure to the Owner's SCADA system.
      e. Field mounting of instrumentation.
      f. Integrating of new process control equipment into new control panel.
      g. Communications to/from the new RTU to the Owner's SCADA system.

B. Coordination:
   1. Instrumentation and Controls:
      a. Instrumentation and Controls equipment as shown and specified herein shall be furnished, installed, and placed into satisfactory operation by an Instrumentation and Controls subcontractor. Programming of PLC and configuration of OIT software is part of the work and shall be programmed and configured by an owner approved programmer.
      b. Some panels and equipment are furnished under other Specification Sections under this Contract. Coordinate with Suppliers of these panels and equipment to provide fully functional system in accordance with the Contract Documents and that interfaces with the control system.
      c. The Input/Output List (I/O List) in this section identifies the I/O required RTU-32 . The I/O List is for coordinating signals between field instrumentation and equipment provided by other suppliers.

2. To centralize responsibility, materials and equipment provided under this Section shall be furnished by a single Supplier.
3. CONTRACTORS shall assume responsibility for adequacy and performance of materials and equipment provided under this section.
4. CONTRACTOR shall perform all work described in this section per the OWNER's SCADA System Standards.
5. To the greatest extent possible, provide materials and equipment from a single manufacturer.
6. Other contractor's responsibilities:
    a. Prepare all instrumentation and control equipment submittals in accordance with the contract documents.
    b. Proper interfacing of instrumentation and control equipment with field equipment, instruments, devices, and panels, including required interfacing with packaged control systems furnished by other equipment suppliers, and required interfacing with the Site's electrical system.
    c. Review and coordination with manufacturers, Suppliers, and other contracts of Shop Drawings and other CONTRACTOR submittals for equipment, valves, and appurtenances for ensuring proper interfacing of hardware, and locations and installation requirements of inline devices and instrument taps.
    d. Direct, detailed oversight of installation of instruments, panels, consoles, cabinets, wiring and other components, and related wiring and piping connections. Reinstallation or replacement of any instrumentation and controls component or electrical conduit and wiring resulting from absence of detailed oversight shall be provided at no additional cost to the OWNER.
    e. Calibrating, source quality control, field quality control, and start-up of the system.
    f. Responsibility for correction period obligations for instrumentation and control system.
    g. Training of operations and maintenance personnel in operation and maintenance (including calibration and troubleshooting) of the instrumentation and control system.

C. Related Sections:
1. Division 01, General Requirements
2. Division 26, Electrical
3. Section 26 29 13, Reduced Voltage Solid State Motor Controllers

1.2 REFERENCES

A. Definitions:
   1. General: Definitions of terminology related to Instrumentation and Industrial Electronic Systems used in the specifications shall be as defined in IEEE 100, ISA S51.1, and NEMA ICS 1.
   2. Two-Wire Transmitter: A transducer which derives operating power supply from the signal transmission circuit and requires no separate power supply connections. A two-wire transmitter produces a 4 to 20 milliampere current regulated signal in a series circuit with a 24-volt direct current driving potential and a maximum circuit resistance of 600 ohms.
   3. Panel: An instrument support system which may be a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems including consoles, cabinets, and racks. Panels provide mechanical protection, electrical isolation, and protection from dust, dirt, moisture, and chemical contaminants which may be present in the atmosphere.
   4. Data Sheets: Data sheets shall refer to ISA S20 or ISA TR20.00.01.
   5. Signal Types: Used in systems specified in Division 40
      a. High-Level Analog: Signals with full output level greater than 100 millivolts but less than 30 volts, including 4-20 mA transmission.
      b. Discrete Control or Events: Dry contact closures and signals monitored by solid state equipment, relays, or control circuits.
      c. Low Voltage Discrete Control or Events: Dry contact closures and signals monitored by solid state equipment, relays, or control circuits operating at less than 30 volts and 250 milliamperes.
      d. Digital Code: Code information from the output of an analog to digital converter or digital transmission terminal.
      e. Radio Frequency Signals: Continuous wave alternating current signals with fundamental frequency greater than 10 kilohertz.

   6. I&C Subcontractor: A firm engaged in the business of detailed control system design and engineering, instrumentation component purchase, system and panel assembly, programming, and implementing the specified process control and industrial automation systems.

A. Reference Standards
   1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of

conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids).
3. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.
    a. IEEE 100, Standard Dictionary of Electrical and Electronic Terms
    b. ISA S5.4, Instrumentation Loop Diagram
    c. ISA S20, Specification Forms for Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
    d. ISA S51.1, Process Instrumentation Terminology
    e. ISA TR20.00.01, Specification Forms for Process Measurement and Controls Instrumentation, Part 1: General Considerations
    f. NEMA ICS 1, General Standards for Industrial Control and Systems
4. The following organizations have generated standards that are to be used as guides in assuring quality and reliability of components and systems; govern nomenclature, define parameters of configuration and construction, in addition to specific details in this Specification and the Contract Drawings:
    a. ISA, Instrument Society of America.
    b. API, American Petroleum Institute.
    c. UL, Underwriters' Laboratories, Inc.
    d. AWWA, American Water Works Association.
    e. NRC, Nuclear Regulatory Commission.
    f. NEMA, National Electrical Manufacturers Association.
    g. OSHA, Occupational Safety and Health Administration.
    h. ANSI, American National Standards Institute.
    i. MIL, Military Standards.
    j. NFPA, National Fire Protection Association.
    k. SAMA, Scientific Apparatus Manufacturers Association.
    l. JIC, Joint Industrial Council.
    m. IEEE, Institute of Electrical and Electronic Engineers.
    n. NEC, National Electrical Code.
    o. FM, Factory Mutual.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:
    1. Shop Drawings:

a. Field Instruments:
    i. Manufacturer's product name and complete model number of devices proposed for use, including manufacturer's name and address.
    ii. Instrument tag number in accordance with the Contract Documents.
    iii. Data sheets and manufacturer's catalog literature. Provide data sheets in accordance with ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets using a format similar to ISA 20.
    iv. Description of construction features.
    v. Performance and operation data.
    vi. Installation, mounting, and calibration details; instructions and recommendations.
    vii. Service requirements.
    viii. Dimensions of instruments and details of mating flanges and locations of closed tanks, pipe sizes for insertion instruments, and upstream/downstream straight run pipe lengths required.
    ix. Range of each device and calibration information.
    x. Descriptions of materials of construction and listing of NEMA ratings for equipment.
b. Field Wiring and piping diagrams, include the following:
    i. Wire and pipe size and type
    ii. Terminal numbers at field devices and in panels
    iii. Color coding.
    iv. Conduit numbers in which wiring will be located.
    v. Locations, functional names, and manufacturer's designations of items to which wiring to piping are connected.
c. Electrical control schematics in accordance with NFPA 79. Drawings shall be in accordance with convention indicated in Annex D of the NFPA 79. Typical wiring diagrams that do not accurately reflect actual wiring to be furnished are unacceptable. Tables or charts for describing wire numbers are unacceptable.
d. Stock list or bill of materials for each panel including tag number, functional name, manufacturer's name, model number and quantity for components mounted in or on the panel or enclosure.
e. Instrumentation and Controls Equipment:
    i. Submit the following general information:

1. Detailed block diagram showing system hardware configuration and identifying model numbers of system components.
2. Software listings for operating system, applications, and HMI.

3. Software language and organization.
4. Format, protocol and procedures for data transmission and communications with input/output modules and peripheral devices, including wide area network (WAN) or local area network (LAN).
5. Input/Output Information:
    a. Input/output (I/O) point listing with I/O module cross-reference identification.
    b. I/O module cross-reference identification based on I/O address list developed by I&C Subcontractor.
6. Database listing, including all I/O points.
    f. Complete point-to-point interconnection wiring diagrams of field wiring associated with the system. Diagrams shall include the following:
        i. Field wiring between each equipment item, panel, instruments, and other devices, and wiring to control stations, panelboards, and motor starters. Some of this equipment may be specified in other Divisions, CONTRACTOR is responsible for providing complete point-to-point interconnection wiring diagrams for control and monitoring of that equipment.
        ii. Numbered terminal block and terminal identification for each wire termination.
        iii. Identification of assigned wire numbers for interconnections. Assign each wire a unique number.
        iv. Schedule showing the wiring numbers and the conduit number in which the numbered wire is installed.
        v. Junction and pull boxes through which wiring will be routed.
        vi. Identification of equipment in accordance with the Contract Documents.

2. Product Data:
    a. Product data for field instrumentation in accordance with requirements for Shop Drawings in this section.
    b. Product data for field wiring and piping provided for instrumentation and control service and not included under other Sections or contracts.
3. Samples:
    a. Sign-off sheets to be used at time of testing.

B. Informational Submittals: Submit the following:
1. Manufacturer's Instructions:
    a. Shipping, handling, storage, installation, and start-up instructions.
2. Source Quality Control Submittals:
    a. Factory test reports and results.

3. Field testing reports.
    a. Installation inspection and check-out report.
    b. Submit detailed written report of results of each visit to Site by I&C Subcontractor's service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.

C. Closeout Submittals: Submit the following:
    1. Operations and Maintenance Data:
        a. Submit in accordance with Section 01 78 23, Operation and Maintenance Data.
        b. Include complete up-to-date system software documentation. Provide hardcopy and electronic copies.
        c. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.
        d. Final calibration sheets for each installed instrument signed by factory-authorized technician.

    2. Record Documentation:
        a. Prepare and submit record documents in accordance with Section 01 78 39, Project Record Documents.
        b. Revise all system Shop Drawing submittals to reflect as-built conditions in accordance with the following.
            1) Two copies of each revised Shop Drawings and documentation to replace out-dated drawings and documentation contained in operation and maintenance manuals. Submit half-size black line drawings for each drawing larger than 11 inches by 17 inches. Include specific instructions for out-dated drawing removal and replacement with record documents submittal.
            2) Half-size black line prints of wiring diagrams applicable to each control panel shall be placed in clear plastic envelopes and stored in a suitable print pocket or container inside each control panel.
            3) Submit CADD drawings of the point-to-point interconnection wiring diagrams updated to reflect final as-built equipment information and as-installed field installation information.

1.4 STORAGE AND HANDLING

A. Prior to packaging, each manufacturer or Supplier shall securely attach tag number and instructions for proper field handling and installation to each instrument.

Comply with Section 01 65 00, Product Delivery Requirements, and Section 01 66 00, Product Storage and Handling Requirements.

PART 2 – PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Power Supplies:
   1. Electrically powered equipment and devices shall be suitable for operation on 115-volt plus-or-minus 10 percent, single-phase, 60 Hertz plus-or-minus two Hertz, power supply. If different voltage or closer regulation is required, provide suitable regulator or transformer at no additional cost to OWNER.
   2. Provide appropriate power supplies for field instruments requiring power source less than 115 volts. Power supplies shall be mounted in control panels or enclosures installed near associated instrument or in field panels.
   3. Power supplies shall be capable of minimum of 130 percent of maximum simultaneous current draw.
   4. Provide power on-off switch or air circuit breaker for each item provided under this Section that requires electric power.

