City of Fort Bragg

Water Treatment Plant Rehabilitation Project - Issued for Bids

Construction Documents

Project Manual

August 2023

HDR Project No. 4007 – 10276484

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City of Fort Bragg

Water Treatment Plant Rehabilitation Project

Construction Documents
Project Manual

November 2023

11-10-2023

2365 Iron Point Road, Suite 300
Folsom, CA 95630

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SECTION 00 01 00
ADVERTISEMENT FOR BIDS

City of Fort Bragg
Fort Bragg, California
Water Treatment Plant Rehabilitation Project
City Project No. WTR-00017

Sealed Bids for the construction of the Water Treatment Plant Rehabilitation Project will be received by City of Fort Bragg at the office of 416 North Franklin Street, Fort Bragg CA, 95437 until 3:00 PM local time on January 19th, 2024, at which time the Bids will be publically opened and read. The Project consists of constructing upgrades and rehabilitation of the existing water treatment plant.

Bids will be received for a single prime contract. Bids shall be on a lump sum as indicated on the Bid Form.

The Issuing Office for the Bidding Documents is Acting City Clerk, Cristal Munoz, 416 N. Franklin St., Fort Bragg, CA 95437. Prospective bidders may examine the Bidding Documents at the Issuing Office on Monday through Friday between the hours of 9:00 AM - 5:00 PM. Questions regarding the Bidding Documents shall be directed to Cristal Munoz at cmunoz@fortbragg.com.

The Bidding Documents may also be examined at Fort Bragg City Hall, 416 North Franklin Street, Fort Bragg, CA 95437.

Copies of the Bidding Documents may be obtained from the Issuing Office at the location and hours mentioned above. The Bidding Documents are also available by request through John Smith, Public Works Department.

A pre-bid conference will be held from 1:00 PM to 3:00 PM local time on December 7th, 2023 at the Fort Bragg Town Hall located at 363 North Main Street, Fort Bragg, CA 95437. Attendance at the pre-bid conference is mandatory.

Bid security shall be furnished in accordance with the Instructions to Bidders.

Bidders shall submit proof of qualifications to perform the Work as described in the Instructions to Bidders.

Prospective Bidders shall be licensed Contractors in the State of California and shall be skilled and regularly engaged in the general class or type of work called for under the Contract. Each Bidder shall have a Class A California Contractor's license.

This is project is receiving funding and/or financing from the Drinking Water State Revolving Fund (DWSRF), therefore Contractor shall comply with procedures and requirements set forth in Section 00 73 73.

Owner: City of Fort Bragg

By: Peggy Ducey

Title: City Manager

Date: November 9, 2023

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

FOR CONSTRUCTION CONTRACT

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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, nor does it grant or confer ownership or any property interest in the Bidding Documents and other documents distributed for the Project. Authorization to download documents, or other distribution, includes the right for Bidding Documents holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the Bidding Documents holder pays all costs associated with printing or reproduction. Paper or other types of printed documents may not be re-sold under any circumstances.

2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a Bidding Documents holder with the Issuing Office at such website, and 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. Registered Bidding Documents holders will receive Addenda issued by Owner or Issuing Office.

2.04 Bidder may register as a Bidding Documents holder and obtain complete sets of Bidding Documents, in the format stated in the Advertisement or invitation to bid, from the Issuing Office. Bidders may rely that sets of Bidding Documents obtained from the Issuing Office are complete, unless an omission is blatant. Registered Bidding Documents holders will receive Addenda issued by Owner or Issuing Office.

2.05 Plan rooms (including construction information subscription services, and electronic and virtual plan rooms) may distribute the Bidding Documents, or make them available for examination. Those prospective bidders that obtain an electronic (digital) copy of the Bidding Documents from a plan room are encouraged to register as Bidding Documents holders from the Bidding Documents Website or Issuing Office. Owner is not responsible for omissions in Bidding

Documents or other documents obtained from plan rooms or other such sources (such as other prospective bidders), or for a Bidder's failure to obtain Addenda from a plan room.

2.06 *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 prospective 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 the latest version of 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 any bidder's or 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 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 certain documents that were developed by Engineer as part of the Project design process, as Electronic Documents in native file formats as originally prepared by Engineer.

1. Release of such documents will be solely for the convenience of the Contractor and subject to additional requirements. No such document is a Contract Document.

2. 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 electronic/digital information provided in Electronic Documents is appropriate and adequate for Contractor's specific purposes.

3. In no case will 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 To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and upon Owner's request, Bidder must submit the following information:

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. Such statement or certification, as applicable, shall be signed by the same officer of Bidder's company that signed the Bid.

C. Bidder's state (or other issuing entity) contractor license number, if applicable.

D. Subcontractor and Supplier qualification information.

E. Other required information regarding qualifications.

3.02 Prospective Bidders must submit required information regarding their qualifications within the time indicated. Owner will review the submitted information to determine which contractors are qualified to bid on the Work. Owner will issue an Addendum listing those contractors that Owner has determined to be qualified to construct the Project. Bids will only be accepted from listed contractors. The information that each prospective Bidder must submit to seek prequalification includes the following:

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. Prospective Bidder's state (or other) contractor license number, if applicable.

D. Subcontractor and Supplier qualification information.

E. Other required information regarding qualifications.

3.03 Bidder is to submit the following information with its Bid to demonstrate Bidder's qualifications to perform the Work:

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.

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

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

3.06 Bidders shall be experienced in the kind of Work to be performed, shall have the or be able to obtain construction equipment necessary for the Work, and shall possess sufficient capital to properly perform the Work within the time allowed. Bids received from Bidders who have previously failed to complete work within the time required, or who have previously performed similar work in an unsatisfactory manner, may be rejected. A Bid may be rejected if Bidder cannot show and document to Owner's satisfaction that Bidder has the necessary ability, facilities, equipment, and resources to commence the Work at the time prescribed and thereafter to prosecute and complete the Work at the rate or within the times specified. A Bid may be rejected if Bidder is already obligated for the performance of other work which would delay the commencement, prosecution or completion of the Work.

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. Bids 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 Bidders that attended the pre-bid conference and are, on that basis alone, 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 Bidding Documents. Owner or Issuing Office will issue Addenda to make any changes to the Bidding 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, including in Specifications Section 01 11 00. 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. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any prospective 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 *Other Site-Related Documents*

A. Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.

B. The other Site-related documents are not part of the Contract Documents.

C. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.

D. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.

B. A Site visit is scheduled following the pre-bid conference. Maps, directions, or GPS coordinates to the Site, when the Site is remote from the pre-bid conference location, will be available at the pre-bid conference.

C. Bidders visiting the Site are required to: (1) arrange their own transportation to the Site; and (2) each Bidder visiting the Site is responsible for providing and using its own personal

protective equipment appropriate for the Site and conditions, and in accordance with posted requirements, if any. [At minimum, each visitor to the Site should have an appropriate hardhat, steel-toed boots, eye and hearing protection (other than ordinary eyewear), and a high-visibility reflective safety vest.] Comply with Paragraph 5.05 of these Instructions to Bidders.

D. All access to the Site, other than during a regularly scheduled Site visit, must be coordinated through the following Owner or Engineer contact for visiting the Site: Heath Daniels, Lead Operator. Bidder must conduct the required Site visit during normal working hours, Mondays through Fridays.

E. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

F. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.

G. Bidder must comply with Laws and Regulations regarding excavation and location of utilities, obtain necessary permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

H. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 *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 indicated in the Supplementary Conditions. Where the Bidding Documents indicate an Owner's safety program, visitors to the Site during the bidding phase and at other times shall comply with Owner's safety programs.

5.06 *Other Work at the Site*

A. Reference is made to Specifications Section 01 11 00, 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 potentially 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 complete and 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, Successful Bidder (as Contractor) will make similar express representations and certifications when it signs 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.

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all Bidding Documents holders registered with the Issuing Office. Questions received less than seven days prior to the date for opening of Bids may not be answered.

7.04 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 Bidding Documents.

7.05 Addenda that engineer judges to have a material or significant effect on Bidders' preparation of pricing and other requirement element of the Bid will be transmitted via Addendum for Bidders' receipt not less than three days prior to the scheduled date for receipt of the Bids. Clarifications or modifications that Engineer deems will not have a material or substantial effect on the preparation of Bids may be transmitted for Bidders' receipt later, for receipt prior to the deadline for receipt of Bids.

ARTICLE 8—BID SECURITY

8.01 *Required Form and Amount of Bid Security*

A. 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.

B. Such bid bond will be issued in the form included in the Bidding Documents.

8.02 *Bid Security of Successful Bidder*

A. The Bid security of the apparent Successful Bidder will be retained until Owner awards the Contract to such Bidder, and such Bidder has signed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Successful Bidder's bid security will be released.

B. If the Successful Bidder fails to sign and deliver the Contract and furnish the required Contract security within the number of days, indicated in Paragraph 20.01 of these

Instructions to Bidders, 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.

C. Upon Successful Bidder's default:

1. When the bid security is a penal sum bid bond, the entire penal sum amount of the bid bond will be forfeit and due Owner.

2. When the bid security is a damages form of bid bond, to the extent of Owner's damages will be forfeit and due Owner.

3. If a type of bid security other than a bid bond is allowed and is furnished, the amount that will be forfeit and due Owner will be the same as for the form of bid bond included in the Bidding Documents. Owner will so notify the defaulting Bidder in writing of the annulment and the amount of the forfeiture, with documentation of the amount forfeited.

D. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

8.03 *Bid Security of Bidders other than the Successful Bidder*

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

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

C. Release of Bid Security: Owner may release any Bidder's bid security by returning such bid security to the associated Bidder. When bid security is in the form of a bid bond, Owner may dispose of or destroy the bid bond and so advice the associated Bidder in writing that the bid bond has been released.

ARTICLE 9—CONTRACT TIMES

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

9.02 Provisions for liquidated and special 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, equipment, and procedures 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 or alternative procedure 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 or invitation to bid. Each such request must comply with the requirements of (1) Paragraphs 7.05 and 7.06 of the General Conditions, and (2) the Division 01 Specifications

governing substitutes and "or-equals", as applicable, and the review of the request will be governed by the principles in those provisions of the Bidding Documents. The burden of proof of the merit of the proposed item or procedure is upon Bidder. Engineer's decision of approval or disapproval of a proposed item or procedure will be final. If Engineer approves any such proposed item or procedure, such approval will be set forth in an Addendum issued in accordance with Article 7 of these Instructions to 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, and will perform the Work in accordance with procedures indicated in the Bidding Documents, as supplemented by Addenda, if 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 in the Specifications or elsewhere in the Bidding Documents. 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 not submit a Bid.

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

A. Electrical

B. Packaged Water Treatment System Retrofit

C. Geomembrane Liner

11.03 If requested by Owner or Engineer, 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 awarding the Contract.

11.04 If apparent Successful Bidder declines to make a requested substitution, Owner may award the Contract to another Bidder, consistent with the basis for evaluating the Bids for award as set forth in these Instructions to Bidders, 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 issuance 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 in 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 8.5inch 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 signed 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 signed 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 signed 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 indicated on the Bid Form.

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 *Cash Allowances*

A. For cash allowances the bid price (for items other than cash allowances) must include such amounts as Bidder deems proper for Contractor's overhead, handling and installation costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

ARTICLE 14—SUBMITTAL OF BID

14.01 The Bidding Documents include one separate, unbound copy of the Bid Form, and, where required, the Bid Bond Form and other supplements to the Bid Form. The unbound copy of the Bid Form and supplements (if any) is to be completed and submitted with the Bid security and the other documents required with the Bid by 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, and 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 method, 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 or invitation to bid.

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. Owner accepts no responsibility for delays in returning Bids submitted or delivered to the incorrect location.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

15.01 An unopened Bid may be withdrawn by an appropriate document duly signed in the same manner that a Bid must be signed and delivered to the place where Bids are to be submitted, prior to the date and time established in the Bidding Documents for the receipt 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 of this Article and submit a new Bid prior to the date and time for established in the Bidding Documents the receipt 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, will be 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. Owner may reject the Bid of any Bidder that fails to demonstrate appropriate qualifications, experience, and resources for the Work, in accordance with Article 3 of these Instructions to Bidders.

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 *Basis for Award of Contract*

A. If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest-priced, responsive Bid that has not otherwise been disqualified.

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 elsewhere in the Bidding Documents, or prior to the Notice of Award.

B. The method used to determine the lowest bid shall be in compliance with the California Public Contract Code, 20103.8.

18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications, experience, and resources of the Bidder and may consider the qualifications, experience, and resources 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, with or without Engineer's assistance, 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 Paragraph 2.01 and Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, set forth Owner's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the signed Agreement to Owner (or Owner's representative), it must be accompanied by required bonds and insurance documentation.

19.02 Article 8 ("Bid Security") of these Instructions to Bidders 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 unsigned 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 required bonds and insurance documentation (as required by the Contract Documents) to Owner . Within 10 days thereafter, Owner will deliver one fully signed 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—SALES AND USE TAXES

21.01 Except as may be otherwise specifically provided herein, all sales and/or use taxes assessed by federal, state or local authorities on materials used or furnished by the Contractor in performing the work hereunder shall be paid by the Contractor.