B. Signal Requirements:
   1. Control system shall use four to 20 mA DC analog signals, unless otherwise shown or indicated.
   2. Provide signal converters and repeaters where required. Adequately size power supplies for signal converters and repeater loads.
   3. Isolate signals from ground.
   4. Signals transient DC voltage shall not exceed 300 volts over one millisecond and shall not have a DC component over 300 volts.
   5. Discrete signals shall use 120 VAC.

C. Surge Protection Requirements:
   1. Provide surge protection to protect electronic instrumentation and control systems from surges propagating along signal and power supply cabling. Protection systems shall be such that the protection level shall not interfere with normal operation, but shall be lower than instrument surge withstand level, and be maintenance-free and self-restoring.
   2. Provide instruments in suitable metallic cases, properly grounded. Ground wires for surge protectors shall be connected to good earth ground and, where practical, run each ground wire individually and insulated from other

wires. Mount protectors within instrument enclosure or in separate junction box compatible with the area designation coupled to the enclosure.

D. Miscellaneous:
   1. General:
      a. Instrumentation components shall be heavy-duty types, constructed for continuous service.
      b. System shall consist of equipment models currently in production.
      c. Materials and equipment, including cabling and interconnections, shall be in accordance with Division 16, Electrical, and manufacturer's recommendations, unless indicated otherwise in the Contract Documents.
      d. Materials and equipment shall, where applicable, be in accordance with UL standards and be so marked and labeled.
   2. Provide surge protection for instruments and other control system components that could be damaged by electrical surges. Provide lightning arresters on both ends of communication lines, except for fiber optic cabling, external to buildings or structures, including leased telephone lines and similar communication lines.
   3. Field-mounted instruments and system components shall be constructed for use in humid and corrosive service conditions. Field-mounted instrument enclosures, junction boxes and appurtenances shall have NEMA rating appropriate for hazardous rating requirements shown or indicated on Electrical Drawings, instrument data sheets, and elsewhere in the Contract Documents.
   4. Miscellaneous hardware such as fittings, fasteners, and screws, be Type 316 stainless steel or other appropriate material to prevent galvanic reactions, and shall be suitable for service intended. Piping stands shall be provided for fastening instruments as required. Provide threaded pipe stands with flange bolted to slab. Use carbon steel piping and flanges painted in accordance with Section 09 90 00, Coatings.
   5. Data processing equipment and relays with interconnections to field devices shall be wired through field wiring terminal blocks in the panel. Terminals as part of relay base are unacceptable.
   6. Arrange panel-mounted instruments, switches, and other devices ergonomically for functional use and ease of maintenance. Similar types of panel-mounted devices shall be by one same manufacturer and of the same model line.
   7. Equipment furnished shall be of modular construction and be capable of field expansion through installation of plug-in circuit cards and additional cabinets as necessary.

8. Field- and panel-mounted instruments shall be tagged with equipment number and nomenclature indicated in the Contract Documents; if not so indicated, tag in accordance with approved Shop Drawings.
9. Coordinate ranges and scales specified in the Contract Documents with manufacturer of the equipment actually furnished for operability over the intended range. Complete the coordination prior to submitting Shop Drawings to ENGINEER.
10. Treat field-mounted devices with anti-fungus spray.
11. Protect field-mounted devices from exposure to high and freezing temperatures to provide complete operability under the environmental conditions indicated in the Contract Documents.

E. Environmental Conditions:
   1. Provide control system suitable for continuous operation under the following conditions:
      a. Indoor Instruments:
         1) Ambient Temperature: Zero degrees F to 120 degrees F.
         2) Relative Humidity: 100 percent, maximum.
      b. Outdoor Instruments
         1) Ambient Temperature: -15 degrees F to 120 degrees F.
         2) Relative Humidity: 100 percent, maximum.
   2. Protect outdoor-mounted field instruments from direct sunlight by providing sunshade for instruments. Construct sunshade out of non-corrosive material. Sunshade shall withstand wind velocity of 70 miles per hour.

2.2 PANELS

A. General Provisions:
   1. Provide electrical components and devices, support hardware, fasteners, and interconnecting wiring and piping required to provide control panels complete and operational.
   2. Locate and provide hardware so that connections can be easily made and there is ample room for servicing each item.
   3. Prevent movement by adequately supporting and restraining devices and components mounted on or within panel.
   4. Provide panels with sub-panels for installation of all internally mounted hardware.
   5. Provide numbered terminal strips for terminating field wiring and wiring from other panels, unless otherwise shown or indicated.
   6. Provide copper grounding studs for hardware requiring grounding.
   7. Provide the following convenience accessories inside each panel:

a. One 120 vac, 20-amp duplex, grounding type receptacle.
d. Duplex receptacle shall have a dedicated circuit breaker.

9. Panels to be located in non-hazardous (non-classified) environments shall comply with UL 50 and UL 508A.
10. CONTRACTOR is responsible for detailed layout and design of panels, in accordance with the Contract Documents. Base cutouts and design on instrument manufacturers' requirements.
11. Provide easily accessible pocket built into panel door to enclose "as built" panel wiring diagrams.
12. Panels shall be UL-listed.

B. Identification:
1. Provide laminated plastic nameplate for identification of panels. Use self-tapping stainless-steel screws for fastening nameplates to panels. When self-tapping screws may degrade panel's NEMA rating, retain NEMA rating intact by using gaskets on each side of panel surface and use retaining plate on the panel back that is same size as nameplate. When gaskets and retaining plate are used, use full-penetration screws with nuts.
2. Panel identification nameplates shall have 1/2-inch high engraved letters.
3. Tag electric components and devices mounted within panels with high adhesive labels.
4. Identify terminal strips with nameplate engraved as "TB-XX" where "XX' is the numerical identification of terminal strip.
5. Identify terminals within each terminal strip with sequential numbers and wire numbers.
6. Internal panel wiring shall be color-coded and numerically identified with unique wire numbers affixed at each end of each wire. Color coding shall be in accordance with panel wiring color code table, below:

Panel Wiring Color Code Table

Description	Color
110 vac panel power before fuses or breakers	Black
Controlled 110 vac power (e.g., after relay contacts, selector switch contacts, and similar equipment.)	Red
110 vac power source from devices external to panel	Yellow
110 vac neutral	White
24 vdc positive power from power supplies	Brown
24 vdc negative power from power supplies	
Controlled 24 vdc power (e.g., after PLC output contacts, relay contacts, and similar)	Blue
24 vdc positive power from devices external to panel	Orange
24 vdc negative power from devices external to panel	
24 vdc four to 20 mA DC signal cable	Grey with red positive, clear negative

Grounding wire	Green

C. Panel Construction Features:
   1. Control panels located in non-environmentally controlled areas and outdoor areas shall be rated NEMA 4X and with the following features:
      a. Panels shall be Type 316L stainless steel construction with minimum thickness of 12-gage for all surfaces, except areas requiring reinforcing, with a smooth-brushed finish.
      b. Stainless steel screw clamp assemblies on three sides of each door.
      c. Rolled lip around three sides of door and along top of enclosure opening.
      d. Hasp and staple for padlocking.
      e. Provide clear-plastic, gasketed lockable hinged door to encompass non-NEMA 4X front-of-panel devices.

D. Electrical Systems:
   1. Power Source and Internal Power Distribution:
      a. Provide in the panel, near where incoming power is terminated, nameplate with panel power supply source, type, voltage, and circuit number.
      b. Protect incoming 120 vac power feeds to power the panel by providing lightning and surge arrestors, properly connected to grounds.
      c. Provide panels with internal 120 vac power distribution system with properly-sized and -rated circuit breakers to distribute power. Power not more than six devices from a single breaker. When power supplies are included in the panel, not more than two power supplies shall be powered from a single breaker. Convenience receptacles and interior panel lights shall have their own breakers. When one or more field instruments require 120 vac power from the panel for instrument power, power not more than three instruments from a given breaker.
      d. Provide space for a minimum of two spare breakers in each panel.
   2. Electrical Systems:
      a. Internal wiring shall be Type MTW and THW stranded copper wire with thermoplastic insulation rated for 600 volts at 85 degrees C for single conductors, color-coded and labeled with wire identification.
      b. For DC signal wiring, use shielded cable with 18-gage conductors. DC field signal wiring terminal strips shall be capable of handling wires up and including No. 12 size.
      c. For AC power wiring, use No. 12 minimum AWG. For AC signal and control wiring, use No. 16 minimum AWG. For wiring carrying more than 15 amps, use sizes required by the NEC (NFPA 70) .
      d. Inside of panels, route DC signal wiring separately from power wiring with minimum separation distance of six inches.

e. Use covered Panduit to route internal panel cables and wiring. Panduit in each section of panel shall be appropriately sized to accommodate the quantity of wires to be routed with a spare capacity of 40 percent.
f. Install wire troughs inside panels along horizontal or vertical routes to present a neat appearance. Angled runs are unacceptable.
g. Wiring that is routed without Panduit shall be adequately supported and restrained to prevent sagging or other movement. Use of adhesive anchors to support or restrain wiring is unacceptable.
h. Terminate internal panel wiring using forked, insulated, crimp-on connectors; soldered connectors are unacceptable. Provide panels with 600-volt rated barrier type terminal strips mounted on Din rails. Identify terminal strips as indicated in this Section. Identification devices shall be self-stick, plastic tape strips with permanent, machine-printed numbers.
i. Wiring in panels shall be installed such that, if wires are removed from any one device, power will not be disrupted to other devices.
j. Provide spare terminals equal in number to 20 percent of terminals used for each type of wiring (e.g., DC signal and AC power).
k. Provide ground terminals to terminate the shield wire of shielded cables. Termination of more than two shielded wires on a single ground terminal is unacceptable.
l. Provide a single copper bus bar with 5/16-inch diameter copper grounding stud to connect the panel to external ground. Panel's internal grounds shall be terminated to the bus bar.
m. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.
n. When DC power or low voltage AC power is required, furnish and install in the panel required power supplies and transformers.
o. Provide complete wiring diagram of "as-built" circuitry enclosed in transparent plastic.

3. Provide complete wiring diagram of "as-built" circuitry enclosed in transparent plastic.

2.3 PANEL HARDWARE AND COMPONENTS

A. Antenna Hardware

1. Antenna

a. Omnidirectional multiband LTE antenna and ground impulse suppressors shall be furnished for cellular communication.
b. Location of antennas shall be determined by Contractor at the time of installation.
c. Requirements:

i. Frequency: 698-960/1710 to 2700 MHz
ii. Gain: 5 dB
iii. Impedance: 50 Ohm
iv. Connector: Integral N-Female

d. Manufacturer:
i. Signal Booster
ii. Or equal

2. LMR-400 Antenna Cable:
a. Ultra low loss coax cable (<1dB)
b. Connector: N-Male on both ends
c. Coaxial cable grounding kit
3. In-line Cable Surge Protectors

B. PLC Hardware
1. Controller
a. HMI with built-in PLC
b. Location of controller shall be in RTU-32 enclosure and mounted to the backplane.
c. Requirements:
i. Power Supply: 24VDC
ii. Screen Size: minimum 3.5 touchscreen”
iii. I/O: Built-in, can support I/O expansion
iv. Connectivity: Ethernet
d. Manufacturer:
i. Horner
ii. Or equivalent compatible with existing FCWS system.

2.4 DATA SHEETS – PRIMARY SENSORS AND FIELD INSTRUMENTS

A. General
1. Primary sensors and field instruments shall be in accordance with the “data sheets” included in Part 3 of this specification.

2.5 IDENTIFICATION

A. Input/Output List Identification
1. I/O point list contains information required to configure PLC I/O interface hardware, and to indicate range conversion or signal functions.
2. “POINT NUMBER” is an alphanumeric character string. For example, for the point “MP-FI-806-0123” the following apply:

a. The first two characters (MP) refer to the specific plant area (MP = Main Pump, for example).
b. The third character is the functional identifier and conforms with ANSI/ISA S5.1. In the example, "F" represents flow.
c. The fourth (and sometimes fourth and fifth) alphabetical character (I) is the function identifier. In the example, the "I" represent indication input.
d. The first three-digit number (806) identifies the P&ID number.
e. The next four-digit number (0123) identifies the loop or field device.
f. Suffix, where required, is used for distinguishing between similar variables.

3. "DESCRIPTION" is an alphanumeric character string up to 40 characters in length. Points described as "SPARE" indicate pre-wired I/O.
4. "SIGNAL TYPE" is one of the following:
   a. AI indicates analog input.
   b. DI indicates discrete input.
   d. AO indicates analog output.
   e. DO indicates momentary, maintained or latched discrete output.

C. ISA Identification
1. A = Miscellaneous Analytical.
2. B = Burner, Combustion.
3. C = Chlorine Residual/Gas.
4. D = Density.
5. E = Voltage.
6. F = Flow.
7. G = Intrusion.
8. H = Hand.
9. I = Current.
10. J = Power.
11. K = Time.
12. L = Level.
13. M = Motor.
14. N = pH.
15. O = Oxygen.
16. P = Pressure.
17. Q = Quantity.
18. R = Radioactivity.
19. S = Speed, Frequency.
20. T = Temperature.
21. U = Common.

22. V = Vibration.
23. W = Torque (Weight or Force).
24. X = Hazardous Gas.
25. Y = Event, State or Presence (Switch Position).
26. Z = Position, Dimension.

C. Function Identifier:
1. A = Available / In Auto (input)
2. B = Backward Rotation (input)
3. C = Full Closed (input)
4. D = Full Open (input)
5. E = Close/Energize (output)
6. H = High (input)
7. I = Input (Analog)
8. L = Low (input)
9. N = Open (output) or Control Mode (input)
10. O = Output (Analog)
11. R = Running (input)
12. S = Start (output)
13. T = Stop (output)
14. U = Malfunction or Alarm (input)
15. V = Slow (output)
16. W = Slow (input)
17. X = Selector Switch (input)

2.6 PROCESS CONTROL DESCRIPTION

A. Programming of PLC and configuration of HMI screen is part of integrators scope of work. Process Control Description below are provided for informational purposes.

B. Reference Drawing: I-02

C. PUMPS
1. The pump system consists of 2 pumps which are RVSS operated.
2. System Operation
a. Each pump shall have local controls on the RVSS enclosure, which has Local/Off/Remote selection, Start/Stop control, and status and alarm indicating lights. When Local mode is selected, the pump shall be started and stopped from the RVSS. When Remote mode is selected, pump control shall be based on the control signal received from RTU-32.

Operation of the pumps under normal conditions shall be automatic by the PLC in RTU-32. Monitoring and control of the pumps shall also be available at the existing SCADA Workstations at the Owner Control Room. For each pump, display the following

i. Running status
ii. In hand/auto/remote
iii. Elapsed time indicator
iv. Warning
v. Failure
vi. Other conditions shown on the drawings

b. Primary operation of the pumps will require pumps to be utilized for the normal daily turnover of water in tank by running pumps for an adjustable period on an adjustable sequence by alternating pump sequence on a timer schedule to balance pump runtimes.

c. Secondary operation will start and stop the pumps in case of low distribution system pressure in a lead/lag format. At low system pressure (adjustable), lead pump will turn on. If low system pressure persists (greater than 10 minutes -adjustable), lag pump will turn on. Pumps will remain in operation until low system pressure condition is resolved.

D. PRESSURE TRANSMITTER

1. There are 5 pressure transmitters on the system PIT-3201, PIT-3202, PIT-3203, PIT-3211 and PIT-3221. Display, trend, and record all pressures.
2. PIT-3201 will be utilized to monitor the level inside the elevated storage tank.
   a. The pressure inside the base of the tank will be used to determine the water surface elevation in the tank.
   b. When the high level setpoint in reached, the tank control valve solenoid will de-energize and the main tank control valve will close.
3. PIT-3202, located in the vault, is utilized for display to monitor the pressures on the inlet side of the distribution system.
4. PIT-3203, located in the booster pump house, is utilized to monitor the pressure on the common pump discharge and for operation of the electric check valves.
5. Pressure Transmitters PIT-3211 and PIT-3221 are utilized to monitor the pressure at the discharge of each pump and to open the electric check valves for Pump 1 and Pump 2, respectively.

E. TANK CONTROL VALVE

1. The Tank Control Valve is located in the Tank Control Valve Vault. The valve assembly consists of a main valve, a pilot valve that mechanically modulates the main valve to maintain upstream pressure, and a solenoid valve for lockout of the pilot valve. The valve assembly acts to maintain the minimum pressure on the inlet side based on an adjustable setpoint.
2. The solenoid valve shall be normally-closed type. If the solenoid valve is de-energized, the pilot valve will be disconnected from the system pressure and the main valve will close or remain closed.
3. When the solenoid valve is energized:
   a. The pilot valve will act to open the main valve when upstream pressure is above the setpoint.
   b. The pilot valve will act to close the main valve when the upstream pressure is at or below the setpoint.
4. The solenoid valve will de-energize if:
   a. Loss of power to the RTU.
   b. The level in the elevated storage tank reaches high water level, as determined from PIT-3201.
   c. A pump is called to run.

F. ELECTRIC CHECK VALVES

1. An Electric Check Valve is located on the discharge side of P-3211 and P-3221, respectively.
2. When a pump is called to run, the Electric Check Valve will open once the corresponding individual pump discharge PIT, either PIT-3211 or PIT-3221, reaches the current pressure at PIT-3203.
3. When a pump is called to stop, the corresponding Electric Check Valve will begin close at the normal valve closing speed (adjustable) by means of the Normal Solenoid Pilot valve. When the Electric Check Valve reaches the intermediate limit switch, the RVSS will be called to stop and the Electric Check Valve will finish closing at the emergency valve closing speed (adjustable) by means of the Emergency Solenoid Pilot valve. On loss of power to the pump or on E-stop condition, the Electric Check Valve will closeat the emergency valve closing speed (adjustable) by means of the Emergency Solenoid Pilot valve.

G. FLOW METER

1. The Flow Meter FIT-3202 is located down stream of PIT-3203, utilized for monitoring flow. Display, trend, record station flow.

2.7 SOURCE QUALITY CONTROL

A. Panel Operational Testing
   1. Test all input/output components to verify that internal panel wiring is properly terminated at correct locations. Verify initial ranges and settings.
   2. Test all system hardware and software to verify proper operation as stand-alone units. Test shall include, but not be limited to, the following:
      a. Power distribution and breaker ratings to match approved Shop Drawings.
      b. Power fail/restart tests.
      c. Diagnostics checks.
      d. Demonstrate that all specified equipment functional capabilities are working properly.
      e. Check and verify process displays are in accordance with approved Shop Drawings.
   3. Test components and devices requiring data transmission to verify that communication between such components is working properly. Verify communication by using the same media required for the completed system at the Site as indicated in the Contract Documents.
   4. Perform integrated system test with all system equipment and simulated inputs/outputs connected to verify that equipment is performing properly as an integrated system.
   5. Simulation devices shall be of suitable quality to not mask control panel defects.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Environmental Requirements:
   1. Do not install instruments in areas where construction may cause instrument to be damaged, without providing adequate protection for said instrument.

B. Installation of Instrumentation:

1. Secure field-mounted instruments to stands or brackets in accordance with manufacturer's recommendations, approved or accepted (as applicable) submittals, and the Contract Documents.
2. Locate sensors where shown on the Drawings. Confirm exact locations in the field with ENGINEER.
3. Install all devices so that devices are readily accessible for service and do not cause potential hazards.

B. Services and Operator Instructions
1. Provide repairs or replacement of defective materials, equipment or workmanship, including with respect to equipment, the services of factory-trained servicemen.
2. In addition to the calibration required for check-out, provide two additional calibrations on all instruments. The first re-calibration shall be approximately six months after acceptance of the system, and the second shall be approximately eleven months after acceptance. As part of each calibration, provide two copies of the calibration sheets, a detailed list of deficiencies (should any be found), and a statement that the entire system is in proper operation and condition (except for the deficiencies noted) and shall be turned over to the OWNER.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. System Check-Out and Start-Up Responsibilities:
a. CONTRACTOR shall perform check-out and start-up of all system components.
b. Check and approve the installation of all instrumentation and control system components and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation.
c. CONTRACTOR shall provide all test equipment necessary to perform the testing during system checkout and start-up.
d. CONTRACTOR shall furnish ENGINEER an Installation Inspection Report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by an authorized representative of the CONTRACTOR.

B. Loop Status Reports: Each loop shall have a Loop Status Report to organize and track its inspection, adjustment, and calibration. These reports shall include the

following information and check-off items with spaces for sign-off by the CONTRACTOR and OWNER:

1. Project Name, Test Date, name of the person whom the CONTRACTOR authorized to conduct the test and CONTRACTORs Name.
2. Loop Number.
3. Tag Number for each component.
4. Check-offs/sign-offs for each component: Tag/identification; installation; termination (wiring and tubing); scale, range, and setpoint as applicable; and calibration/adjustment (four-point for analog, set point for switches) rising and falling.
5. Check-offs/sign-offs for the loop: Panel interface terminations; I/O interface terminations; I/O signal operation; inputs/outputs operational (received/sent, processed, adjusted); total loop operation; process controller scaling and adjustment; and space for comments.

C. Loop Checks:
   1. CONTRACTOR shall test all I/O from the field device to the PLC terminals and verify that the PLC has received the signal.
   2. Loop checks shall be documented using OWNER-approved Input/Output Status Sign-Off forms.