ARTICLE 22—CONTRACTS TO BE ASSIGNED

22.01 There are no direct purchase procurement contracts previously made by the Owner that the Contractor will be required to accept.

ARTICLE 23—LAWS AND REGULATIONS

23.01 Contractor's License Classification: In accordance with the provisions of California Business and Professions Code, Section 7028, Owner has determined that Contractor shall possess a valid Class A Contractor License at the time of Bid and for the duration of the contract. Failure to possess the specified license shall render the Bid as non-responsive and shall act as a bar to award of the contract to any Bidder not possessing said license at the time of Bid opening. The Contractors' State License Board may be contacted at 9821 Business Park Drive, Sacramento, CA 95827; P.O. Box 26000, Sacramento CA 95826. (800) 321-2752.

23.02 This project is subject to Davis Bacon Act. Bidders must review attachment of Section 00 73 73 for Bacon Prevailing Wage Requirements prior to submitting a bid.

23.03 This project is subject to a Disadvantaged Business Enterprise ("DBE") program. Bidders must comply with certain Good Faith Efforts to located DBE suppliers and subcontractors. Bidders must

review attachment of Section 00 73 73 for DISADVANTAGED BUSINESS ENTERPRISE PROGRAM REQUIREMENTS.

23.04 This project is subject to American Iron and Steel Requirements. Each bidder, by submitting a bid, acknowledges to and for the benefit of the City of Fort Bragg and the State of California that is understands the goods and services for this project are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel", that requires all the of the iron and steel products used in the project to be produced in provided by the Bidder. Each bidder, by submitting a bid, represents and warrants to and for the benefit of the City of Fort Bragg and the State of California that:

(a) The Bidder was reviewed and understands the American Iron and Steel Requirement,

(b) All of the iron and steel products that will be used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirements is approved, and,

(c) The Bidder will provide and further verified information, certification or assurance of compliance with the requirement, or information necessary to support a waiver of the American Iron Steel Requirement, as may be requested by the City of Fort Bragg or the State of California.

Any failure to comply with this requirement by the Contractor shall permit the City of Fort Bragg and/or the State of California to recover as damages against the Bidder any loss, expense, or cost (including without limitation attorney's fees) incurred by the City of Fort Bragg and/or the State of California resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the City of Fort Bragg). While the Bidder has no direct contractual privity with the State, as a lender to the Purchaser for funding of its project, the City of Fort Bragg and the Bidder agree that the State is a third-party beneficiary.

23.05 Bidder must review Executive Order N-6-22 (the EO) regarding Economic Sanctions against Russia and Russian entities and individuals. "Economic Sanctions" refers to sanctions imposed by the U.S. government in response to Russia's actions in Ukraine, as well as any sanctions imposed under state law. The EO directs state agencies to terminate contracts with, and to refrain from entering any new contracts with, individuals or entities that are determined to be a target of Economic Sanctions. Bidder shall follow this EO without any exceptions. Accordingly, should the State Water Board determine Recipient is a target of Economic Sanctions or is conducting prohibited transactions with sanctioned individuals or entities, that shall be grounds for termination of the contract.

ARTICLE 24—WORKERS' COMPENSATION REQUIREMENTS

24.01 As required by Section 1860 of the California Labor Code and in accordance with the provisions of Section 3700 of the Labor Code, every contractor will be required to secure the payment of workers' compensation to its employees.

24.02 In accordance with Section 1861 of the California Labor Code, the contractor shall furnish the owner with a statement as follows: "I am aware of the provisions of 3700 of the Labor Code which requires every employer to be insured against liability for worker's compensation or to undertake

self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract."

ARTICLE 25—REGISTRATION WITH DEPARTMENT OF INDUSTRIAL RELATIONS

25.01 This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations. No contractor or subcontractor may be listed on a bid proposal for a public works project unless registered with the Department of Industrial Relations pursuant to Labor Code Section 1725.5 [with limited exceptions from this requirement for bid purposes only under Labor Code Section 1711.1(a)]. No contractor or subcontractor may be awarded a contract for public work on a public work on a public works project unless registered with the Department of Industrial Relations pursuant to Labor Code Section 1725.

SECTION 00 41 13
BID FORM

FOR CONSTRUCTION CONTRACT

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:

City of Fort Bragg

416 Franklin Street

Fort Bragg, California 95437

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 following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

E. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;

F. Required Bidder Qualification Statement with supporting data; and

ARTICLE 3—BASIS OF BID

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):

1. Lump Sum Price (Single Lump Sum)

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
1.	Mobilization and Demobilization	LS	1		$
2.	Sheeting, shoring, and bracing or equivalent methods conforming to applicable safety requirements	LS	1		$
3.	Demolition	LS	1		$
4.	Overall AC paving	SF	24,000		$
5.	16” FW pipeline	LF	690		$
6.	Magnetic Meters	EA	2		$
7.	Piping modifications at existing Finish Water Storage Tank 2	LS	1		$
8.	4” Sanitary sewer pipeline including cleanout	LF	85		$
9.	18” PVC basin transfer pipe	LF	10		$
10.	6” Raw Water (RW) pipeline	LF	450		$
11.	4” RW pipeline	LF	170		$
12.	3” Drain bypass	LF	30		$
13.	10” RW Piping modifications	LF	120		$
14.	18” Butterfly Valve	EA	1		$
15.	Finish water storage tank no. 2 rehabilitation	LS	1		$
16.	Improvements at raw water storage ponds	EA	2		$
17.	Improvements at backwash clarification ponds	EA	2		$
18.	Building improvements at the Water Treatment building	LS	1		$
19.	Building improvements at the Control Building	LS	1		$
20.	Rehabilitation of Filter Treatment Units no. 1 and no. 2	EA	2		$
21.	Process and mechanical work in Water Treatment Building and Control building other than filter rehabilitation	LS	1		$
22.	Electrical, instrumentation and controls	LS	1		$
Total of All Unit Price Bid Items					$

Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

3.02 *Description of Bid items*

Refer below for a description of different bid items:

BID ITEM NO. 1

Bid item no. 1 includes preparatory work to start and finish the project including any overhead costs necessary to start and finish the project. This bid item includes, but is not limited to, costs related to mobilization and demobilization of equipment and personnel, site restoration to it original condition and implementation of safety protocol.

BID ITEM NO. 2

Bid item no. 2 includes but is not limited to safety measures and techniques, in accordance with Labor Code Section 6705, including shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches five feet or more in depth. This bid item also includes, if necessary, costs for the preparation of shoring system plan by a registered engineer.

BID ITEM NO. 3

Bid item no. 3 includes but is not limited to work shown on X-drawings. This work also includes: site assessment, disconnecting utilities; structural, electrical, and process-mechanical demolition and removal, and site cleanup. This bid item includes temporary facilities required to facilitate work.

BID ITEM NO.4

Bid item no. 4 includes but is not limited to site preparations, subbase preparations, base course installation, asphalt concrete preparation and placement, compaction, finishing and curing. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 5

Bid item no. 5 includes but is not limited to the 16" FW pipeline installation and the related appurtenances like reducers, and valves. This bid item includes trench excavation and backfill for this piping. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM No. 6

Bid item no. 6 includes but is not limited to the two magnetic flow meters and related valve vaults for the 16" FW pipeline. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 7

Bid item no. 7 includes but is not limited to the pipeline modifications at the existing 1.5-million-gallon Finish Water Storage Tank No. 2 inlet and outlet and related mechanical restraints, valves, pipe supports and other appurtenances. This bid item also includes the coating of the pipe and all the related

appurtenances. Excavation and backfill related to this piping is included in this bid item. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 8

Bid item no. 8 includes but is not limited to the 4" Sanitary Sewer pipeline and the associated cleanout shown on sheet C08. Trench excavation and backfill is included in this bid item. All AC paving is included in bid item 4.

BID ITEM NO. 9

Bid item no. 9 includes but is not limited to the 18" PVC water transfer pipe located in the embankment between raw water storage pond no. 1 and no. 2. This bid item includes relocation of existing 18" gate valve into the roadway. Trench excavation and backfill is included in this bid item. All AC paving is included in bid item 4. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 10

Bid item no. 10 includes but is not limited to the 6" RW pipeline and related valves. Trench excavation and backfill is included in this bid item. All AC paving is included in bid item 4. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 11

Bid item no. 11 includes but is not limited to the 4" RW pipeline, 10" RW piping connected to RW Pond No. 1 and the related mechanical coupling. Trench excavation and backfill is included in this bid item. All AC paving is included in bid item 4. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 12

Bid item no. 12 includes but is not limited to the 3" bypass connected to the existing 3" clarified backwash return pump station discharge and isolation gate valves with valve boxes. Trench excavation and backfill is included in this bid item. All AC paving is included in bid item 4. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 13

Bid item no. 13 includes but is not limited to the 10" RW pipeline modifications on Noyo River supply line to the RW storage ponds and the related valves and other appurtenances, as shown on sheet C12. Trench excavation and backfill is included in this bid item. All AC paving is included in bid item 4. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 14

Bid item no. 14 includes but is not limited to the 18" butterfly valve and the valve vault located on the existing RW pipeline connecting RW Pond No. 1 to the raw water clearwell. Trench excavation and backfill is included in this bid item. All AC paving is included in bid item 4. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 15

Bid item no. 15 includes but is not limited to the removal of existing coating and recoating the entire interior and exterior surface of the Finish Water Storage Tank No. 2. This bid item also includes the demolition of the existing piping as necessary to accommodate construction. This bid item also includes

water leakage testing, disinfection of the tank and any other work necessary to rehabilitate the tank and to make it operational after the improvements. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 16

Bid item no. 16 includes but is not limited to excavation, regrading, surface preparation, installation of liner, anchor trench and safety ladders, outlet pipe collar modifications and demolition of existing structures as necessary to accommodate construction at the two raw water storage ponds. This bid item also includes water leakage testing, disinfection of the ponds and any others work necessary to accomplish the improvements and to make the ponds operational after the improvements. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 17

Bid item no. 17 includes but is not limited to excavation, subgrade preparation, and installation of thickened footing, reinforcement, and concrete liner at the two backwash clarification ponds. This bid item also includes any other work necessary to accomplish the improvements and to make the ponds operational after the improvements. This bid item also includes removal of the backwash sludge shown on sheet X01. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 18

Bid item no. 18 includes but is not limited to replacement of roof panels and exhaust fan, retrofitting of the double-door, relocation, and renovation of the laboratory and office at the Water Treatment Building. This bid item also includes any necessary modifications to the existing, structural, plumbing, or electrical items to facilitate the building improvements. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 19

Bid item no. 19 includes but is not limited to installation of structure, doors, plank grating, structural supports, platform, stairs, railing, exhaust fan, electrical panels, metal sidings, footing and foundation for the Control Building. This bid item also includes any necessary modifications to the existing structural, plumbing, or electrical items to facilitate the building improvements. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 20

Bid item no. 20 includes but is not limited to removal and disposal of existing filter media, gasket material, filter header pipe, surface wash piping, valving and other related material required to rehabilitate both the filter treatment units inside the Water Treatment Building. This bid item also includes but is not limited to the recoating of interior and exterior of the filter treatment units, procurement and installation of piping modifications, gaskets, media retaining screens, blowers, valves, and other pipeline appurtenances to be supplied by the filter treatment unit manufacturer. This bid item shall include any testing required to re-commissioning this equipment. This bid item shall also account for all work shown on the R-drawings. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 21

Bid item no. 21 includes but is not limited to the process and mechanical work, including procurement, installation, and testing in the Water Treatment Building and Control Building not covered under bid item 20. This bid item includes the new raw transfer water pump and retrofit of the two raw water

pumps and two finish water vertical turbine pumps. This bid item also includes any temporary controls and accommodations to facilitate work.

BID ITEM NO. 22

Bid item no. 22 includes but is not limited to the procurement, installation, and testing of electrical instruments, control systems, cables, and conduits along with setting up various logic control panels, outlets and related outlet boxes, harmonic filters, and other electrical, instrumentation and controls equipment. This bid item also includes any temporary controls and accommodations to facilitate work.

ARTICLE 4—TIME OF COMPLETION

4.01 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 days indicated in the Agreement.

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

ARTICLE 5—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.01 *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.

5.02 *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.

5.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *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.

6.02 *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.