D. Functional Test:
   1. CONTRACTOR shall demonstrate operation of each device and the connection to the PLC and SCADA System. Test operation of pumps, valves, and instruments locally, at RTU, and remotely using FCWS SCADA system.

3.4 SUPPLEMENTS

A. The supplements listed below, following the “End of Section” designation, are part of this Specification section.

+ + END OF SECTION + +

NO.	I/O TAG	DESCRIPTION	SIGNAL TYPE	INPUT FROM / OUTPUT TO	CONTROL PANEL	DRAWING REFERENCE
1	PIT-3201	ELEVATED TANK DIFFERENTIAL PRESSURE	AI	DIF PRESSURE / RTU-32	RTU-32	I-02
2	PIT-3202	ELEVATED TANK PRESSURE	AI	PRESSURE TRANSMITTER / RTU-32	RTU-32	I-02
3	FI-3202	PUMP HOUSE DISCHARGE FLOW	AI	FLOW METER / RTU-32	RTU-32	I-02
4	ZD-3201	TANK CONTROL VALVE OPEN	DI	VALVE / RTU-32	RTU-32	I-02
5	ZC-3201	TANK CONTROL VALVE CLOSE	DI	VALVE / RTU-32	RTU-32	I-02
6	ZD-3211	PUMP NO.1 DISCHARGE CHECK VALVE OPEN	DI	ACTUATOR / RTU-32	RTU-32	I-02
7	ZC-3211	PUMP NO.1 DISCHARGE CHECK VALVE CLOSE	DI	ACTUATOR / RTU-32	RTU-32	I-02
8	UA-3221	PUMP NO.2 DISCHARGE CHECK VALVE OPEN	DI	ACTUATOR / RTU-32	RTU-32	I-02
9	ZD-3221	PUMP NO.2 DISCHARGE CHECK VALVE CLOSE	DI	ACTUATOR / RTU-32	RTU-32	I-02
10	UU-3211	PUMP NO.1 MASS ALARM	DI	RVSS-1 / RTU-32	RTU-32	I-02
11	ZX-3211	PUMP NO.1 RUN	DI	RVSS-1 / RTU-32	RTU-32	I-02
12	MS-3211	PUMP NO.1 START/STOP	DO	RVSS-1 / RTU-32	RTU-32	I-02
13	UU-3211	PUMP NO.1 RVSS FAULT	DI	RVSS-1 / RTU-32	RTU-32	I-02
14	MR-3211	PUMP NO.1 IN REMOTE	DI	RVSS-1 / RTU-32	RTU-32	I-02
15	ZA-3211	PUMP NO.1 E-STOP	DI	RVSS-1 / RTU-32	RTU-32	I-02
16	TAH-3211	PUMP NO.1 HIGH TEMPERATURE	DI	RVSS-1 / RTU-32	RTU-32	I-02
17	JR-3211	PUMP NO.1 RVSS POWER ON	DI	RVSS-1 / RTU-32	RTU-32	I-02
18	PAL-3211	PUMP NO.1 INLET PRESSURE LOW	DI	RVSS-1 / RTU-32	RTU-32	I-02
19	PIT-3211	PUMP NO.1 DISCHARGE PRESSURE TRANSMITTER	DI	RVSS-1 / RTU-32	RTU-32	I-02
20	UU-3221	PUMP NO.2 MASS ALARM	DI	RVSS-2 / RTU-32	RTU-32	I-02
21	ZX-3221	PUMP NO.2 RUN	DI	RVSS-2 / RTU-32	RTU-32	I-02
22	MS-3221	PUMP NO.2 START/STOP	DO	RVSS-2 / RTU-32	RTU-32	I-02
23	UU-3221	PUMP NO.2 RVSS FAULT	DI	RVSS-2 / RTU-32	RTU-32	I-02
24	MR-3221	PUMP NO.2 IN REMOTE	DI	RVSS-2 / RTU-32	RTU-32	I-02
25	ZA-3221	PUMP NO.2 E-STOP	DI	RVSS-2 / RTU-32	RTU-32	I-02
26	TAH-3221	PUMP NO.2 HIGH TEMPERATURE	DI	RVSS-2 / RTU-32	RTU-32	I-02
27	JR-3221	PUMP NO.2 RVSS POWER ON	DI	RVSS-2 / RTU-32	RTU-32	I-02
28	PAL-3221	PUMP NO.2 INLET PRESSURE LOW	DI	RVSS-2 / RTU-32	RTU-32	I-02
29	PIT-3221	PUMP NO.2 DISCHARGE PRESSURE TRANSMITTER	DI	RVSS-2 / RTU-32	RTU-32	I-02
30	LSH-3201	SUMP PUMP NO.1 LEVEL SWITCH	DI	LEVEL SWITCH / RTU-32	RTU-32	I-02
31	LSH-3202	SUMP PUMP NO.2 LEVEL SWITCH	DI	LEVEL SWITCH / RTU-32	RTU-32	I-02
32	PIT-3203	DISCHARGE PRESSURE TRANSMITTER	AI	PRESSURE TRANSMITTER / RTU-32	RTU-32	I-02
33	UU-3201	ATC ALARM	DI	ATC PANEL / RTU-32	RTU-32	I-02

I/O COUNT	
AI	4
AO	0
DI	27
DO	2

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT

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SECTION 43 21 13.10

SUBMERSIBLE END SUCTION CENTRIFUGAL SUMP PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, services, equipment and incidentals required to furnish and install sump pumps complete and operational with motors, control equipment and accessories as shown and specified. This Section includes, but may not be limited to the following:
      a. Two submersible sump pumps.
      b. Pump appurtenances.

B. Related Sections:
   1. Division 40, Process Interconnections.
   2. Section 01 78 23, Operations and Maintenance Data.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Equipment furnished shall be a standard product of the manufacturer.
   2. All sump pump equipment shall be the product of one manufacturer.
   3. Manufacturer shall have a minimum of five years of experience of producing substantially similar equipment, and shall be able to show evidence of at least five installations, each in satisfactory operation for at least five years.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. National Electric Code.
   2. Standards of National Electrical Manufacturers Association.
   3. Institute of Electrical and Electronic Engineers.
   4. American National Standards Institute.
   5. Standards of American Water Works Association.

1.3 SUBMITTALS

A. Shop Drawings and Product Data:
   1. Submit manufacturer's literature, illustrations, specifications and engineering data including the following:
      a. Complete description in sufficient detail to permit item by item comparison with the specifications.
      b. Dimensions.
      c. Materials.

d. Size.
e. Weight.
f. Performance data and curves showing pump performance, efficiencies, break horsepower and NPSH.
g. Brake and motor horsepower.
h. Speed.
i. Complete motor information.
j. Manufacturer's standard guarantee.
k. Complete product data and catalog cuts on all control components and wiring.

2. Submit Shop Drawings showing the following:
   a. Fabrication and assembly drawings.
   b. Installation details.
   c. Pump Motor and wiring diagrams.

B. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data:
      a. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation and spare parts information.
      b. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01 78 23, Operations and Maintenance Data.

1.4 DELIVERY, STORAGE AND HANDLING

A. Prepare and protect equipment for shipment in accordance with manufacturer’s printed operation and maintenance manuals.

B. Handle all pumps and appurtenances very carefully. Equipment which is damaged will not be acceptable.

C. Store materials to permit easy access for inspection and identification. Protect equipment including packaged materials from corrosion and deterioration. Storage of equipment shall be in accordance with Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURER' REQUIREMENTS

A. Acceptable Manufacturers:
   1. Liberty Pumps
   2. Goulds Water Technology.
   3. Zoeller M98.
   4. Or approved equal.

2.2 PUMP DESIGN

A. General Requirements:
   1. Type: Submersible pump and motor.
   2. Design to be easily removable for inspection and servicing.
   3. Design, construct and install sump pumps for the service intended.

B. Performance Requirements:
   1. Capable of pumping materials required under applicable service conditions,.
   2. Capable of meeting detailed performance requirements specified in the pump schedule in Section 3.4.
   3. Continually decreasing head-capacity curve between shut-off and maximum capacity.
   4. Capable of operating continuously at all points on the head-capacity curve between minimum and maximum capacity without vibration, noise, cavitation, or overheating.

2.3 DETAILS OF CONSTRUCTION

A. Pump Chamber: Cast iron.

B. Motor Housing: Stainless steel or cast iron.

C. Impeller:
   1. Vortex or semi open non-clog design.
   2. Material: Plastic.
   3. Capable of passing ½ inch solids.

D. Shaft, Bearings and Seals:
   1. Stainless steel shafts, or steel as specified in Pump Schedule.
   2. Upper Bearing Type: Sleeve or ball bearing.
   3. Shaft Seal Construction: Carbon-Ceramic.

E. Volute:
   1. Material: Cast iron.
   2. Free Standing Pumps: Provide volute with integral base legs drilled and tapped for pipe leg extensions.

F. Motors:
   1. Submersible, suitable for operation on 115 VAC, single phase 60 Hz nominal system.
   2. Motors shall be in accordance with all current applicable standards of NEMA, IEEE, AFBMA, NEC, and ANSI.
   3. Motors shall be provided with a minimum service factor of 1.15.
   4. Power cord shall be 25 ft long, A.W.G. 16/3, water resistant, with three-prong plug

2.4 CONTROLS

A. General:
   1. Pump shall have integral vertical float switch for ON/OFF operation.

2.5 FACTORY ASSEMBLY AND PAINTING

A. Shop Assembly:
   1. Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the Project site.
   2. Disassemble units only to the extent necessary for shipping and handling limitations.
   3. Clearly mark units for reassembly and coordinated installation.

B. Use Type 304 stainless steel fasteners unless otherwise specified.

C. Painting: Provide manufacturer's standard paint system.

2.6 TOOLS, SPARE PARTS AND MAINTENANCE MATERIALS

A. Each pump shall be furnished with the following spare parts.
   1. Recommended spare parts kit.
   2. One set of special tools required for maintenance and operations.

B. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the OWNER at the completion of the project.

PART 3 – EXECUTION

3.1 INSPECTION

A. Inspect all equipment immediately upon delivery to Site. Any damaged equipment shall be replaced.

3.2 INSTALLATION

A. Install in accordance with the Drawings, approved Shop Drawings and recommendations of the manufacturer.

B. Install all piping, valves and appurtenances as required to provide a complete and fully operational system.

C. Coordinate sump pump installation with sump pit size. Sump is to be sized for one installed sump pump plus room for another portable pump.

3.3 FIELD QUALITY CONTROL

A. Field Testing:
   1. Field test and calibrate equipment to demonstrate to the OWNER's representative that all equipment will satisfactorily perform the functions and Criteria specified in Part 2.
   2. Provide all test apparatus required at no extra cost to OWNER.
   3. Follow testing procedures recommended by the manufacturer and approved by the ENGINEER.