ARTICLE 7—ATTACHMENTS TO THIS BID

7.01 The following documents are attached to and made a condition of this bid:

A. Required Bid security;

B. List of Proposed Subcontractors;

C. Contractor Qualification Statement and references;

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;

E. Contractor's License No.;

F. Non-Collusion Affidavit;

G. Manufacturer's Certification Letter of Compliance with American Iron and Steel Requirements for all equals and substitutes approved by Addenda (if applicable)'

H. Disadvantaged Business Enterprise requirements completed, SWRCB form 4500-3 and 4500-4;

I. Contractor DIR Registration Number.

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)

Bidder's Address for giving notices:

_____

_____

Bidder's Contact Person:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: _____

Employer's Tax ID No.: _____

Contractor DIR Registration No.: _____

SECTION 00 43 13
BID BOND (PENAL SUM FORM)

Bidder Name: [Full formal name of Bidder] Address *(principal place of business)*: [Address of Bidder'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] Address *(principal place of business)*: [Address of Owner's principal place of business]	**Bid** Project *(name and location)*: [Owner project/contract name, and location of the project] Bid Due Date: [Enter date bid is due]
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 43 36
LIST OF SUBCONTRACTORS

Note: In accordance with Supplementary Condition SC-7.07.A- the Contractor shall not award work valued at more than 50 percent (50%) of the Contract Price to Subcontractors without prior written approval of the Owner.

Work to be Performed	Percent of Total Contract	Subcontractor's Name and Location of Business	DIR Registration Number

(Add additional sheets if necessary)

BIDDER: _____

Date: _____

This page is intentionally blank.

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 Completed			
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 Completed			
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 Completed			
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 Completed		
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 Completed		
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 Completed		
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 Completed		
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 Completed		
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 Completed		
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	

SECTION 00 45 19
NON COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID

(Public Contract Code Section 7106)

State of California
County of _____

_____, being first duly sworn, deposes and

says that he or she is_____of_____, the party making the foregoing bid, that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and further that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

By _____

Subscribed and sworn to before me on _____
(date)

_____
(Notary Public)

(SEAL)

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SECION 00 51 00
NOTICE OF AWARD

Date of Issuance:			
Owner:		Owner's Contract No.:	
Engineer:		Engineer's Project No.:	
Project:		Contract Name:	
Bidder:			
Bidder's Address:			

TO BIDDER:

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

The Project includes construction of:

1. Demolition existing and construction of new control building.
2. Lining of raw water ponds and backwash storage ponds.
3. Demolition of old reactor clarifier
4. Rehabilitation of two filter treatment units.
5. New vertical turbine pump.
6. Modification to existing vertical turbine pumps.
7. Chemical metering pumps
8. Site grading and paving.
9. 16" piping in Cedar Street.
10. Modifications to Finish water storage tank no. 2.
11. Include all electrical, control, instrumentation, piping, and related appurtenances as contained in the Contract Documents.

The Contract Price of the awarded Contract is: $_____

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

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

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

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

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

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: _____

_____

Authorized Signature

By: _____

Title: _____

Copy: Engineer

SECTION 00 52 13
AGREEMENT

BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between [name of contracting entity] ("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: The Project includes construction of:

A. Demolition existing wooden control building and construction of new control building.

B. Lining of raw water ponds and backwash storage ponds.

C. Demolition of old reactor clarifier

D. Rehabilitation of two filter treatment units.

E. New vertical turbine pump.

F. Modification to existing vertical turbine pumps.

G. Chemical metering pumps

H. Site grading and paving.

I. 16" piping in Cedar Street.

J. Modifications to finish water storage tank no. 2.

K. Include all electrical, control, instrumentation, piping, and related appurtenances as contained in the Contract Documents.

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Ft. Bragg Water Treatment Plant Rehabilitation project.

ARTICLE 3—ENGINEER

3.01 The Owner has retained HDR Engineering, 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.

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.

4.03 *Contract Times: Days*

A. The Work will be substantially complete within 520 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 563 days after the date when the Contract Times commence to run.

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. 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 $1,000 for each day that expires after such time until the Work is completed and ready for final payment.

4. Liquidated damages for failing to timely attain Milestones, 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.

4.06 *Special Damages*

A. Contractor shall reimburse Owner (1) for fines and penalties (if any) imposed on Owner as a direct result of Contractor's failure to attain Substantial Completion according to the Contract Times, (2) for fines and penalties (if any) imposed on Owner by an authority having jurisdiction for actions or inaction of Contractor arising from Contractor's performance of the Work (regardless of whether such event was connected with any delay in compliance with the Contract Times), and (3) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in

Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.

B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

C. The special damages imposed in this paragraph are supplemental to any liquidated damages for delayed completion established in this Agreement.

4.07 Owner reserves the right to withhold from payments due Contractor under the Contract amounts for liquidated damages (if any), special damages (if any), and performance damages (if any) in accordance with the Contract.

ARTICLE 5—CONTRACT PRICE

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

A. For all Work other than Unit Price Work, a lump sum of $_____.

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

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

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment up to 60 days after receipt, 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).

1) If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

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 the remainder to Contractor to 95 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 100 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

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

6.04 *Consent of Surety*

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

6.05 *Interest*

A. All amounts not paid when due as provided in the General Conditions shall bear interest at the maximum legal rate

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. Wage Determination Schedule.
6. Statutory and Funding-Financing Entity Requirements.
7. Specifications as listed in the table of contents of the project manual (copy of list attached).
8. Drawings (not attached but incorporated by reference) consisting of _____ sheets with each sheet bearing the following general title: _____.
9. Drawings listed on the attached sheet index.

10. Addenda (numbers _____ to _____, inclusive).
11. Exhibits to this Agreement (enumerated as follows):
    a. Contractor's Bid (pages _____ to _____, inclusive).
12. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.
    d. Field Orders.
    e. Warranty Bond, if any.

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

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

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

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

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

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and

Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

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

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

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

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

11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

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

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

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

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

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

8.03 *Standard General Conditions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the

Contractor, through a process such as highlighting or “track changes” (redline/strikeout), or in the Supplementary Conditions.

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

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

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

SECTION 00 55 00
NOTICE TO PROCEED

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

TO CONTRACTOR:

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

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

Before starting any Work at the Site, Contractor must comply with the following:

Paragraph 2.01.B of the General Conditions provides that you must deliver to the Owner (with copies to Engineer and other identified additional insureds and loss payees) certificates of insurance you are required to purchase and maintain in accordance with the Contract Documents.

Owner**:** _____

_____

Authorized Signature

By: _____

Title: _____

Date Issued: _____

Copy: Engineer

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SECTION 00 61 13.13
PERFORMANCE BOND

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

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

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

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

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

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

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

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

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

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

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

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

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

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

14. Definitions

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

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

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

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

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

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

16. Modifications to this Bond are as follows: None.

SECTION 00 61 13.16
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)*: [Owner's project/contract name, and location of the project] 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: None.

SECTION 00 62 76
Payment Request Form

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

Application For Payment

Change Order Summary

Approved Change Orders		
Number	Additions	Deductions
TOTALS NET CHANGE		
BY CHANGE ORDERS		

Contractor's Certification

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

Contractor Signature

By:	Date:

1. ORIGINAL CONTRACT PRICE..... $ _____

2. Net change by Change Orders..... $ _____

3. Current Contract Price (Line 1 ± 2)..... $ _____

4. TOTAL COMPLETED AND STORED TO DATE
(Column F total on Progress Estimates)..... $ _____

5. RETAINAGE:

a. X ____Work Completed ..... $ _____

b. X ____Stored Material ..... $ _____

c. Total Retainage (Line 5.a + Line 5.b)..... $ _____

6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5.c)..... $ _____

7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)..... $ _____

8. AMOUNT DUE THIS APPLICATION..... $ _____

9. BALANCE TO FINISH, PLUS RETAINAGE
(Column G total on Progress Estimates + Line 5.c above)..... $ _____

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

is recommended by: _____ _____
(Engineer) (Date)

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

is approved by: _____ _____
(Owner) (Date)

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

Progress Estimate - Lump Sum Work

Contractor's Application

For (Contract):	Application Number:
Application Period:	Application Date:

			Work Completed		E	F		G
A		B	C	D				
Specification Section No.	Description	Scheduled Value ($)	From Previous Application (C+D)	This Period	Materials Presently Stored (not in C or D)	Total Completed and Stored to Date (C + D + E)	% (F / B)	Balance to Finish (B - F)
	Totals							

Stored Material Summary

Contractor's Application

For (Contract):	Application Number:
Application Period:	Application Date:

A		B	C		D		E		F		G
					Stored Previously				Incorporated in Work		
Bid Item No.	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Storage Location	Description of Materials or Equipment Stored	Date Placed into Storage (Month/Year)	Amount ($)	Amount Stored this Month ($)	Subtotal Amount Completed and Stored to Date (D + E)	Date (Month/ Year)	Amount ($)	Materials Remaining in Storage ($) (D + E - F)
				Totals							

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SECTION 00 65 16
CERTIFICATE OF SUBSTANTIAL COMPLETION

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

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

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

Date of Substantial Completion

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

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

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

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

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

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

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

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

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00 72 13 General Conditions

STANDARD GENERAL CONDITIONS

OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS

OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

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

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

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

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

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

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

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

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

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

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

10. *Claim*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

46. *Technical Data*

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

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

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

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

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

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

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

1.02 *Terminology*

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

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

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

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

1. does not conform to the Contract Documents;

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

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

E. *Furnish, Install, Perform, Provide*

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

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

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

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

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

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

ARTICLE 2—PRELIMINARY MATTERS

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

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

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

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

2.02 *Copies of Documents*

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

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

2.03 *Before Starting Construction*

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

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

2. a preliminary Schedule of Submittals; and

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

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

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

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

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

2.05 *Acceptance of Schedules*

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

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

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

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

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

2.06 *Electronic Transmittals*

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

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

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

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

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

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

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

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

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

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

G. Nothing in the Contract Documents creates:

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

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

3.02 *Reference Standards*

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

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

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

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

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

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

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

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

B. *Resolving Discrepancies*

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

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

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

3.04 *Requirements of the Contract Documents*

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

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

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

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

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

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

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

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

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

4.02 *Starting the Work*

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

4.03 *Reference Points*

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

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

4.04 *Progress Schedule*

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

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

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

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

4.05 *Delays in Contractor's Progress*

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

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

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

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

2. Abnormal weather conditions;

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

4. Acts of war or terrorism.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

5.01 *Availability of Lands*

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

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

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

5.02 *Use of Site and Other Areas*

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

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

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

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

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

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

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

5.03 *Subsurface and Physical Conditions*

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

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

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

3. Technical Data contained in such reports and drawings.

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

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

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

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

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

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

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

5.04 *Differing Subsurface or Physical Conditions*

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

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

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

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

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

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

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

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

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

E. *Possible Price and Times Adjustments*

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

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

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

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

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

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

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

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

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

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

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

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

5.05 *Underground Facilities*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

F. *Possible Price and Times Adjustments*

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

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

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

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

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

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

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

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

5.06 *Hazardous Environmental Conditions at Site*

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

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

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

3. Technical Data contained in such reports and drawings.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

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

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

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

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

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

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

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

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

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

6.02 *Insurance—General Provisions*

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

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

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

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

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

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

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

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

H. Contractor shall require:

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

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

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

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

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

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

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

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

6.03 *Contractor's Insurance*

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

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

1. include at least the specific coverages required;

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

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

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

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

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

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

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

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

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

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

6.04 *Builder's Risk and Other Property Insurance*

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

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

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

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

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

6.05 *Property Losses; Subrogation*

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

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

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

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

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

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

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

6.06 *Receipt and Application of Property Insurance Proceeds*

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

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

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

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

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

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

7.02 *Supervision and Superintendence*

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

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

7.03 *Labor; Working Hours*

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

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

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

7.04 *Services, Materials, and Equipment*

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

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

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

7.05 *"Or Equals"*

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

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

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

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

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

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

4) is not objectionable to Owner.

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

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

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

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

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

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

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

7.06 *Substitutes*

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

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

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

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

    a. will certify that the proposed substitute item will:

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

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

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

    b. will state:

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

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

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

    c. will identify:

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

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

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

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

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

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

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

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

7.07 *Concerning Subcontractors and Suppliers*

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

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

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

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

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

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

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

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

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

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

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

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

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

7.08 *Patent Fees and Royalties*

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

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

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

7.09 *Permits*

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

7.10 *Taxes*

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

7.11 *Laws and Regulations*

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

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

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

7.12 *Record Documents*

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

7.13 *Safety and Protection*

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

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

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

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

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

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

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

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

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

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

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

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

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

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

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

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

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

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

b. determine and verify:

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

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

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

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

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

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

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

1. *Shop Drawings*

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

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

2. *Samples*

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

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

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

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

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

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

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

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

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

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

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

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

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

D. *Resubmittal Procedures for Shop Drawings and Samples*

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

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

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

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

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

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

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

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

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

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

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

7.17 *Contractor's General Warranty and Guarantee*

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

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

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

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

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

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

2. normal wear and tear under normal usage.

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

1. Observations by Engineer;

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

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

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

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

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

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

8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.

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

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

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

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

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

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

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

9.03 *Furnish Data*

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

9.04 *Pay When Due*

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

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

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

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

9.07 *Change Orders*

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

9.08 *Inspections, Tests, and Approvals*

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

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

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

9.11 *Evidence of Financial Arrangements*

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

9.12 *Safety Programs*

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

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

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

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

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

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

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

10.05 *Determinations for Unit Price Work*

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

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

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

10.07 *Limitations on Engineer's Authority and Responsibilities*

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

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

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

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

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

10.08 *Compliance with Safety Program*

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

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

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

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

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

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

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

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

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

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

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

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

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

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

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

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

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

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

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

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

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

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

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, 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.

SECTION 00 73 01
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, if any, used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The paragraph address system used in these Supplementary Conditions is the same as the paragraph 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:

When the Project is to be constructed under multiple direct Contracts awarded by the Owner, the term “Contractor” shall mean the appropriate prime contractor. Whenever a specific prime Contractor is referred to, terms such as “General Contractor”, “Electrical Contractor”, “Plumbing Contractor”, “HVAC Contractor”, or other appropriate Contract-indicating term will be used.

SC-1.01.A.40 Add the following to Paragraph 1.01.A.40:

Trucking, shipping, 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 the following to Paragraph 1.01.A.45:

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.

SC-101.A.51 Add the following to Paragraph 1.01.A.50:

American Iron and Steel (AIS) Requirements – Compliance with the AIS Requirements for this project are described in attachments of these contract documents.

SC-101.A.52 Add the following to Paragraph 1.01.A.51:

Davis Bacon Requirements – Compliance with Davis Bacon Requirements for this project are described in attachments of these contract documents.

SC-101.A53 Add the following to Paragraph 1.01.A.52:

Disadvantaged Business Enterprise Requirements – Compliance with the Disadvantaged Business Enterprise Requirements for this project are described in attachments of these contract documents.

SC-1.01.A.54 Add the following to Paragraph 1.01.A.52:

Abnormal Weather Conditions – Conditions of extreme or unusual weather for a given region, elevation, or season as determined by Engineer. Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered Abnormal Weather Conditions.

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.

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 two paper 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 two paper copies of conformed Contract Documents incorporating and integrating all Addenda and amendments, if any, negotiated prior to the Effective Date of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional paper copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction.

2.06 *Electronic Transmittals*

SC-2.06 Delete in its entirety Paragraph 2.06.B and replace with the following new paragraph:

B. *Electronic Document Protocol*: Comply with Specifications Section 01 31 26 – Electronic Communication Protocols.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

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

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

F. The Specifications and other verbal components of the Contract Documents may vary in form, format, and style. Some Specification sections are written in varying degrees of streamlined or declarative style and some Specifications sections may, in

comparison, employ a more-narrative style. Omissions of such words and phrases as "Contractor shall," "in conformity with," "as shown," or "as specified" are intentional in streamlined language in the Contract Documents. Omitted words and phrases are incorporated by inference. Similar types of provisions may appear in various parts of a Specifications section or elsewhere in the Contract Documents. Contractor shall not attempt to take advantage of any variation of form, format or style in Change Proposal(s) and Claim(s).

G. Cross referencing of Specification sections in a Specifications section's heading "Related Sections includes, but are not necessarily limited to: "and elsewhere within each Specifications section is provided as an aid and convenience to Contractor. Contractor shall not rely on cross referencing indicated and is responsible for coordinating the entire Work and providing a complete Project whether or not cross referencing is provided in each Specifications section or whether or not cross referencing is complete.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.05 *Delays in Contractor's Progress*

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

5. *Weather-Related Delays*

a. If "abnormal weather conditions" as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: (1) that weather conditions were abnormal for the period of time in which the delay occurred, (2) that such weather conditions could not have been reasonably anticipated, and (3) that such weather conditions had an adverse effect on the Work on the critical path at the time of the delay.

b. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:

1) Contractor shall anticipate the number of foreseeable bad weather days per month indicated in Table SC-4.05-C-1—Foreseeable Bad Weather Days.

2) In each month, every bad weather day exceeding the number of foreseeable bad weather days established in Table SC-4.05.C-1—Foreseeable Bad Weather Days, will be considered as "abnormal weather conditions." The existence of abnormal weather conditions will not relieve Contractor of the obligation to demonstrate and document that delays caused by abnormal weather are specific to the planned work activities or that such activities thus delayed were on Contractor's then-current Progress Schedule's critical path for the Project.

Table SC-4.05.C-1—Foreseeable Bad Weather Days

Month	Number of Foreseeable Bad Weather Days in Month Based on Precipitation as Rain Equivalent (inches) (1)	Ambient Outdoor Air Temperature (degrees F)	
		Number of Foreseeable Bad Weather Days in Month Based on Low Temperature (at 11:00 a.m.)	Number of Foreseeable Bad Weather Days in Month Based on High Temperature (at 3:00 p.m.)
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

Notes:
1. Two inches of sleet equal one inch of rain. Five inches of wet, heavy snow equal one inch of rain. Fifteen inches of "dry" powder snow equals one inch of rain.

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

SC-5.04.A Add the following new paragraph immediately after Paragraph 5.04.A.4:

5. Contractor encounters human remains, recognizes the existence of burial markers, archaeological sites, historical sites, artifacts of potential archaeological or historical interest, or wetlands not shown or indicated in the Contract Documents, Contractor shall immediately cease operations that may disturb such area(s) and secure the adjacent Work; and Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations (Contractor shall continue to suspend such operations until otherwise instructed by Owner but shall continue with all other operations that do not affect those remains or features);

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 2018 edition.

2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond 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. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Employer's Liability	
Policy limit	$1,000,000.00

E. *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.

F. *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.

G. *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.

H. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	Policy limits of not less than:
General Aggregate	$5,000,000.00
Products—Completed Operations Aggregate	$5,000,000.00
Personal and Advertising Injury	$5,000,000.00
Bodily Injury and Property Damage—Each Occurrence	$5,000,000.00

I. *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)	$2,000,000.00

J. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$5,000,000.00
General Aggregate	$5,000,000.00

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

G. *Coverage for Completion Delays:* The builder's risk policy will include, for the benefit of Owner, loss of revenue and soft cost coverage for losses arising from delays in completion that result from covered physical losses or damage. Such coverage will include, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, compensation for loss of net revenues, rental costs, and attorneys' fees and engineering or other consultants' fees, if not otherwise covered.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.02 *Supervision and Superintendence*

SC-7.02 Add the following to Paragraph 7.02, following Paragraph 7.02.B:

C. Unless 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 8:00 AM – 4:30 PM.
2. Owner's legal holidays are:

New Year's Day (January 1).

Birthday of Martin Luther King, Jr. (Third Monday in January).

Washington's Birthday (Third Monday in February).

Memorial Day (Last Monday in May).

Independence Day (July 4).

Labor Day (First Monday in September).

Columbus Day (Second Monday in October).

Veterans Day (November 11).

Thanksgiving Day (Fourth Thursday in November).

Christmas Day (December 25).

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state "…all Work at the Site must be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday." The balance of Paragraph 7.03.C remains unchanged except for the foregoing.

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

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

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

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

SC-7.04 *Services, Materials, and Equipment*

SC 7.04.D. Add the following new subparagraphs immediately after Paragraph 7.04 C:

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

SC-7.05 *"Or Equals"*

SC-7.05.A Amend the third sentence of the paragraph by striking out the following words:

Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item is permitted.

SC-7.05.A.1 Amend the last sentence of Paragraph a.3 by striking out "and:" and adding a period at the end of Paragraph a.3.

SC-7.05.A.1 Delete paragraph 7.04.A.1.a.4 in its entirety and insert the following in its place:

[Deleted]

SC-7.07 *Concerning Subcontractors, Suppliers and Others*

SC 7.07.A Amend Paragraph 7.07A by adding the following text to the end of the Paragraph:

The Contractor shall not award work valued at more than fifty percent of the Contract Price to Subcontractor(s), without prior written approval of the Owner.

SC 7.07.B Delete Paragraph 7.07B in its entirety and insert the following in its place:

[Deleted]

SC 7.07.E Amend the second paragraph of Paragraph 7.07E by striking out "Owner may also require Contractor to retain specific replacements; provided, however, that"

SC- 7.09 *Permits*

SC-7.09 Add a new paragraph immediately after Paragraph GC-7.09.A. which is to read as follows:

A. In those instances where a certificate of occupancy must be obtained before the Work under this Contract can be occupied and placed into service by Owner, it shall be the responsibility of Contractor to arrange, coordinate, and pay any costs of obtaining said certificate."

SC-7.13 *Safety and Protection*

SC-7.13 Add the following new paragraph immediately after Paragraph 7.13.G:

A. For all excavations in excess of five (5) feet, the Contractor shall, pursuant to Labor Code Section 6705, submit in advance of any excavation hereunder a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from caving ground. No such excavation shall be made until said detailed plan is submitted by Contractor and accepted by Engineer.

7.13 *Safety and Protection*

SC-7.13 Add the following new paragraph immediately after Paragraph 7.13.G:

A. For all excavations in excess of five (5) feet, the Contractor shall, pursuant to Labor Code Section 6705, submit in advance of any excavation hereunder a detailed plan

showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from caving ground. No such excavation shall be made until said detailed plan is submitted by Contractor and accepted by Engineer.

7.14 *Hazard Communication Programs*

SC-7.14 Add the following new paragraph immediately after Paragraph 7.14.A:

B *Single Prime Contract*: Contractor shall be responsible for coordinating exchange of 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 and Regulations. 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 material safety data sheets or other hazard communication information shall be readily accessible to the employees of employers on the Site.

ARTICLE 8—OTHER WORK AT THE SITE

No Supplementary Conditions in this Article.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.13 *Owner's Site Representative*

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

9.13 *Owner's Site Representative*

A. Owner will furnish an "Owner's Site Representative" (OSR) to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Owner's Site Representative is not Engineer's consultant, agent, or employee.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

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

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

ARTICLE 11—CLAIMS

SC-12.01 Add the following new paragraph immediately after paragraph 12.01.G:

A. If this is a "Public Works Contract" as defined in Section 22200 of the California Public Contract Code, claims shall be resolved pursuant to Section 9204 of the California Public Contract Code. Key provisions of that section are summarized as follows:

1. "Claim" means a separate demand by a contractor sent by registered mail or certified mail with return receipt requested, for one or more of the following:

a. A time extension, including, without limitation, for relief from damages or penalties for delay assessed by a public entity under a contract for a public works project.

b. Payment by the public entity of money or damages arising from work done by, or on behalf of, the contractor pursuant to the contract for a public works project and payment for which is not otherwise expressly provided or to which the claimant is not otherwise entitled.

2. Payment of an amount that is disputed by the public entity.

3. Upon receipt of a claim pursuant to this section, Owner shall conduct a reasonable review of the claim and, within a period not to exceed 45 days, shall provide Contractor a written statement identifying what portion of the claim is disputed and what portion is undisputed. Upon receipt of a claim, Owner and Contractor may, by mutual agreement, extend the time period provided in this subdivision.

4. Contactor shall furnish reasonable documentation to support the claim.

5. Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after Owner issues its written statement.

6. If Contractor disputes Owner's written response, or if Owner fails to respond to a claim, Contractor may demand in writing an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand in writing sent by registered mail or certified mail, return receipt requested, Owner shall schedule a meet and confer conference within 30 days for settlement of the dispute.

7. Within 10 business days following the conclusion of the meet and confer conference , if the claim or any portion of the claim remains in dispute, Owner shall provide Contractor a written statement identifying the portion of the claim that remains in dispute and the portion that is undisputed. Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after Owner issues its written statement, Any undisputed portion of the claim, as identified by the Contractor in writing, shall be submitted to nonbinding mediation with the public entity and Contractor sharing the associated costs equally. If the mediation is unsuccessful, the parts of the claim remaining in dispute shall be subject to applicable procedures outside this section.

8. Failure by Owner to respond to a claim from Contractor within the time periods described herein or to otherwise meet the time requirements of this section shall result in the claim being rejected in its entirety. A claim that is denied by reason of the public entity's failure to have responded to a claim, or its failure to otherwise meet the time requirements of this section, shall not constitute an adverse finding with regard to the merits of the claim or the responsibility or qualifications of the claimant.

9. Amounts not paid in a timely manner as required by this section shall bear interest at the maximum legal rate.

ARTICLE 12—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

12.01 *Cost of the Work*

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

C. Construction Equipment and Machinery:

1. Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

2. Costs for equipment and machinery owned by Contractor will be paid at a rate shown for such equipment in the Caltrans Labor Surcharge & Equipment Rental Rate Book. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than $1,000 will be considered small tools.

13.02 Allowances

SC-13.02.C Delete Paragraph 13.02.C in its entirety and insert the following in its place:

[Deleted]

ARTICLE 13—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

No Supplementary Conditions in this Article.

ARTICLE 14—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

SC-15.01.B Amend the second sentence of Paragraph 15.01.B.2 by striking out the following text::

"a bill of sale, invoice, or other."

15.03 Substantial Completion

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

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

expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

15.02 *Contractor's Warranty of Title*

SC-15.02.A Amend Paragraph 15.02.A by striking out the following text:

"no later than 7 days after the time of payment by Owner" and insert "no later than the time of payment by Owner."