3.4 PUMP SCHEDULE

A. Table 43 21 13.10-A Submersible End Suction Centrifugal Sump Pumps Schedule

Liquid Temperature Range, (°F):	50 - 80
Quantity of Pumps:	2
Pump Designation:	Sump Pump 1 and 2
Location:	Piping Pits
Design Flow, (gpm):	55
Total Head, (feet):	10
Pump Speed, (RPM, maximum):	3450
Discharge Connection:	1-1/2"
Max Motor (Hp):	0.50
Motor, (Volts/Phase/Hertz):	115 / 1 / 60
Motor Insulation Class:	F

+ + END OF SECTION + +

SECTION 43 21 13.23

CENTRIFUGAL AXIAL SPLIT CASE PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals required to furnish and install centrifugal axial split case pumps complete and operational with motors, control equipment and accessories as shown and specified. Anchor bolts are included in this Section.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before the centrifugal axial split case pumps Work.

C. Related Sections:
   1. Section 03 30 00, Cast-In-Place Concrete.
   2. Section 03 60 00, Grouting.
   3. Section 05 05 33, Anchor Systems.
   4. Section 09 91 00, Painting.
   5. Section 40 05 93, Common Motor Requirements for Process Equipment.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American Bearing Manufacturers Association, (ABMA).
   2. American National Standards Institute, (ANSI).
   3. American Water Works Association, (AWWA).
   4. Hydraulic Institute, (HI).
   5. Institute of Electrical and Electronic Engineers, (IEEE).
      a. IEEE 85, Airborne Sound Measurements - Rotating Electrical Machinery.
   6. National Electrical Code, (NEC).
   7. National Electrical Manufacturers Association, (NEMA).
   8. National Sanitation Foundation, (NSF).

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:
   1. Manufacturer shall have a minimum of five years experience producing substantially similar equipment and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.

B. Component Supply and Compatibility:
   1. Obtain all equipment included in this Section regardless of the component manufacturer from a single centrifugal axial split case pumps manufacturer.
   2. The centrifugal axial split case pumps equipment manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the centrifugal axial split case pumps equipment manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product Data:
      a. Manufacturer's literature, illustrations, specifications and engineering data including: dimensions, materials, size, weight, performance data and curves showing overall pump efficiencies, required net positive suction head, allowable suction lift, flow rate, head, brake horsepower, motor horsepower, speed and shut-off head.
      b. Motor tests and data as described in Part 2.
   2. Shop Drawings:
      a. Fabrication, assembly, installation and wiring diagrams.
      b. Motor Shop Drawings in accordance with Section 40 05 93, Common Motor Requirements for Process Equipment.

B. Informational Submittals: Submit the following:
   1. Source Quality Control:
      a. Guarantee.
      b. Certified pump tests for all pumps.
      c. Motor shop test results in accordance with Section 40 05 93, Common Motor Requirements for Process Equipment.
   2. Field Quality Control Submittals:
      a. Results of motor tests at the Site in accordance with Section 40 05 93, Common Motor Requirements for Process Equipment.

C. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data:
      a. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation and spare parts information.
      b. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01 78 23, Operations and Maintenance Data.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.

B. Storage and Protection:
1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

C. Acceptance at Site:
1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

1.6 GUARANTEE

A. In addition to the manufacturer's standard guarantee, CONTRACTOR shall include the services of a factory-trained serviceman to provide repair service for the equipment for the period of one year commencing with the time the equipment is placed in continuous permanent operation. This service shall include the cost of all replacement parts required during the interval.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

A. Description:
1. Pumps shall be the axial split case horizontal, single-stage, double-suction centrifugal type. They shall be specially designed, constructed, and installed for the service intended and shall comply with the following minimum conditions:

B. Design Criteria:

1. Pump is required to meet the design criteria below within the preferred operation range as outlined in Hydraulic Institute Standard 9.6.

Pump Identification:	**Pump No. 1 & Pump No. 2**
Number Required:	2
Design Flow, (gpm):	850
Design TH, (ft.):	89
Minimum efficiency at Design, (percent):	80
Maximum HP at Shut-off:	25
Motor, (Hp):	30
Maximum Speed, (rpm):	1750
Suction Size, (in.):	5 or 6
Discharge Size, (in.):	4
Available NPSH at Design, (ft.):	121
*Flow at 2nd Design Point, (gpm):	960
TH at 2nd Design Point, (ft.):	80
**Flow at 3rd Design Point, (gpm):	680
TH at 3rd Design Point, (ft.):	98
Liquid Pumped:	Potable Water
Liquid, (pH):	6-8
Temperature, (°F):	60-80
Impeller Rotation:	Clockwise

*Total flow at the 2nd design point head shall be within three percent of the value specified.
**Total flow at the 3rd design point head shall be within eight percent of the value specified.

2.2 MANUFACTURERS

A. Products and Manufacturers: Provide one of the following:
   1. Patterson Pump Company
   2. Peerless Pump Company
   3. Or Engineer Approved Equal.

2.3 DETAILS OF CONSTRUCTION

A. Pump Materials and Construction:
   1. Casing: Cast-iron. Provide the casing joint with dowels for accurate reassembly. The casing shall be furnished with valve openings for venting the high points of the casing and for draining. Pressure instrument taps shall be provided at suction and discharge flanges.
   2. Impeller Type: Enclosed, statically and dynamically balanced.
   3. Impeller Material: 316 Stainless Steel.
   4. Impeller Wear Ring: 316 Stainless Steel.
   5. Casing Head Wear Ring: Vesconite.
   6. Shaft Sleeve: Bronze.
   7. Shaft: Carbon steel.

8. Seals: Mechanical seals, as recommended by pump manufacturer, API Plan 11 flushing.
9. Bearings: Anti-friction, grease or oil lubricated with a minimum B-10 life of 25,000 hours.
10. Baseplate: Structural steel or cast-iron provided with means for collecting and draining oil and water.
11. Furnish with 125 pound ANSI connection flanges.
12. Coupling: Shall have a minimum 1.5 service factor based on the drive rated horsepower and protected with an approved guard.
13. Type 316 stainless steel anchor bolts and inserts shall be furnished under this Section and shall be sized and installed in accordance with the manufacturer's recommendations. Anchor bolts shall conform to the requirements of Section 05 05 33, Anchor Systems.
14. All bolts, nuts and cap screws shall have hexagon heads.
15. Stainless steel nameplates providing the manufacturer's model and serial number, rated capacity, head, speed and all other pertinent data shall be attached to the pump.

B. Motors:
1. Motors shall conform to the requirements of Section 40 05 93, Common Motor Requirements for Process Equipment.
2. Drip-proof, TEFC, solid shaft, ball bearing type.
3. Motors shall be in accordance with all current applicable standards of NEMA, IEEE, ABMA, NEC, and ANSI.
4. Motors shall be normal starting torque, normal slip, squirrel cage induction type.
5. Motors shall be capable of carrying full load current continuously without injurious temperature rise in an ambient temperature of 40ºC.
6. Motors shall be provided with a service factor of 1.15.
7. Motors shall be of sufficient size so that there will be no overload on the motor above rated nameplate horsepower under any condition of operation from shut-off to zero head, unless otherwise specifically permitted in this Section.
8. Motor thrust bearings, if required, shall be adequate to carry continuous thrust loads under all conditions of operation.
9. Locked rotor currents shall be as specified in NEMA Standards.
10. Lubrication may be grease or oil type.
11. Motor Sensors:
    a. Each pump motor shall be equipped with a minimum of three thermal sensors embedded in the stator windings and wired to the control panel for supplemental motor protection.
    b. Leakage sensor in lower part of stator housing shall be wired to leads in the junction chamber.
12. Motors shall have built-in thermal overload protection.
13. Motor Tests and Data:
    a. For each motor, furnish a certified motor data sheet for the actual motor or for a previously manufactured electrically duplicate motor which was tested. Provide the following minimum data:

1) Starting torque.
2) Efficiency at 1/2, 3/4 and full load.
3) Power factor at 1/2, 3/4 and full load.
4) Percent slip.
5) Running light, full load and locked rotor current.
6) Current balance check.
7) Vibration check.
8) Temperature rises and results of dielectric tests.
9) Motor type and frame size.
10) Bearing type and lubrication medium.
11) Insulation and enclosure type.

2.5 CONTROLS AND ACCESSORIES

A. Pumps shall be furnished with the following accessories and controls:
   1. Automatic air release valve.

2.6 TOOLS, SPARE PARTS AND MAINTENANCE MATERIALS

A. Each pump shall be furnished with the following:
   1. One mechanical seal.
   2. One set of gaskets.
   3. One shaft sleeve.
   4. Two sets of special tools required for normal maintenance or operation.

B. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the OWNER at the conclusion of the Project.

2.7 SURFACE PREPARATION AND PAINTING

A. Pumps, motors, frames, baseplates, appurtenances, etc., shall receive shop primer coating conforming to the requirements of Section 09 91 00, Painting.

B. Surface preparation and painting shall conform to the requirements of Section 09 91 00, Painting.

C. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.

D. CONTRACTOR shall certify, in writing, that the shop primer and finish coating system conforms to the requirements of Section 09 91 00, Painting.

E. Field painting shall conform to the requirements of Section 09 91 00, Painting.

2.8 SOURCE QUALITY CONTROL

A. Shop Tests:
   1. Pump casings shall be hydrostatically tested to twice the discharge head or 1-1/2 times the shutoff head, whichever is greater.
   2. Running Test: Pump assembly shall be operated from zero to maximum capacity as shown on the approved curve. Results of the test shall be shown in a plot of test curves showing head, flow, horsepower, efficiency, and current. Readings shall be taken at a minimum of five evenly spaced capacity points including shut-off, design point and minimum head for which pump is designed to operate.
   3. Each test shall be witnessed by a Registered Professional Engineer, who may be an employee of the manufacturer. The Registered Professional Engineer shall sign and seal all copies of curves and shall certify that hydrostatic tests were performed. Tests shall be conducted in conformance with the methods described in HI 14.6, acceptance grade 1U.
   4. Pumps shall not be shipped until the ENGINEER has approved the test reports.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall verify that structures, pipes and equipment are compatible.

B. Make adjustments required to place system in proper operating condition.

3.2 INSTALLATION

A. Manufacturer's representative shall check and approve the installation prior to operation. Manufacturer's representative shall field test and calibrate the equipment to assure that the system operates to the OWNER'S satisfaction.

B. All pumping units shall be installed on concrete bases and secured with anchor bolts in accordance with the manufacturer's recommendations and as shown. The concrete bases shall be poured up to 1-inch below the metal bases or soleplates. Concrete work and grout are in Division 03, Concrete. The base with the equipment mounted thereon, or the soleplate, shall then be accurately shimmed to grade and the spaces between filled with an approved non-shrink grout. After the grout has reached its initial set, exposed edges shall be cut back 1/2-inch and the edges neatly finished with 1 to 2 cement mortar. Where channel baseplates are used, the void inside the channel shall be filled with non-shrink mortar and the open ends plastered with 1 to 2 cement mortar.

C. Neatly placed 1/2-inch hard copper pipe shall be provided on each pump to convey leakage to nearest acceptable drainage inlet.