15.06 *Final Payment*

SC-15.06.E Delete Paragraph 15.06.E in its entirety and insert the following in its place:

E. Thirty-five days after the filing of a Notice of Completion with the County Recorder and after presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

15.07 Waiver of Claims

SC-15.07.B. Amend Paragraph 15.07.B to state "The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner and/or Engineer other than those pending matters that have been duly submitted or appealed under the provisions of Article 17."

ARTICLE 15—SUSPENSION OF WORK AND TERMINATION

No Supplementary Conditions in this Article.

ARTICLE 16—FINAL RESOLUTIONS OF DISPUTES

17.02 *Arbitration*

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

SC-17.02 *Arbitration*

A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of $100,000 or less will be settled in accordance with the American Arbitration Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be concurrently sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or, if no specified time is applicable, within a reasonable time after the matter in question has arisen, and in no event will any such demand be

made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

C. The arbitration will be held in the same municipality as the Owner's principal office location, or other, as directed by the Owner.

D. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrator(s) will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.

E. The Arbitrator(s) will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.

F. The award of the arbitrator(s) must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.

G. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.

H. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;

2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;

3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and

4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.

I. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.

J. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without

the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

17.03 *Attorneys' Fees*

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02.

SC-17.03 *Attorneys' Fees*

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

ARTICLE 17—MISCELLANEOUS

SC-18.11 Add a 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.

SC-18.12 Add a new paragraph immediately after Paragraph 18.11, to read as follows:

SC-18.12 *Publicity*

A. 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.

SC-19 Add new article immediately after Article 18, to read as follows:

ARTICLE 19 – CALIFORNIA STATE REQUIREMENTS

SC-19.01 *Registration with the California Department of Industrial Relations*

A. This project is a “public works” project as defined in California Labor Code Section 1720 through 1743. In accordance with California Labor Code Article 1725.5, Contractor and all subcontractors are required to be registered with the California Department of Industrial Relations (DIR) in order to bid or be listed on a bid and/or work on a public works project.

SC-19.02 *Antitrust Claim Settlement*

A. In entering into a public works contract or a subcontract to supply goods, services, or materials pursuant to a public works contract, the Contractor or Subcontractor offers and agrees to assign to the awarding body all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to the Contractor, without further acknowledgment by the parties.

SC-19.03 *Utilities*

A. Contractor shall be responsible for marking all excavations and notifying Underground Service Alert (USA) at least 48 hours before digging and follow all other provisions of California Government Code Sections 4216 through 4216.9. Contractor shall maintain an active USA ticket number for the entire duration of the excavation.

B. Unless otherwise indicated in the Contract Documents, all utility lines, conduits, wires, or structures shall be maintained by the Contractor and shall not be disturbed, disconnected, or damaged by him during the progress of the Work, provided, that should the Contractor in the performance of the Work disturb, disconnect, or damage any of the above, all expenses arising from such disturbance or in the replacement or repair thereof shall be borne by the Contractor. However, in accordance with Section 4215 of the California Government Code, the Contractor shall be compensated for all costs of locating and repairing damage to main or trunkline utility facilities located on the work site and for costs of operating equipment on the work site necessarily idled during such work where the Contractor has exercised reasonable care in removing or relocating utility facilities which are inaccurately indicated in the Contract Documents.

ARTICLE 20 - FUNDING-FINANCING ENTITY REQUIREMENTS

SC-20.1 *Funding-Financing Entity Requirements*

A. This project is receiving funding and/or financing from the Drinking Water State Revolving Fund (DWSRF), therefore Contractor shall comply with procedures and requirements set forth in Section 00 73 73.

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SECTION 00 73 73
FUNDING-FINANCING ENTITY REQUIREMENTS

Bound following this page are requirements of entities that are furnishing funding or financing for the Project. These documents are part of the Contract Documents and consist of this page and the following:

Funding or Financing Entity Requirements:

1. Guidelines for Meeting the California State Revolving Fund (CASRF) Programs (Clean Water and Drinking Water SRF) Disadvantaged Enterprise Requirements, comprised of 12 pages.
2. Implementation of American Iron and Steel (AIS) provisions of P.L. 113-76 and Contractor's Certification Letter, comprised of 21 pages.
3. Executive Order N-6-22 and Attestation of Compliance with Economic Sanctions in Response to Russia's actions in Ukraine, comprised of 5 pages.
4. Davis Bacon Requirements for DWSRF Projects, comprised of 10 pages.
5. David Bacon Wage Rate Determination, comprised of 23 pages.
6. Guidelines for Enhancing Public Awareness of SRF Assistance Agreements, comprised of 7 pages.

FUNDING ENTITY REQUIREMENT NO. 1 - Guidelines for Meeting the California State Revolving Fund (CASRF) Programs (Clean Water and Drinking Water SRF) Disadvantaged Enterprise Requirements, comprised of 12 pages

California State Water Resources Control Board
Division of Financial Assistance
1001 I Street • Sacramento, California 95814 • (916) 341-5700 FAX (916) 341-5707
Mailing Address: P. O. Box 944212 • Sacramento, California • 94244-2120
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Guidelines for Meeting the California State Revolving Fund (CASRF) Programs (Clean Water and Drinking Water SRF) Disadvantaged Business Enterprise Requirements

The Disadvantaged Business Enterprise (DBE) Program is an outreach, education, and objectives program designed to increase the participation of DBEs in the Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Fund (DWSRF) Programs.

How to Achieve the Purpose of the Program

Recipients of CWSRF/DWSRF financing that are subject to the DBE requirements (recipients) are required to seek, and are encouraged to use, DBEs for their procurement needs. Recipients should award a "fair share" of sub-agreements to DBEs. This applies to all sub-agreements for equipment, supplies, construction, and services.

The key functional components of the DBE Program are as follows:

- Fair Share Objectives
- DBE Certification
- Six Good Faith Efforts
- Contract Administration Requirements
- DBE Reporting

Disadvantaged Business Enterprises are:

- Entities owned and/or controlled by socially and economically disadvantaged individuals as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note) (10% statute), and Public Law 102-389 (42 U.S.C. 4370d) (8% statute), respectively;
- Minority Business Enterprise (MBE) - entities that are at least 51% owned and/or controlled by a socially and economically disadvantaged individual as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note), and Public Law 102-389 (42 U.S.C. 4370d), respectively;
- Women Business Enterprise (WBE) - entities that are at least 51% owned and/or controlled by women;
- Small Business Enterprise (SBE);
- Small Business in a Rural Area (SBRA);
- Labor Surplus Area Firm (LSAF); or
- Historically Underutilized Business (HUB) Zone Small Business Concern or a concern under a successor program.

Certifying DBE Firms:

Under the DBE Program, entities can no longer self-certify and contractors and sub-contractors must be certified at bid opening. Contractors and sub-contractors must provide to the CASRF recipient proof of DBE certification. Certifications will be accepted from the following:

- The U.S. Environmental Protection Agency (USEPA)
- The Small Business Administration(SBA)
- The Department of Transportation's State implemented DBE Certification Program (with U.S. citizenship)
- Tribal, State and Local governments
- Independent private organization certifications

If an entity holds one of these certifications, it is considered acceptable for establishing status under the DBE Program.

Six Good Faith Efforts (GFE)

All CWSRF/DWSRF financing recipients are required to complete and ensure that the prime contractor complies with the GFE below to ensure that DBEs have the opportunity to compete for financial assistance dollars.

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practical through outreach and recruitment activities. For Tribal, State and Local Government Recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. Make information on forthcoming opportunities available to DBEs. Posting solicitations for bids or proposals for a minimum of 30 calendar days in a local newspaper, before the bid opening date.
3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs.
4. Encourage contracting with a group of DBEs when a contract is too large for one firm to handle individually.
5. Use the services of the SBA **and/or** Minority Business Development Agency (MBDA) of the US Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the above steps.

The forms listed in the table below and attached to these guidelines; must be completed and submitted with the GFE:

FORM NUMBER	FORM NAME	REQUIREMENT	PROVIDED BY	COMPLETED BY	SUBMITTED TO
SWRCB Form 4500-2 or EPA Form	**DBE Sub-Contractor Participation Form**	**As Needed to Report Issues**	**Recipient**	**Sub-contractor**	**EPA DBE Coordinator**
SWRCB Form 4500-3 or EPA Form	**DBE Sub-Contractor Performance Form**	**Include with Bid or Proposal Package**	**Prime Contractor**	**Sub-Contractor**	**SWRCB by Recipient**
SWRCB Form 4500-4 or EPA Form	**DBE Sub-Contractor Utilization Form**	**Include with Bid or Proposal Package**	**Recipient**	**Prime Contractor**	**SWRCB by Recipient**

The completed forms must be submitted with each Bid or Proposal. The recipient shall review the bidder's documents closely to determine that the GFE was performed **prior** to bid or proposal opening date. Failure to complete the GFE and to substantiate completion of the GFE before the bid opening date could jeopardize CWSRF/DWSRF financing for the project. The following situations and circumstances require action as indicated:

1. If the apparent successful low bidder was rejected, a complete explanation must be provided.

2. Failure of the apparent low bidder to **perform** the GFE **prior** to bid opening constitutes a non-responsive bid. The construction contract may then be awarded to the next low, responsive, and responsible bidder that meets the requirements or the Recipient may re-advertise the project.

3. If there is a bid dispute, all disputes shall be settled **prior** to submission of the Final Budget Approval Form.

Administration Requirements

- A recipient of CWSRF/DWSRF financing must require entities receiving funds to create and maintain a Bidders List if the recipient of the financing agreement is subject to, or chooses to follow, competitive bidding requirements.
- The Bidders list must include all firms that bid or quote on prime contracts, or bid or quote on subcontracts, including both DBEs and non-DBEs.

- Information retained on the Bidder's List must include the following:
    1. Entity's name with point of contact;
    2. Entity's mailing address and telephone number;
    3. The project description on which the entity bid or quoted and when;
    4. Amount of bid/quote; and
    5. Entity's status as a DBE or non-DBE.
- The Bidders List must be kept until the recipient is no longer receiving funding under the agreement.
- The recipient shall include Bidders List as part of the Final Budget Approval Form.
- A recipient must require its prime contractor to pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the Recipient.
- A recipient must be notified in writing by its prime contractor prior to any termination of a DBE subcontractor by the prime contractor.
- If a DBE subcontractor fails to complete work under the subcontract for any reason, the recipient must require the prime contractor to employ the six GFEs if soliciting a replacement subcontractor.
- A recipient must require its prime contractor to employ the six GFEs even if the prime contractor has achieved its fair share objectives.

Reporting Requirements

For the duration of the construction contract(s), the recipient is required to submit to the State Water Resources Control Board DBE reports annually by October 10 of each fiscal year on the attached Utilization Report form (UR-334). Failure to provide this information as stipulated in the financial agreement language may be cause for withholding disbursements.

CONTACT FOR MORE INFORMATION

SWRCB, CASRF – Barbara August (916) 341-6952 barbara.august@waterboards.ca.gov

US EPA, Region 9 – Joe Ochab (415) 972-3761 ochab.joe@epa.gov

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Disadvantaged Business Enterprise (DBE) Program

DBE Subcontractor Participation Form

A Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE[1] subcontractor[2] the opportunity to describe work received and/or report any concerns regarding the funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the DBE Coordinator at any time during the project period of performance.

Subcontractor Name	Project Name	
Bid / Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity	

Contract Item Number	**Description of Work Received from the Prime Contractor Involving Construction, Services, Equipment or Supplies**	**Amount Received by Prime Contractor**

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.2015 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an award of financial assistance.

Please use the space below to report any concerns regarding the above funded project:

Subcontractor Signature	Print Name
Title	Date

The public reporting and record keeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Do not send the completed form to this address.

Send completed Form 4500-2 to:
Mr. Joe Ochab, DBE Coordinator
US EPA, Region 9
75 Hawthorne Street
San Francisco, CA 94105

FORM 4500-2 (DBE Subcontractor Participation Form)

Disadvantaged Business Enterprise (DBE) Program

DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] description of work to be performed and the price of the work submitted to the prime contractor. A Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractor's bid or proposal package.

Subcontractor Name	Project Name	
Bid / Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity	

Contract Item Number	**Description of Work Submitted from the Prime Contractor Involving Construction, Services, Equipment or Supplies**	**Price of Work Submitted to the Prime Contractor**
DBE Certified By: _ DOT _ SBA Other: _____	Meets/exceeds EPA certification standards? YES NO Unknown	

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.2015 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an award of financial assistance.

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	Date

Subcontractor Signature	Print Name
Title	Date

Disadvantaged Business Enterprise (DBE) Program

DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE[1] subcontractor's[2] and the estimated dollar amount of each subcontract. A Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name
Bid / Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Issuing/Funding Entity		

I have identified potential DBE certified subcontractors. YES NO

If *yes*, please complete the table below. If *no*, please explain:

Subcontractor Name/ Company Name	**Company Address / Phone / Email**	**Estimated Dollar Amount**	**Currently DBE Certified?**

--Continue on back if needed--

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.2015 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an award of financial assistance.