D. Installation shall include furnishing and applying an initial supply of grease and oil, recommended by the manufacturer.

E. Support piping independent of pump.

F. Check and align all pumps, motor and drive shafting, to the standards of the Hydraulic Institute.

3.3 FIELD QUALITY CONTROL

A. All equipment will be given running tests by CONTRACTOR at the job Site following installation of the equipment and controls. Should the tests indicate any malfunction, CONTRACTOR shall make any necessary repairs and adjustments. Such tests and adjustments shall be repeated until, in the opinion of the ENGINEER, the installation is complete and the equipment is functioning properly and accurately, and is ready for permanent operation.

B. A factory trained representative shall be provided for installation supervision, start-up and test services and operation and maintenance personnel training services. The representative shall make a minimum of 3 visits, minimum 8 hours on-Site for each visit, to the Site. The first visit shall be for assistance in the installation of equipment. Subsequent visits shall be for checking the completed installation, start-up and training of the system. Manufacturer's representative shall test operate the system in the presence of the ENGINEER and verify that the equipment conforms to the requirements. Representative shall revisit the Site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

C. All costs, including travel, lodging, meals and incidentals, for additional visits shall be at no additional cost to the OWNER.

+ + END OF SECTION + +

SECTION 43 41 13

ELEVATED STEEL WATER STORAGE TANK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. The CONTRACTOR shall be responsible for all labor, materials and equipment necessary for the design, fabrication, construction, painting, disinfection and testing of an elevated, welded carbon steel water storage tank supported by a series of supporting columns and cross bracing, and associated foundations.
   2. Tanks shall conform to dimensions and layouts as shown.
   3. Tanks shall be of the following type and use:
      a. One (1), multi-column elevated tank for storage of potable water.
   4. This Section includes protective equipment and accessories.

B. Related Sections:

   1. Section 03 00 05, Concrete.
   2. Section 05 05 33, Anchor Systems.
   3. Section 05 12 00, Structural Steel Framing.
   4. Section 05 53 11, Steel Grating.
   5. Section 09 91 00, Painting.
   6. Section 26 05 05, General Provisions for Electrical Systems.
   7. Section 31 20 00, Earth Moving.
   8. Section 31 63 16, Auger Cast Grout Piles
   8. Section 40 05 05, Exposed Piping Installation.
   9. Section 40 05 06, Couplings, Adapters, and Specials for Process Piping.

C. Welded Steel Tank Manufacturer's Responsibility: To ensure that all the tanks are properly coordinated and are in accordance with the intent of these Specifications, CONTRACTOR shall obtain the steel tanks specified herein from the steel tank manufacturer in whom shall be vested unit responsibility for the elevated steel tank, support columns, cross bracing, tank foundation, and appurtenances.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American Concrete Institute, (ACI).
      a. ACI 318, Building Code Requirements for Reinforced Concrete.
      b. ACI 301, Specifications for Structural Concrete
   2. American Institute of Steel Construction, (AISC).
      a. AISC 303, Code of Standard Practice for Steel Buildings and Bridges

b. AISC 325, Steel Construction Manual.
c. AISC 360, Specifications for Structural Steel Buildings.

3. American Society of Civil Engineers, (ASCE).
   a. ASCE 7, Minimum Design Loads for Buildings and Other Structures.
4. American National Standards Institute, (ANSI).
   a. ANSI B.16.5, 150 pound flanged fittings.
5. American Society for Testing and Materials, (ASTM).
   a. ASTM A 36, Specification for Carbon Structural Steel.
   b. ASTM A 53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   c. ASTM A 181, Specification for Carbon Steel Forgings, for General-Purpose Piping.
   d. ASTM A615, Specifications for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
6. American Water Works Association, (AWWA).
   a. AWWA D100, Standard for Welded Carbon Steel Tanks for Water Storage
   b. AWWA D102, Standard for Painting Steel Water Storage Tanks
   c. AWWA C652, Standard for Disinfection of Water Storage Facilities
7. American Welding Society, (AWS).
   a. AWS 2.4, Standard Symbols for Welding, Brazing and Nondestructive Examination
   b. AWS B2.1, Specification for Welding Procedure and Performance Qualification
   c. AWS D1.1/D1.1M, Structural Welding Code - Steel
8. National Sanitation Foundation, (NSF).
   a. NSF 61, Materials in contact with Potable Water
9. The Society for Protective Coatings, (SSPC).
   a. SSPC, Structures Painting Council Standards for Blast Cleaning Surface Preparations and Painting of Steel Surfaces.
10. FAA Advisory Circular 70/7460-1K, Obstruction Marking and Lighting.
11. National Fire Protection Association, (NFPA).
    a. NFPA 70, National Electrical Code, latest Edition.
    b. NFPA 780, Standard for the Installation of Lightning Protection.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. All tank work shall be performed by a manufacturer that specializes in the design and construction of ANSI/AWWA D100 elevated steel tanks for water storage, which is capable of meeting all the requirements of these specifications. No manufacturer will be considered qualified unless it has designed and built in its own name at least five ANSI/AWWA D100 elevated steel tanks of equal or greater size as those specified herein, in the last ten years, and which have been in successful service for a minimum of five years. .
   3. Professional Engineer:
      a. Tank manufacturer shall employ registered professional engineer legally qualified to practice in the state of Georgia. Professional engineer shall have

at least ten years experience in design and field construction of ANSI/AWWA D100 elevated steel tanks.

b. Responsibilities include:
   1) Reviewing elevated steel tanks system performance and design criteria stated in the Contract Documents.
   2) Preparing written requests for clarifications or interpretations of performance or design criteria for submittal to ENGINEER by CONTRACTOR.
   3) Preparing or supervising the preparation of design calculations for the elevated tank, foundation, appurtenances, design drawings, and related Shop Drawings.
   4) Signing and sealing all calculations, design drawings, and Shop Drawings.
   5) Certifying that:
      a) Design of elevated steel tanks and appurtenances has been performed in accordance with performance and design criteria stated in the Contract Documents, and
      b) Design conforms to all applicable local, state, and federal Laws and Regulations, and to prevailing standards of practice.

4. Testing Laboratory:
   a. Retain the services of independent testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
   b. Testing laboratory shall comply with the requirements of Section 01 45 29.13, Testing Laboratory Services Furnished by Contractor, and demonstrate to ENGINEER's satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated, in accordance with ASTM E329.
5. Welding:
   a. All steel tank welding procedures must be performed in accordance with AWWA D100, Section 8. Written weld procedure specifications (WPS) shall comply with ASME BPVC Sec. IX or AWS B2.1. Personnel involved in tank welding operations shall be qualified to the same code as the Weld Procedure Specifications.
   b. For tank accessories and appurtenances, qualify procedures and personnel according to AWS D1.1/D1.1M, AWS D1.2/D1.2M or AWS D1.4/D1.4M, as required for the component involved.
   c. Submit certification that each welder employed on or to be employed for the Work possesses current certification in the welding process with which welder will be working. Certifications shall be current and valid throughout the Work.

B. Component Supply and Compatibility:
   1. Obtain all welded steel tanks components through a single source and from a single manufacturer.

2. Elevated welded steel tanks manufacturer shall review and approve, or prepare all Shop Drawings and other submittals for all components furnished under this Section.
3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by steel tanks manufacturer.

C. Quality Assurance Plan:
   1. Prepare a quality assurance plan in accordance with applicable Sections of ANSI/AWWA D100, to verify that materials, fabrication and construction conform to the design requirements. The plan shall include the following:
      a. Procedures for exercising control of fabrication and construction.
      b. Required inspections and tests.
      c. Inspection and test procedures.

D. Regulatory Requirements: Conform to the following:
   1. Fabricate welded steel elevated tanks to comply with material verification and special inspection requirements of the governing Building Code and Authorities Having Jurisdiction at the Site.
   2. 29 CFR 1910, Occupational Health and Safety Standards, Sections 1910.24 and 1910.27, for stairs and ladders, respectively.
   3. All materials that can contact potable water or water that will be treated to become potable shall be listed in NSF/ANSI 61.

E. Pre-installation Conference:
   1. Prior to erection of elevated steel tanks and associated Work, CONTRACTOR shall schedule and meet at the Site with the tank manufacturer and installer, the installers of substrate construction to receive the elevated steel tanks, the installers of other Work in and around the elevated steel tank that follows the steel tank Work, ENGINEER, and other representatives directly concerned with performance of the Work. Review foreseeable methods and procedures related to the elevated steel tank Work, including, but not necessarily limited to the following:
      a. Review Project requirements and the Contract Documents.
      b. Review required submittals, both completed and yet to be completed.
      c. Review status of foundation work, including approval of surface preparations, structural loading limitations and similar considerations.
      d. Review detailed requirements of CONTRACTOR's proposed concrete design mixes.
      e. Review and discuss procedures for producing proper concrete construction, and to clarify roles of the parties involved.
      f. Review construction schedule and availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
      g. Review environmental conditions, other Project conditions, and procedures for coping with unfavorable conditions.
      h. Review regulations concerning code compliance, environmental

protection, health, safety, fire and similar considerations.

i. Review required inspection, testing, and certifying procedures.

2. Record the discussions of the conference and the decisions and agreements or disagreements reached, and furnish a copy of the record to each party attending.
3. Record all revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.
4. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
   a. Shop Drawings for the construction of elevated welded steel tanks system, including plans, elevations, sections, details of entire system showing full dimensions and identification marks, and tank lettering layout drawings. Shop Drawings shall include size and position of all structural components, the required strength or grade of all materials, construction tolerances, and finishes.
   b. Drawings of concrete elements shall show all details including construction joints, openings, and inserts.
   c. Drawings of steel components shall show all details of shop and field welded joints and other connections. Standard weld symbols as listed in AWS 2.4 shall be used. Include sequence of erection.
   d. Foundation details shall include excavation, soil protection, and fill, according to the requirements of Section 31 23 05, Excavation and Fill.
   e. Piping details shall include design and product data for all tank manufacturer's recommended expansion joints and all couplings/adapters required for pipe material transitions in the tank riser and overflow piping.
   f. CONTRACTOR shall also note Work not supplied by tank manufacturer and who is to supply such Work.
2. Product Data:
   a. Manufacturer's complete product information, specifications and installation instructions for elevated steel tanks components and accessories. Include material descriptions, dimensions, and profiles of individual system components, such as valves and couplings, pre-manufactured pipe supports, ladder and ladder safety devices, railing, hatches, manways, vent, doors with hardware, etc.
   b. Provide technical data and color samples of all coating products. Comply with the requirements of Section 09 91 00, Painting.

B. Delegated Design Submittals:

1. Design Data: Submit the following:
   a. Laboratory Trial Batch Reports: Provide a separate mix design for each

concrete and auger cast grout compressive strength required or specified. Submit laboratory test reports for materials, and mix design tests, including list of concrete and grout materials and proportions for the proposed mix designs. Include data sheets, test results, certifications, and mill reports to qualify the materials proposed for use in the mix designs, including admixtures. Comply with the requirements of Section 03 00 05, Concrete, and Section 31 63 16 Auger Cast Grout Piles.

b. Reinforcing steel shop drawings showing fabrication and placement. Include location, dimensions, and additional reinforcing required at all penetrations through the concrete foundation. Comply with the requirements of Section 03 00 05, Concrete.

c. Provide design, detail drawings, and procedures for the foundation support forming system.

d. Design Calculations:

1) Complete calculations for the elevated steel tanks and foundation, encompassing all required platforms and railing, platform connections and appurtenances, as one package with the Shop Drawings. Structural calculations shall include all specified performance criteria, required load cases and load combinations used in the design and resulting forces. All calculations and assumptions shall be presented so that ENGINEER can easily follow the progress and logic of tank manufacturer's professional engineer. The design analysis shall include the name and office phone number of the designer to answer questions during the shop drawing review.

2) Design calculations shall be signed, sealed, and dated by tank manufacturer's professional engineer, licensed in the State of Georgia. State of professional engineer's registration, registration number, and name on seal shall be clearly legible.

C. Informational Submittals: Submit the following:

1. Delivery Tickets: Copies of all delivery tickets for each load of concrete and grout delivered to or mixed at the Site. Each delivery tickets shall contain information in accordance with ASTM C94/C94M along with project identification name and number (if any), date, mix type, mix time, quantity and amount of water introduced.

2. Certificates.

a. Certification by professional engineer that elevated steel tanks system design is in accordance with performance and design criteria stated in the Contract Documents, and that design conforms to applicable local, state, and federal Laws and Regulations, and to prevailing standards of practice.

b. Welder's certifications.

3. Qualification Statements: Submit qualifications for the following:

a. Manufacturer.

b. Professional Engineer.

c. Testing Laboratory.

4. Quality Assurance Plan.

C. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data:
      a. Operation and maintenance manuals in accordance with Section 01 78 23, Operations and Maintenance Data.
   2. Warranty Documentation:
      a. Copies of special warranties, as specified.
   3. Record Documentation:
      a. Immediately upon completion of the Work submit three copies of Record Drawings showing the actual in-place installation of all work specified in this Section. The record drawings shall include the locations of all welding examinations submitted.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Deliver concrete reinforcing materials to the site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams. Deliver appurtenant equipment to the job site in an undamaged and ready to place condition. Deliver concrete in accordance with the requirements of Section 03 00 05, Concrete.
   2. Comply with Section 01 65 00, Product Delivery Requirements.

B. Storage and Handling:
   1. All materials used for concrete shall be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer. Bins or platforms having hard clean surfaces shall be provided for storage. Suitable means shall be taken during hauling, piling, and handling to ensure that segregation of the coarse and fine aggregate particles does not occur and the grading is not affected.
   2. Protect steel members and packaged materials from corrosion and deterioration.
   3. Comply with 01 66 00, Product Storage and Handling Requirements.

1.6 SITE CONDITIONS

A. Site Information:
   1. Information on subsurface conditions is available in the reports listed in the Supplementary Conditions.
   2. Additional test borings and other exploratory operations may be made by CONTRACTOR at no additional cost to OWNER, provided such operations are acceptable to ENGINEER.

1.7 WARRANTY

A. General Warranty: The special warranties specified in this Article shall not deprive OWNER of other rights or remedies OWNER may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by CONTRACTOR under the Contract Documents. The obligations of CONTRACTOR under the Contract Documents shall not be limited in any way by the provisions of the specified special warranties.

B. Special Warranties:
   1. Tank manufacturer shall guarantee workmanship and materials on the elevated welded steel tank systems and components for a period of two years from date of OWNER's acceptance. In case leakage or other defects appear within the two year period, tank manufacturer will make repairs promptly upon written notice by OWNER that such defects have been found.

PART 2 - PRODUCTS

2.1 DETAILS OF CONSTRUCTION

A. The elevated tank shall be all-welded construction having a "witch's hat" style roof and toroidal bottom, supported by multiple vertical columns and cross bracing. Tank shall be designed and constructed in accordance with the provisions of ANSI/AWWA D100. All members of structural steel or of reinforced concrete shall be designed to safely withstand the maximum stresses to which they may be subjected during erection and operation. The elevated tank shall be in accordance with the shape, dimensions, and details required by the Drawings and as specified herein.

B. Manufacturers: Provide one of the following:
   1. Caldwell Tanks.
   2. Phoenix Tanks.
   3. Or equal.

C. Tank Schedule:

Parameter	Value
Chemical Stored:	Potable Water
Specific Gravity:	1.0
Ambient Temperature Range, (°F):	-10°F to 100°F
Pressure:	Atmospheric
Nominal Capacity, (gallons):	400,000
Tank Diameter, (feet):	36
Height of Tank, Top of Foundation to Top of Tank, (feet):	162
Tank High Water Line, (feet):	146
Tank Operating Range, (feet):	54.5
Tank Low Water Line, (feet):	91.5
Top of Foundation Elevation, (feet):	875
Tank Base Diameter, (feet):	48
Existing Ground Elevation, (feet):	874.5
Finished Ground Elevation, (feet):	875
Tank Fill Diameter, (inches):	12
Tank Overflow Line Diameter, (inches):	12
Tank Drain Diameter, (inches):	8

2.2 DESIGN

A. General
   1. The structural design of the elevated storage tank shall conform to the following design standards (latest edition) except as modified or clarified as follows:
      a. Foundations – AWWA D100 and ACI 318 – Building Code Requirements for reinforced concrete.
      b. Steel Tank – AWWA D100
      c. Steel Tank Painting – AWWA D102

B. Environmental Loads
   1. Wind Load – Wind pressure shall be determined in accordance with AWWA D100, Section 3.1.4. Basic wind speed used in the Wind Pressure formula shall be determined using the mapped site location and Figure 1 of AWWA D100.
      Basic Wind Speed (BWS) =___114____ MPH

   2. Seismic Load – Seismic loads shall be determined in accordance with AWWA D100, Section 13.
      a. Region Dependent Transition Period (T_L) =____12____ (Fig. 19).
      b. Site Class ____D____ (Table 25)

c. MCE Spectral Response Acceleration at 0.2sec (S_S) and 1sec (S_1) (Fig's. 5-18)

S_S =____16.3%____
S_1 =_____8.2%___
Longitude =__-84.51____ (at tank center)
Latitude =____33.47____ (at tank center)

3. Snow Load – Snow load shall be determined in accordance with AWWA D100, Section 3.1.3.1.

C. Foundation:

A geotechnical investigation has been carried out at the site and a copy of the report is included with the Contract Documents. Recommendations for the foundation and allowable bearing capacities are defined in this report. The Owner shall retain the services of the Geotechnical consultant to verify the adequacy of the bearing stratum after the Contractor has carried out the excavation and before any concrete or reinforcement is placed. The concrete foundation shall be designed by the Contractor based upon the recommendations in the Geotechnical report. The report must provide the allowable soil bearing pressure with appropriate factors of safety, the active and passive earth pressure coefficients, the angle of soils internal friction, its cohesion, unit weight and recommendations for bearing depth and backfill requirements.

D. Steel Tank

1. Provide an all-welded steel tank. All materials, design, and fabrication shall be in strict accordance with AWWA D100.
2. All exposed lap joints shall be fully seal welded on both sides.
3. All members shall be designed to safely withstand the maximum stress to which they may be subjected during erection and operation. The minimum thickness of steel tank components shall be per AWWA D100, and as follows:
   a. Parts not in contact with water: 3/16 inch.
   b. Parts in contact with water: 1/4 inch.
4. The overturning moment used in designing the pedestal and foundation shall include the moment due to eccentricity of the gravity loads caused by deflection of the structure under wind or seismic conditions (i.e. P- delta effect).
5. All portions of the tank including the roof shall be of watertight construction.

2.3 CONSTRUCTION

A. Concrete Foundation

1. The foundation shall be designed and constructed to safely and permanently support the structure. The basis of the foundation construction shall be consistent with the soils investigation data included in the Contract Documents. Appropriate changes to construction schedule and price will be negotiated if, during excavation, soil conditions are encountered which differ from those described in geotechnical report. The concrete foundation shall be constructed in accordance

with ACI 301. Minimum concrete compressive strength shall be as specified in Section 03 00 05, Concrete.

2. Reinforcing bars shall be deformed in accordance with ASTM A615/A615M, and as follows:
   a. Provide Grade 60 for all bars, unless indicated otherwise.

B. Steel Tank Construction:
   1. General: The erection of the steel tank shall comply with the requirements of Section 10 of AWWA D100 except as modified by these documents.
   2. Welding: All shop and field welding shall conform to AWS and AWWA D100, Section 10. The contractor shall ensure welders or welding operators are qualified in accordance with ASME Section IX or ANSI/AWS B2.1.
   3. Fabrication: All fabrication and shop assembly shall conform to the requirements of AWWA D100, Section 9, Shop Fabrication.
   4. Erection: Plates subjected to stress by the weight or pressure of the contained liquid shall be assembled and welded in such a manner that the proper curvature of the plates in both directions is maintained. Plates shall be assembled and welded together by a procedure that will result in a minimum of distortion from weld shrinkage.
   5. Inspection and Testing: Inspection of shop and field welds shall be in accordance with AWWA D100, Section 11, Inspection and Testing. All inspection shall be performed prior to interior and exterior field painting. Radiographic inspection shall be performed by an independent testing agency with all costs included in the Contractor's bid and paid by the Contractor.
   6. Roof Lap Joints: All interior lap joints shall be sealed by means of caulking or continuous seal welding. This shall include penetrations of roof accessories.
   7. Galvanic Corrosion Protection: Dissimilar metals inside the tank and below the high water level shall be electrically isolated from carbon steel components to which they attach. Painting of the dissimilar metal does not eliminate the requirement for isolation.

2.4 ACCESSORIES

A. General
   1. The following accessories shall be provided in accordance with these specifications. All items shall be in full conformity with the current applicable OSHA safety regulations and the operating requirements of the structure.

B. Ladders
   1. Access ladders shall be provided at the following locations:
      a. The tower ladder shall extend up one column from near the base connecting with the balcony. The first rung shall be located approximately 8 feet above top of foundation.
      b. An roof access tank ladder from the balcony to the eave of the tank roof.
      c. An roof ladder from the eave of the tank roof to the tank vent.

c. An inside tank ladder from the roof hatch to the inside bottom of the tank.
d. An inside riser ladder from the base of the riser to the bottom of the tank.

2. Ladder side rails shall be a minimum 3/8 inch by 2 inches with a 16 inch clear spacing. Rungs shall be not less than 3/4 inch, round or square, spaced at 12 inch centers. The surface of the rungs shall be knurled, dimpled or otherwise treated to minimize slipping. Ladders shall be secured to adjacent structures by brackets located at intervals not exceeding 10 feet. Brackets shall be of sufficient length to provide a minimum distance of 7 inches from the center of the rung to the nearest permanent object behind the ladder.