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	Date

STATE WATER RESOURCES CONTROL BOARD – DIVISION OF FINANCIAL ASSISTANCE
DISADVANTAGED BUSINESS ENTERPRISE (DBE) UTILIZATION
CALIFORNIA STATE REVOLVING FUNDS (CASRF)
FORM UR-334

1. Grant/Finance Agreement Number:	2. Annual Reporting Period 10/1/___ through 09/30/_	3. Purchase Period of Financing Agreement:
4. Total Payments Paid to Prime Contractor or Sub-Contractors During Current Reporting Period: $		
5. Recipient's Name and Address:	6. Recipient's Contact Person and Phone Number:	

7. List All DBE Payments Paid by Recipient or Prime Contractor During Current Reporting Period:

Payment or Purchase Paid by Recipient or Prime Contractor	Amount Paid to Any DBE Contractor or Sub-Contractor For Service Provided to Recipient		Date of Payment (MM/DD/YY)	Procurement Type Code** (see below)	Name and Address of DBE Contractor of Sub-Contractor or Vendor
	MBE	**WBE**			

8. Initial here if no DBE contractors or sub-contractors paid during current reporting period:
9. Initial here if all procurements for this contract are completed:
10. Comments:

11. Signature and Title of Recipient's Authorized Representative	12. Date

Email Form UR-334 to:

DrinkingWaterSRF@waterboards.ca.gov OR CleanWaterSRF@waterboards.ca.gov

Questions may be directed to:

Barbara August, SWRCB
Barbara.August@waterboards.ca.gov
Phone: (916) 341-6952
Fax: (916) 327-7469

****Procurement Type:**
1. Construction
2. Supplies
3. Services (includes business services; professional services; repair services and personnel services)
4. Equipment

STATE WATER RESOURCES CONTROL BOARD - DIVISION OF FINANCIAL ASSISTANCE
DISADVANTAGED BUSINESS ENTERPRISE (DBE) UTILIZATION
CALIFORNIA STATE REVOLVING FUNDS

INSTRUCTIONS FOR COMPLETING FORM UR-334

Box 1 Grant or Financing Agreement Number.

Box 2 Annual reporting period.

Box 3 Enter the dates between which you made procurements under this financing agreement or grant.

Box 4 Enter the total amount of payments paid to the contractor or sub-contractors during this reporting period.

Box 5 Enter Recipient's Name and Address.

Box 6 Enter Recipient's Contact Name and Phone Number.

Box 7 Enter details for the **DBE purchases only** and be sure to limit them to the current period. 1) Use either an "R" or a "C" to represent "Recipient" or "Contractor." 2) Enter a dollar total for DBE and total the two columns at the bottom of the section. 3) Provide the payment date. 4) Enter a product type choice from those at the bottom of the page. 5) List the vendor name and address in the right-hand column

Box 8 Initial here if no DBE contractors or sub-contractors were paid during this reporting period.

Box 9 Initial this box only if all purchases under this financing agreement or grant have been completed during this reporting period or a previous period. If you initial this box, we will no longer send you a survey.

Box 10 This box is for explanatory information or questions.

Box 11 Provide an authorized representative signature.

Box 12 Enter the date form completed.

FUNDING ENTITY REQUIREMENT NO. 2 - Implementation of American Iron and Steel (AIS) provisions of P.L. 113-76 and Contractor's Certification Letter, comprised of 21 pages

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 20 2014

OFFICE OF WATER

MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: For Andrew D. Sawyers, Director
Office of Wastewater Management (4201M)

Peter C. Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

Implementation

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term ‘‘iron and steel products’’ means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the ‘‘Administrator’’) finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out

the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Project Coverage

1) What classes of projects are covered by the AIS requirement?

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Federal Fiscal Year 2014, are covered. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

2) Does the AIS requirement apply to nonpoint source projects or national estuary projects?

No. Congress did not include an AIS requirement for nonpoint source and national estuary projects unless the project can also be classified as a 'treatment works' as defined by section 212 of the Clean Water Act.

3) Are any projects for the construction, alteration, maintenance, or repair of a public water system or treatment works excluded from the AIS requirement?

Any project, whether a treatment works project or a public water system project, for which engineering plans and specifications were approved by the responsible state agency prior to January 17, 2014, is excluded from the AIS requirements.

4) What if the project does not have approved engineering plans and specifications but has signed an assistance agreement with a CWSRF or DWSRF program prior to January 17, 2014?

The AIS requirements do not apply to any project for which an assistance agreement was signed prior to January 17, 2014.

5) What if the project does not have approved engineering plans and specifications, but bids were advertised prior to January 17, 2014 and an assistance agreement was signed after January 17, 2014?

If the project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the approval date for purposes of the exemption in section 436(f).

6) What if the assistance agreement that was signed prior to January 17, 2014, only funded a part of the overall project, where the remainder of the project will be funded later with another SRF loan?

If the original assistance agreement funded any construction of the project, the date of the original assistance agreement counts for purposes of the exemption. If the original assistance agreement was only for planning and design, the date of that assistance agreement will count for purposes of the exemption only if there is a written commitment or expectation on the part of the assistance recipient to fund the remainder of the project with SRF funds.

7) What if the assistance agreement that was signed prior to January 17, 2014, funded the first phase of a multi-phase project, where the remaining phases will be funded by SRF assistance in the future?

In such a case, the phases of the project will be considered a single project if all construction necessary to complete the building or work, regardless of the number of contracts or assistance agreements involved, are closely related in purpose, time and place. However, there are many situations in which major construction activities are clearly undertaken in phases that are distinct in purpose, time, or place. In the case of distinct phases, projects with engineering plans and specifications approval or assistance agreements signed prior to January 17, 2014 would be excluded from AIS requirements while those approved/signed on January 17, 2014, or later would be covered by the AIS requirements.

8) What if a project has split funding from a non-SRF source?

Many States intend to fund projects with "split" funding, from the SRF program and from State or other programs. Based on the Act language in section 436, which requires that American iron and steel products be used in any project for the construction, alteration, maintenance, or repair of a public water system or treatment works receiving SRF funding between and including January 17, 2014 and September 30, 2014, any project that is funded in whole or in part with such funds must comply with the AIS requirement. A "project" consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all contracts and assistance agreements awarded are closely related in purpose, time and place. This precludes the intentional splitting of SRF projects into separate and smaller contracts or assistance agreements to avoid AIS coverage on some portion of a larger

project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreement for SRF and State or other funding would carry separate requirements.

9) What about refinancing?

If a project began construction, financed from a non-SRF source, prior to January 17, 2014, but is refinanced through an SRF assistance agreement executed on or after January 17, 2014 and prior to October 1, 2014, AIS requirements will apply to all construction that occurs on or after January 17, 2014, through completion of construction, unless, as is likely, engineering plans and specifications were approved by a responsible state agency prior to January 17, 2014. There is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to January 17, 2014.

10) Do the AIS requirements apply to any other EPA programs, besides the SRF program, such as the Tribal Set-aside grants or grants to the Territories and DC?

No, the AIS requirement only applies to funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12)

Covered Iron and Steel Products

11) What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

Lined or unlined pipes or fittings;
Manhole Covers;
Municipal Castings (defined in more detail below);
Hydrants;
Tanks;
Flanges;
Pipe clamps and restraints;
Valves;
Structural steel (defined in more detail below);
Reinforced precast concrete; and
Construction materials (defined in more detail below).

12) What does the term 'primarily iron or steel' mean?

'Primarily iron or steel' places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

13) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

14) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

15) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

16) What does 'produced in the United States' mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the

material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.

17) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

18) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

19) What is the definition of 'municipal castings'?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

Access Hatches;
Ballast Screen;
Benches (Iron or Steel);
Bollards;
Cast Bases;
Cast Iron Hinged Hatches, Square and Rectangular;
Cast Iron Riser Rings;
Catch Basin Inlet;
Cleanout/Monument Boxes;
Construction Covers and Frames;
Curb and Corner Guards;
Curb Openings;
Detectable Warning Plates;
Downspout Shoes (Boot, Inlet);
Drainage Grates, Frames and Curb Inlets;
Inlets;
Junction Boxes;
Lampposts;
Manhole Covers, Rings and Frames, Risers;

Meter Boxes;
Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

20) What is 'structural steel'?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

21) What is a 'construction material' for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered "structural steel". This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

22) What is not considered a 'construction material' for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and

data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

23) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

24) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

Compliance

25) How should an assistance recipient document compliance with the AIS requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements. Sample language for assistance agreements and contracts can be found in Appendix 3 and 4.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer,

processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Appendix 5, are sample certifications. These certifications should be collected and maintained by assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

26) How should a State ensure assistance recipients are complying with the AIS requirement?

In order to ensure compliance with the AIS requirement, States SRF programs must include specific AIS contract language in the assistance agreement. Sample language for assistance agreements can be found in Appendix 3.

States should also, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

27) What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?

If a potentially non-compliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of the non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations, in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-

888-546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: http://www.epa.gov/oig/hotline.htm.

28) How do international trade agreements affect the implementation of the AIS requirements?

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the assistance recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 3 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Appendix 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to either of two email addresses. For CWSRF waiver requests, please send the application to: cwsrfwaiver@epa.gov. For DWSRF waiver requests, please send the application to: dwsrfwaiver@epa.gov.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: http://water.epa.gov/grants_funding/aisrequirement.cfm

2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at dorfman.jordan@epa.gov or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Attachments

Appendix 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that States review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

Items	✓	Notes
General • Waiver request includes the following information: — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor		
Cost Waiver Requests • Waiver request includes the following information: — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers		
Availability Waiver Requests • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?		

Appendix 2: HQ Review Checklist for Waiver Request

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
Cost Waiver Requests • Does the waiver request include the following information? — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products				
— Relevant excerpts from the bid documents used by the contractors to complete the comparison				
— A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market				
• Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%?				
Availability Waiver Requests • Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested? — Supplier information or other documentation indicating availability/delivery date for materials — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials				
• Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers?				
• Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information)				
• Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include: — Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State — Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States — Correspondence with construction trade associations indicating the non-availability of the materials				
• Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?				

Appendix 3: Example Loan Agreement Language

ALL ASSISTANCE AGREEMENT MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN SRF ASSISTANCE AGREEMENTS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE LAW:

Comply with all federal requirements applicable to the Loan (including those imposed by the 2014 Appropriations Act and related SRF Policy Guidelines) which the Participant understands includes, among other, requirements that all of the iron and steel products used in the Project are to be produced in the United States ("American Iron and Steel Requirement") unless (i) the Participant has requested and obtained a waiver from the Agency pertaining to the Project or (ii) the Finance Authority has otherwise advised the Participant in writing that the American Iron and Steel Requirement is not applicable to the Project.

Comply with all record keeping and reporting requirements under the Clean Water Act/Safe Drinking Water Act, including any reports required by a Federal agency or the Finance Authority such as performance indicators of program deliverables, information on costs and project progress. The Participant understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities and (ii) failure to comply with the Clean Water Act/Safe Drinking Water Act and this Agreement may be a default hereunder that results in a repayment of the Loan in advance of the maturity of the Bonds and/or other remedial actions.

Appendix 4: Sample Construction Contract Language

ALL CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN ALL CONTRACTS IN PROJECTS THAT USE SRF FUNDS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE OR LOCAL LAW:

The Contractor acknowledges to and for the benefit of the City of _____ ("Purchaser") and the _____ (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Appendix 5: Sample Certifications

The following information is provided as a sample letter of **step** certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

The following information is provided as a sample letter of certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

CONTRACTOR'S CERTIFICATION

Attestation of Compliance with American Iron and Steel Requirements provision of P.L. 113-76, Consolidated Appropriations Act, 2014

Date:

RE: [Project Name]
[Owner's Name]
[Construction Contract Name]

The Contractor acknowledges to and for the benefit of the City of _____("Purchaser") and the _____ (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

_____
Name of Construction Company (PRINT)

_____
By Authorized Representative (SIGNATURE)

_____
Title

FUNDING ENTITY REQUIREMENT NO. 3 - Executive Order N-6-22 and Attestation of Compliance with economic sanctions in response to Russia’s actions in Ukraine, comprised of 5 pages

EXECUTIVE DEPARTMENT
STATE OF CALIFORNIA

EXECUTIVE ORDER N-6-22

WHEREAS California has a strong commitment to fundamental rights and freedoms at home and around the world; and

WHEREAS the Russian Federation (Russia) has mounted aggressive, unlawful, and violent actions against Ukraine and its people, flouting these fundamental rights and freedoms; and

WHEREAS Russia's attacks on Ukraine and its people have significantly escalated since 2014, despite significant diplomatic efforts by the United States and its partners and allies to stop Russian aggression; and

WHEREAS on February 21, 2022, United States President Joseph R. Biden Jr. issued Executive Order 14065 finding that Russia's purported recognition of the so-called Donetsk People's Republic or Luhansk People's Republic regions of Ukraine contradicts Russia's commitments under the 2014 Minsk cessation of hostility agreements and further threatens the peace, stability, sovereignty, and territorial integrity of Ukraine; and

WHEREAS Executive Order 14065 expands upon a number of previous Executive Orders related to Russia's mounting actions to undermine the sovereignty and territorial integrity of Ukraine, including Executive Orders 13660, 13661, 13662, 13685, and 13849, and further federal actions may follow; and

WHEREAS on February 24, 2022, Russia launched a large-scale invasion of the sovereign nation of Ukraine and continues to conduct a lawless assault on the Ukrainian government and people; and

WHEREAS California joins the United States and other nations, states, and localities in condemning Russia's attacks on Ukraine and its people as an assault on fundamental international rules and norms that have prevailed since the Second World War; and

WHEREAS President Biden and American allies and partners around the world have announced significant economic sanctions on key Russian institutions and banks and on the architects of this war of choice, including Russian President Vladimir Putin, among others; and

WHEREAS California is proud to be home to one of the largest Ukrainian populations in the United States, and continues to stand with the government and people of Ukraine, who have fought with incredible bravery to defend their country and freedom; and

WHEREAS California supports President Biden's efforts to hold Russia accountable for violating Ukrainian sovereignty, for its disregard for the lives and well-being of the Ukrainian people, and for its hostility to freedom and democracy; and

WHEREAS thousands of Russian citizens have courageously taken to the streets to protest their government's lawless invasion of Ukraine, and many

Californian immigrants from Russia and Californians of Russian descent have marched in solidarity with these Russian protestors; and

WHEREAS California's National Guard and the U.S. government have had a nearly three-decade relationship with Ukraine working to support its Ministry of Defense, Ministry of Interior, and Armed Forces by providing military equipment and training as well as humanitarian assistance, from helping to renovate schools and providing school supplies to volunteering at orphanages; and

WHEREAS over the last twenty years, the Office of Emergency Services, along with the California National Guard and the California Emergency Medical Services Authority, has provided training and conducted exercises with the Ukrainian Ministry of Defense and Armed Forces on utilizing the Emergency Management and Incident Command System; and

WHEREAS California, which has a long history of welcoming Ukrainian and other refugees, will continue to support resettlement, in partnership with the federal government, of those seeking safety and freedom from Russia's aggression in Ukraine; and

WHEREAS according to UN agencies, Russian aggression since 2014 has internally displaced 1.5 million Ukrainians, caused an estimated 50,000 casualties, and destabilized the region, and its recent invasion of Ukraine threatens to create Europe's largest refugee crisis in decades, with more than a million refugees fleeing Ukraine in the last week; and

WHEREAS many companies in California have taken steps to limit economic transactions with Russia and Russian entities, to combat misinformation about Russia's actions in Ukraine, and to support the government and people of Ukraine; and

WHEREAS California calls upon businesses, non-governmental organizations, and public entities in the State to review their investments and contracts to ensure their compliance with economic sanctions imposed by the U.S. government in response to Russia's actions in Ukraine, as well as any sanctions imposed under state law (collectively, economic sanctions), and to take actions to support the Ukrainian government and people, including by refraining from new investments in, and financial transactions with, Russian institutions or companies that are headquartered or have their principal place of business in Russia (Russian entities), not transferring technology to Russia or Russian entities, and directly providing support to the government and people of Ukraine.

NOW, THEREFORE, I, GAVIN NEWSOM, Governor of the State of California, in accordance with the authority vested in me by the State Constitution and statutes of the State of California do hereby issue the following Order to become effective immediately:

IT IS HEREBY ORDERED THAT:

1. All agencies and departments subject to my authority shall review all contracts for commodities, services, and technology to determine whether they comply with existing economic sanctions; and

2. All agencies and departments subject to my authority shall terminate any contracts with any individuals or entities that are determined to be a target of economic sanctions, and shall refrain from entering into any new contracts with such individuals or entities while economic sanctions are in effect; and

3. All agencies and departments subject to my authority shall notify all contractors and grantees of their obligations to comply with economic sanctions within 45 days of this Order, and the Department of General Services and the Department of Technology shall provide guidance on such communications within 14 days of this Order; and

4. All agencies and departments subject to my authority shall direct grantees, and contractors with agreements valued at $5 million or more, to report to the agency or department regarding their compliance with economic sanctions; and

5. All agencies and departments subject to my authority shall direct all grantees, and contractors with agreements valued at $5 million or more, to report on steps they have taken in response to Russia's actions in Ukraine, including, but not limited to, desisting from making new investments in, or engaging in financial transactions with, Russian entities, not transferring technology to Russia or Russian entities, and directly providing support to the government and people of Ukraine; and

6. The Department of General Services and Department of Technology shall issue procurement guidance to agencies and departments regarding compliance with economic sanctions and supporting Ukrainian businesses to the extent permitted by state law.

IT IS FURTHER ORDERED that, as soon as hereafter possible, this Order be filed in the Office of the Secretary of State and that widespread publicity and notice be given of this Order.

This Order is not intended to, and does not, create any rights or benefits, substantive or procedural, enforceable at law or in equity, against the State of California, its agencies, departments, entities, officers, employees, or any other person.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of California to be affixed this 4th day of March 2022.

GAVIN NEWSOM
Governor of California

ATTEST:

SHIRLEY N. WEBER, PH.D.
Secretary of State

COMPLIANCE WITH ECONOMIC SANCTIONS

IN RESPONSE TO RUSSIA'S ACTIONS IN UKRAINE

Per Executive Order N-6-22, all contractors and grantees that have agreements valued at $5 million or more with agencies/departments subject to the California Governor's authority are directed to report to their contracting or grantor agency or department regarding their compliance with economic sanctions imposed by the U.S. government in response to Russia's actions in Ukraine, as well as sanctions imposed under state law, if any.

1) ATTESTATION OF COMPLIANCE:

Having conducted a good faith review, I attest that _____ (agency name) is in compliance with the economic sanctions imposed by the U.S. government in response to Russia's actions in Ukraine, as well as sanctions imposed under state law, if any.

Contractor/Provider Name (Printed):	**Contract Number (s):**
By (Authorized Signature):	
Printed name and title of authorized signor:	
Date of Signed Attestation of Compliance:	

2) REPORT OF ACTIONS/STEPS TAKEN:

Attach a brief report to this notice form, on your agency letterhead describing the steps and actions, if any, you have taken in response to Russia's actions in Ukraine and to ensure compliance with the EO. *Please note that responses may be subject to disclosure under the California Public Records Act. Accordingly, please do not include any confidential information or disclosures that could pose security risks.*

FUNDING ENTITY REQUIREMENT NO. 4 - Davis Bacon Requirements for DWSRF Projects, comprised of 10 pages

Davis-Bacon Requirements for DWSRF Projects

For purposes of this Exhibit only, “subrecipient” or “sub recipient” means the Recipient as defined in this Agreement.

For purposes of this Exhibit only, “recipient” or “State recipient” means the State Water Board.

I. Requirements Under Section 1452(a)(5) of the Safe Drinking Water Act For Sub recipients That Are Governmental Entities:

If a sub recipient has questions regarding when Davis-Bacon (DB) applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State Water Board at DavisBacon@waterboards.ca.gov or phone (916) 327-7323. The recipient or sub recipient may also obtain additional guidance from the U.S. Department of Labor’s (DOL) website at http://www.dol.gov/whd/.

1. Applicability of the DB prevailing wage requirements.

DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a sub recipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the sub recipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Sub recipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract

(i) While the solicitation remains open, the sub recipient shall monitor https://sam.gov weekly to ensure that the wage determination contained in the solicitation remains current. The sub recipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the sub recipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the sub recipient.

(ii) If the sub recipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the sub recipient, obtains an extension of the 90 day period from DOL pursuant to 29

CFR 1.6(c)(3)(iv). The sub recipient shall monitor https://sam.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the sub recipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the sub recipient shall insert the appropriate DOL wage determination from https://sam.gov into the ordering instrument.

(c) Sub recipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a sub recipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the sub recipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the sub recipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The sub recipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the sub recipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project carried out in whole or in part with assistance made available by the DWSRF, and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the Safe Drinking Water Act, Section 1452(a)(5), the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or

programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the DB poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Sub recipients may obtain wage determinations from the DOL website, https://sam.gov.

(ii)(A) The sub recipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the sub recipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the sub recipient (s) to the State award official. The State award official will transmit a completed conformance request form (SF-1444 or similar) and supporting materials to WHD-CBACONFORMANCE_INCOMING@dol.gov and to the EPA DB Regional Coordinator concurrently. The DOL Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the sub recipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), documentation of the action taken and the request, including the local wage determination, shall be sent by the sub recipient(s) to the State award official. The State award official will transmit a completed conformance request

form (SF-1444 or similar) which indicates the State award official's disagreement and supporting materials to WHD-CBACONFORMANCE_INCOMING@dol.gov and to the EPA DB Regional Coordinator concurrently. The DOL Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside assets in a separate account for the meeting of obligations under the plan or program.

(2) Withholding. The sub recipient(s), shall upon written request of the EPA Award Official or an authorized representative of the DOL, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the EPA may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of

Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the sub recipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the sub recipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead, the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division website at http://www.dol.gov/whd/forms/wh347instr.htm or its successor site.

The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the sub recipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the DOL for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sub recipient(s).

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions

have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(ii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the EPA or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered

program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include

these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with DB and Related Act requirements. All rulings and interpretations of the DB and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the DOL set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and sub recipient(s), State, EPA, the DOL, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The sub recipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $29 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The sub recipient**,** upon written request of the EPA Award Official or an authorized representative of the DOL, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (a)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Sub recipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Sub recipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the EPA and the DOL, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a) The sub recipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(3), all interviews

must be conducted in confidence. The sub recipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The sub recipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Sub recipients must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the contractor or subcontractor is not complying with DB.

Sub recipients shall immediately conduct interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The sub recipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The sub recipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the sub recipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Sub recipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the sub recipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The sub recipient shall periodically review contractor's and subcontractor's use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S DOL or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Sub recipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at https://www.dol.gov/agencies/whd/contact/local-offices.

FUNDING ENTITY REQUIREMENT NO. 5 - David Bacon Wage Rate Determination, comprised of 23 pages

"General Decision Number: CA20230004 06/23/2023

Superseded General Decision Number: CA20220004

State: California

Construction Types: Heavy (Heavy and Dredging) and Highway

Counties: Del Norte, Humboldt, Lake and Mendocino Counties in California.

DREDGING PROJECTS (does not include hopper dredge work); HEAVY CONSTRUCTION PROJECTS (does not include water well drilling); AND HIGHWAY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2023
1	01/13/2023
2	03/17/2023
3	03/31/2023
4	06/23/2023

ASBE0016-005 02/01/2023

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials, Protective Coverings, Coatings, and Finishes to all types of mechanical systems)		
(1) Mendocino County	$ 62.26	23.82
(2) Del Norte, Humboldt, Lake Counties	$ 62.26	23.82

ASBE0016-006 01/01/2021

	Rates	Fringes
Asbestos Removal worker/hazardous material handler (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not)	$ 30.45	10.60

BRCA0003-001 08/01/2022

	Rates	Fringes
MARBLE FINISHER	$ 39.20	18.31

BRCA0003-003 08/01/2022

	Rates	Fringes
MARBLE MASON	$ 56.98	28.54

BRCA0003-006 05/01/2022

	Rates	Fringes
BRICKLAYER	$ 53.69	26.03

SPECIALTY PAY:
(A) Underground work such as tunnel work, sewer work, manholes, catch basins, sewer pipes and telephone conduit shall be paid $1.25 per hour above the regular rate. Work in direct contact with raw sewage shall receive $1.25 per hour in addition to the above.
(B) Operating a saw or grinder shall receive $1.25 per hour above the regular rate.
(C) Gunite nozzle person shall receive $1.25 per hour above the regular rate.

BRCA0003-008 07/01/2022

	Rates	Fringes
TERRAZZO FINISHER	$ 41.93	18.98
TERRAZZO WORKER/SETTER	$ 56.84	27.53

BRCA0003-013 04/01/2022

	Rates	Fringes
TILE FINISHER		
Del Norte & Humboldt Counties	$ 33.86	17.74
Lake & Mendocino Counties	$ 31.89	17.18
TILE LAYER		
Del Norte & Humboldt Counties	$ 55.41	20.87
Lake & Mendocino Counties	$ 52.28	20.79

CARP0034-001 07/01/2021

	Rates	Fringes
Diver		
Assistant Tender, ROV Tender/Technician	$ 54.10	34.69
Diver standby	$ 60.51	34.69
Diver Tender	$ 59.51	34.69
Diver wet	$ 103.62	34.69
Manifold Operator (mixed gas)	$ 64.51	34.69
Manifold Operator (Standby)	$ 59.51	34.69

DEPTH PAY (Surface Diving):
050 to 100 ft $2.00 per foot
101 to 150 ft $3.00 per foot
151 to 220 ft $4.00 per foot
221 ft.-deeper $5.00 per foot

SATURATION DIVING:
The standby rate shall apply until saturation starts. The saturation diving rate applies when divers are under pressure continuously until work task and decompression are complete. The diver rate shall be paid for all saturation hours.