C. Fall Protection
1. Ladders shall be equipped with a fall arrest system meeting OSHA regulations. The system shall be supplied complete with safety harnesses, locking mechanisms, and accessories for two persons.
2. Provide a caution sign at the lowest point of access of ladders requiring fall prevention systems. The sign shall read: "CAUTION – Safety Equipment required when climbing ladder."
3. Product and Manufacturer: Provide one of the following:
   a. Safe-T-Climb by Miller Safety Products.
   b. Or equal.

D. Balcony
1. The tank shall be equipped with a balcony not less than 30" wide with a handrail not less than 42" high.
2. The balcony, grating, and handrails shall be constructed of finished painted structural steel.
3. Except as otherwise shown, fabricate from structural shapes, plates, and bars, of all-welded construction using mitered corners, welded brackets, and splice plates and minimum number of joints for field connection.
4. For grating requirements, refer to Section 05 53 11, Steel Grating.
5. Railing shall be designed to meet all Georgia Building Code and OSHA requirements.

E. Openings
1. Roof Hatches:
   Provide two access hatches on the roof of the tank. One hatch shall be 30 inch diameter and allow access from the roof to the interior of the tank. The hatch will be hinged and equipped with a hasp for locking. The hatch cover shall have a 2 inch downward edge. The second hatch will be 24 inch diameter and flanged with a removable cover so constructed that an exhaust fan may be connected for ventilation during painting operations. The openings shall have a minimum 4 inch curb.
2. Tank Vent:
   The tank vent should be centrally located on the tank roof above the maximum weir crest elevation. The tank vent shall have an intake and relief capacity

sufficiently large that excessive pressure or vacuum will not develop during maximum flow rate. The vent shall be designed, constructed and screened so as to prevent the ingress of wind driven debris, insects, birds and animals. The vent shall be designed to operate when frosted over or otherwise clogged. The screens or relief material shall not be damaged by the occurrence and shall return automatically to operating position after the pressure or vacuum is relieved.

3. Riser Entrance:
   A minimum 18 x 24 inch elliptical access manhole shall be provided approximately 3 feet above the base of the wet riser. The hatch shall open inward.

F. Riser
The diameter of the wet riser shall be not less than 6 feet. Provide an 8" flanged nozzle for connection of tank drain piping. Provide connection necessary for installation of a pressure sensing device for measurement of tank level. Refer to design drawings for locations.

G. Piping
1. Inlet/Outlet Piping:
   The vertical combined inlet/outlet pipe connection to the bottom of the riser shall be a 12 inch schedule 10S or heavier carbon steel pipe with flanged transition to a ductile iron base elbow of the same diameter. The vertical pipe shall extend up into the riser one foot above the riser base. The base elbow shall be flanged for connection to ductile iron transmission piping supplied by CONTRACTOR.

2. Overflow Piping:
   The overflow pipe shall be designed to carry the maximum design flow rate of 3,100 GPM. The 12 inch steel overflow pipe shall have a minimum wall thickness of 1/4". A suitable weir shall be provided inside the tank with the crest located at High Water Level. The overflow shall be routed from the weir to closely match the roof contour and extend down a column and terminate 3.5 feet above grade. The discharge end of overflow pipe shall have a 150 lb flange.

H. Identification Plate
A tank identification plate shall be mounted on the tank riser pipe above the access manhole. The identification plate shall be corrosion resistant and contain the following information.
1. Tank Contractor

2. Contractor's project or file number

3. Tank capacity

4. Height to High Water Level

5. Date erected

I. Electrical and Lighting:
   1. Obstruction Lighting:
      a. Obstruction lighting shall be provided in accordance with FAA AC 70/7460-1K.
      b. The obstruction light shall be centrally located on the roof of the tank above all permanent installations. It shall be a steady burning, dual fixture type with a lamp-out relay switch. The luminaire shall be weather sealed, corrosion resistant, with aluminum base and housing. Red globes with clear traffic signal LED lamps rated at 8,000 hour life shall be provided.
      c. A pilot light located near the electrical panel shall be provided to indicate when the primary bulb has failed.
   2. Wiring materials (as applicable):
      a. Conduit: Exposed exterior conduit shall be galvanized rigid metal conduit. Underground conduit shall be rigid nonmetallic PVC conduit, schedule 40. Exposed sleeves embedded in concrete wall shall be stainless steel or PVC. Conduit sealing fittings shall be installed between sleeves and conduit. Conduit shall be installed such that it does not obstruct ladder access, create tripping hazard, or create headroom obstruction.
      b. Fittings and Boxes: Exterior applications shall be rated NEMA 4X.
      c. Enclosures: Load centers, power distribution panels, lighting panels, and enclosed switches shall be in NEMA 3R for exterior locations, as defined in NEMA publication NEMA 250.
      d. Grounding shall be provided in accordance with NFPA 70.

2.5 LIGHTNING PROTECTION SYSTEM

A. The storage tank will require a lightning protection system in accordance with Section 26 41 13, Lightning Protection for Structures.

B. Bolted connections shall be used for bonding ground cable to the tank steel structure.

2.6 COATINGS

A. Conform to the requirements of Section 09 91 00, Painting, ANSI/AWWA D102, and as specified herein.

B. All ferrous metal surfaces in contact with potable water shall be coated with NSF approved epoxy paint. Coatings shall be applied by tank manufacturer.

C. Lettering: Additional logos and lettering shall be by OWNER.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR shall examine the areas and conditions under which the elevated steel water tank is to be erected and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 GENERAL

A. Site Preparation:
   1. CONTRACTOR shall prepare elevated tank foundation and final grading in accordance with the requirement of Section 31 20 00, Earth Moving, and as shown on the Drawings.

B. Except as otherwise indicated or specified, elevated steel water tank shall be erected in accordance with the requirements of ANSI/AWWA D100.

3.3 FOUNDATION

A. Excavation Inspection:
   1. Subgrade shall be inspected and approved prior to construction of tank foundation, as required in Section 31 20 00, Earth Moving.

B. Concrete Construction:
   1. All concrete shall be conveyed, placed, finished, cured, and tested per the requirements of Section 03 00 05, Concrete.
   2. The sides of foundations shall be formed using any suitable system conforming to ACI 318. Earth cuts shall not be used as forms for vertical surfaces. Forms shall be provided on top sloping surfaces steeper than 2.5 horizontal to 1 vertical. Straight form panels may be used to form circular foundation shapes. The minimum design radius shall be maintained at all sections.
   3. Finish:
      a. Comply with the requirements of Section 03 00 05, Concrete, and as specified below:
         1) Exposed formed surfaces: smooth form finish.
         2) Not exposed formed surfaces: standard form finish.
         3) Exposed unformed surfaces: trowel finish.
         4) Not exposed unformed surfaces: float finish.

C. Auger Cast Pile Construction:
   1. All grout mix for the auger cast pile foundation shall be conveyed, placed, cured, and tested per the requirements of Section 31 63 16 Auger Cast Grout Piles.

3.4 WELDED STEEL TANK

A. Welding:
   1. Welding procedures and general welding requirements shall be in accordance with applicable Sections of ANSI/AWWA D100.
   2. All welding, including welding for the attachment of piping, conduits and other appurtenances to the tank, shall be completed prior to field painting of the tank.

B. Fabrication and erection:
   1. Layout, cutting, forming, edge preparation and workmanship for steel tank components and fabrications shall be in accordance with applicable Sections of ANSI/AWWA D100.

C. Tolerances:
   1. Steel tank tolerances shall be in accordance with the requirements of applicable Sections of AISI/AWWA D100.

3.5 PAINTING

A. Shop priming and field painting of the elevated steel tank and components shall conform to the requirements of Section 09 91 00, Painting and ANSI/AWWA D102.

3.6 ELECTRICAL WORK

A. All work shall be performed and all materials shall be provided in accordance with Section 26 05 05, General Provisions for Electrical Systems.

3.7 FIELD QUALITY CONTROL

A. Concrete and Grout testing and inspection.
   1. OWNER will employ testing laboratory to perform field quality control sampling and testing during concrete placement to comply with requirements of Section 03 00 05, Concrete, and Section 31 63 16, Auger Cast Grout Piles.

B. Welded Steel Tank Testing and Inspection:
   1. Inspect accessible welds in tank shell as Work progresses.
   2. Test Method: Radiographic.
   3. Quantity, Location and Methods: Comply with AWWA D100.
   4. Inspector: Independent laboratory approved by OWNER.
   5. Report Procedure: Comply with AWWA D100.

3.8 HYDROSTATIC TESTING AND DISINFECTION

A. Welded Steel Tank Hydrostatic Testing:
   1. Test tank for leakage prior to painting.
   2. Fill tank to High Water Level identified on Contract Drawings. OWNER will

only furnish water for initial filling of the steel elevated tank. Additional water required for retesting shall be furnished at CONTRACTOR's expense. The elevated steel tank filling operation will be subject to scheduling and approval by OWNER.

3. Repair leaks by chipping, gouging or oxygen gouging to remove any defective welds and then re-weld.
4. No repair work shall be done on any joints unless the water in the tank is at least 3 feet below the point of repair.
5. After repairs are made, refill and retest tanks until there are no leaks disclosed.

B. Disinfection of elevated steel water tanks shall comply with requirements of AWWA C652 Method 1.

1. Verify that water main has been disinfected. Wait until final coat of paint has properly cured, as determined in accordance with the coating manufacturer's instructions, but in no case less than 7 days before disinfecting tank.
2. Water for initial disinfection and filling will be furnished by OWNER. CONTRACTOR shall provide pumps, hoses, and other temporary equipment required to fill tank. CONTRACTOR shall furnish chlorine required for disinfection.
3. Disinfection Procedure:
   a. Use Chlorination Method No. 1 per AWWA C652 to disinfect inlet/outlet piping, riser, and tank.
   b. Overflow piping need not be disinfected.
4. Bacteriological Sampling and Testing: Comply with AWWA C652. Samples for bacteriological testing will be obtained by CONTRACTOR. First set of bacteriological testing will be paid for by OWNER.
   a. If tank must be emptied, re-disinfected, flushed, and refilled to obtain satisfactory bacteriological samples, or because of extensive leakage, CONTRACTOR shall pay for additional chlorine, re-testing, and water at the utility owner's standard rates.
5. Handling of Disinfection Water: Comply with AWWA C652 if disposal necessary. Properly dispose of heavily chlorinated water. Provide required neutralizing chemical to neutralize the chlorine residual.

3.9 ANNIVERSARY INSPECTION

A. Elevated steel water storage tanks shall be inspected by OWNER and CONTRACTOR approximately one year after completion of the Work. Inspection and remedial work, if required, shall be per the requirements of ANSI/AWWA D100. Cost of anniversary inspection, including repairs, shall be considered as being included in the Contract price.

+ + END OF SECTION + +