DIVING IN ENCLOSURES:
Where it is necessary for Divers to enter pipes or tunnels, or other enclosures where there is no vertical ascent, the following premium shall be paid: Distance traveled from entrance 26 feet to 300 feet: $1.00 per foot. When it is necessary for a diver to enter any pipe, tunnel or other enclosure less than 48"" in height, the premium will be $1.00 per foot.

WORK IN COMBINATION OF CLASSIFICATIONS:
Employees working in any combination of classifications within the diving crew (except dive supervisor) in a shift are paid in the classification with the highest rate for that shift.

CARP0034-003 07/01/2021

	Rates	Fringes
Piledriver	$ 54.10	34.69

CARP0751-002 07/01/2021

Del Norte, Humboldt, Lake and Mendocino Counties

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 54.85	31.49
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 47.77	31.49
Journeyman Carpenter	$ 47.62	31.49
Millwright	$ 50.12	33.08

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* ELEC0551-001 06/01/2023

LAKE AND MENDOCINO COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 56.92	30.16

TUNNEL WORK: Add $0.50 per hour.

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* ELEC0551-002 06/01/2023

DEL NORTE AND HUMBOLDT COUNTIES

	Rates	Fringes
Electricians:	$ 56.92	30.16

TUNNEL WORK: Add $0.50 per hour.

ELEC1245-002 06/01/2022

HUMBOLDT, LAKE AND MENDOCINO COUNTIES

	Rates	Fringes
LINE CONSTRUCTION		
(1) Lineman; Cable splicer	$ 64.40	22.58
(2) Equipment specialist (operates crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), overhead & underground distribution line equipment)	$ 50.00	21.30
(3) Groundman	$ 38.23	20.89
(4) Powderman	$ 51.87	18.79

HOLIDAYS: New Year's Day, M.L. King Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day and day after Thanksgiving, Christmas Day

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ENGI0003-014 06/29/2020

""AREA 1"" WAGE RATES ARE LISTED BELOW

""AREA 2"" RECEIVES AN ADDITIONAL $2.00 PER HOUR ABOVE AREA 1 RATES.

SEE AREA DEFINITIONS BELOW

	Rates	Fringes
OPERATOR: Power Equipment (AREA 1:)		
GROUP 1	$ 51.42	31.15
GROUP 2	$ 49.89	31.15
GROUP 3	$ 48.41	31.15
GROUP 4	$ 47.03	31.15
GROUP 5	$ 45.76	31.15
GROUP 6	$ 44.44	31.15
GROUP 7	$ 43.30	31.15
GROUP 8	$ 42.16	31.15
GROUP 8-A	$ 39.95	31.15
OPERATOR: Power Equipment (Cranes and Attachments - AREA 1:)		
GROUP 1		
Cranes	$ 52.30	31.15
Oiler	$ 43.79	31.15
Truck crane oiler	$ 46.08	31.15
GROUP 2		
Cranes	$ 50.54	31.15
Oiler	$ 42.83	31.15
Truck crane oiler	$ 45.07	31.15
GROUP 3		
Cranes	$ 48.80	31.15
Hydraulic	$ 44.44	31.15
Oiler	$ 42.55	31.15
Truck crane oiler	$ 44.83	31.15
GROUP 4		
Cranes	$ 45.76	31.15
OPERATOR: Power Equipment (Piledriving - AREA 1:)		
GROUP 1		
Lifting devices	$ 52.64	31.15
Oiler	$ 43.38	31.15
Truck Crane Oiler	$ 45.66	31.15
GROUP 2		
Lifting devices	$ 50.82	31.15
Oiler	$ 43.11	31.15
Truck Crane Oiler	$ 45.41	31.15
GROUP 3		
Lifting devices	$ 49.14	31.15
Oiler	$ 42.89	31.15
Truck Crane Oiler	$ 45.12	31.15
GROUP 4		
Lifting devices	$ 47.37	31.15
GROUP 5		
Lifting devices	$ 44.73	31.15
GROUP 6		
Lifting devices	$ 42.50	31.15
OPERATOR: Power Equipment (Steel Erection - AREA 1:)		

GROUP 1
Cranes.....$ 53.27 31.15
Oiler.....$ 43.72 31.15
Truck Crane Oiler.....$ 45.95 31.15
GROUP 2
Cranes.....$ 51.50 31.15
Oiler.....$ 43.45 31.15
Truck Crane Oiler.....$ 45.73 31.15
GROUP 3
Cranes.....$ 50.02 31.15
Hydraulic.....$ 45.07 31.15
Oiler.....$ 43.23 31.15
Truck Crane Oiler.....$ 45.46 31.15
GROUP 4
Cranes.....$ 48.00 31.15
GROUP 5
Cranes.....$ 46.70 31.15

OPERATOR: Power Equipment
(Tunnel and Underground Work
- AREA 1:)
SHAFTS, STOPES, RAISES:
GROUP 1.....$ 47.52 31.15
GROUP 1-A.....$ 49.99 31.15
GROUP 2.....$ 46.26 31.15
GROUP 3.....$ 44.93 31.15
GROUP 4.....$ 43.79 31.15
GROUP 5.....$ 42.65 31.15
UNDERGROUND:
GROUP 1.....$ 47.42 31.15
GROUP 1-A.....$ 49.89 31.15
GROUP 2.....$ 46.16 31.15
GROUP 3.....$ 44.83 31.15
GROUP 4.....$ 43.69 31.15
GROUP 5.....$ 42.55 31.15

FOOTNOTE: Work suspended by ropes or cables, or work on a Yo-Yo Cat: $.60 per hour additional.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Operator of helicopter (when used in erection work); Hydraulic excavator, 7 cu. yds. and over; Power shovels, over 7 cu. yds.

GROUP 2: Highline cableway; Hydraulic excavator, 3-1/2 cu. yds. up to 7 cu. yds.; Licensed construction work boat operator, on site; Power blade operator (finish); Power shovels, over 1 cu. yd. up to and including 7 cu. yds. m.r.c.

GROUP 3: Asphalt milling machine; Cable backhoe; Combination backhoe and loader over 3/4 cu. yds.; Continuous flight tie back machine assistant to engineer or mechanic; Crane mounted continuous flight tie back machine, tonnage to apply; Crane mounted drill attachment, tonnage to apply; Dozer, slope brd; Gradall; Hydraulic excavator, up to 3 1/2 cu. yds.; Loader 4 cu. yds. and over; Long reach excavator; Multiple engine scraper (when used as push pull); Power shovels, up to and including 1 cu. yd.; Pre-stress wire wrapping machine; Side boom cat, 572 or larger; Track loader 4 cu. yds. and over; Wheel excavator (up to and including 750 cu. yds. per hour)

GROUP 4: Asphalt plant engineer/box person; Chicago boom;

Combination backhoe and loader up to and including 3/4 cu. yd.; Concrete batch plant (wet or dry); Dozer and/or push cat; Pull- type elevating loader; Gradesetter, grade checker (GPS, mechanical or otherwise); Grooving and grinding machine; Heading shield operator; Heavy-duty drilling equipment, Hughes, LDH, Watson 3000 or similar; Heavy-duty repairperson and/or welder; Lime spreader; Loader under 4 cu. yds.; Lubrication and service engineer (mobile and grease rack); Mechanical finishers or spreader machine (asphalt, Barber-Greene and similar); Miller Formless M-9000 slope paver or similar; Portable crushing and screening plants; Power blade support; Roller operator, asphalt; Rubber-tired scraper, self-loading (paddle-wheels, etc.); Rubber- tired earthmoving equipment (scrapers); Slip form paver (concrete); Small tractor with drag; Soil stabilizer (P & H or equal); Spider plow and spider puller; Tubex pile rig; Unlicensed constuction work boat operator, on site; Timber skidder; Track loader up to 4 yds.; Tractor-drawn scraper; Tractor, compressor drill combination; Welder; Woods-Mixer (and other similar Pugmill equipment)

GROUP 5: Cast-in-place pipe laying machine; Combination slusher and motor operator; Concrete conveyor or concrete pump, truck or equipment mounted; Concrete conveyor, building site; Concrete pump or pumpcrete gun; Drilling equipment, Watson 2000, Texoma 700 or similar; Drilling and boring machinery, horizontal (not to apply to waterliners, wagon drills or jackhammers); Concrete mixer/all; Person and/or material hoist; Mechanical finishers (concrete) (Clary, Johnson, Bidwell Bridge Deck or similar types); Mechanical burm, curb and/or curb and gutter machine, concrete or asphalt); Mine or shaft hoist; Portable crusher; Power jumbo operator (setting slip-forms, etc., in tunnels); Screed (automatic or manual); Self-propelled compactor with dozer; Tractor with boom D6 or smaller; Trenching machine, maximum digging capacity over 5 ft. depth; Vermeer T-600B rock cutter or similar

GROUP 6: Armor-Coater (or similar); Ballast jack tamper; Boom- type backfilling machine; Assistant plant engineer; Bridge and/or gantry crane; Chemical grouting machine, truck-mounted; Chip spreading machine operator; Concrete saw (self-propelled unit on streets, highways, airports and canals); Deck engineer; Drilling equipment Texoma 600, Hughes 200 Series or similar up to and including 30 ft. m.r.c.; Drill doctor; Helicopter radio operator; Hydro-hammer or similar; Line master; Skidsteer loader, Bobcat larger than 743 series or similar (with attachments); Locomotive; Lull hi-lift or similar; Oiler, truck mounted equipment; Pavement breaker, truck-mounted, with compressor combination; Paving fabric installation and/or laying machine; Pipe bending machine (pipelines only); Pipe wrapping machine (tractor propelled and supported); Screed (except asphaltic concrete paving); Self- propelled pipeline wrapping machine; Tractor; Self-loading chipper; Concrete barrier moving machine

GROUP 7: Ballast regulator; Boom truck or dual-purpose A-frame truck, non-rotating - under 15 tons; Cary lift or similar; Combination slurry mixer and/or cleaner; Drilling equipment, 20 ft. and under m.r.c.; Firetender (hot plant); Grouting machine operator; Highline cableway signalperson; Stationary belt loader (Kolman or similar); Lift slab machine (Vagtborg and similar types); Maginnes internal

full slab vibrator; Material hoist (1 drum); Mechanical trench shield; Pavement breaker with or without compressor combination); Pipe cleaning machine (tractor propelled and supported); Post driver; Roller (except asphalt); Chip Seal; Self-propelled automatically applied concrete curing mahcine (on streets, highways, airports and canals); Self-propelled compactor (without dozer); Signalperson; Slip-form pumps (lifting device for concrete forms); Tie spacer; Tower mobile; Trenching machine, maximum digging capacity up to and including 5 ft. depth; Truck- type loader

GROUP 8: Bit sharpener; Boiler tender; Box operator; Brakeperson; Combination mixer and compressor (shotcrete/gunite); Compressor operator; Deckhand; Fire tender; Forklift (under 20 ft.); Generator; Gunite/shotcrete equipment operator; Hydraulic monitor; Ken seal machine (or similar); Mixermobile; Oiler; Pump operator; Refrigeration plant; Reservoir-debris tug (self-propelled floating); Ross Carrier (construction site); Rotomist operator; Self-propelled tape machine; Shuttlecar; Self-propelled power sweeper operator (includes vacuum sweeper); Slusher operator; Surface heater; Switchperson; Tar pot firetender; Tugger hoist, single drum; Vacuum cooling plant; Welding machine (powered other than by electricity)

GROUP 8-A: Elevator operator; Skidsteer loader-Bobcat 743 series or smaller, and similar (without attachments); Mini excavator under 25 H.P. (backhoe-trencher); Tub grinder wood chipper

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ALL CRANES AND ATTACHMENTS

GROUP 1: Clamshell and dragline over 7 cu. yds.; Crane, over 100 tons; Derrick, over 100 tons; Derrick barge pedestal-mounted, over 100 tons; Self-propelled boom-type lifting device, over 100 tons

GROUP 2: Clamshell and dragline over 1 cu. yd. up to and including 7 cu. yds.; Crane, over 45 tons up to and including 100 tons; Derrick barge, 100 tons and under; Self-propelled boom-type lifting device, over 45 tons; Tower crane

GROUP 3: Clamshell and dragline up to and including 1 cu. yd.; Cranes 45 tons and under; Self-propelled boom-type lifting device 45 tons and under;

GROUP 4: Boom Truck or dual purpose A-frame truck, non-rotating over 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) over 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) - under 15 tons;

PILEDRIVERS

GROUP 1: Derrick barge pedestal mounted over 100 tons; Clamshell over 7 cu. yds.; Self-propelled boom-type lifting device over 100 tons; Truck crane or crawler, land or barge mounted over 100 tons

GROUP 2: Derrick barge pedestal mounted 45 tons to and including 100 tons; Clamshell up to and including 7 cu. yds.; Self-propelled boom-type lifting device over 45 tons; Truck crane or crawler, land or barge mounted, over 45 tons up to and including 100 tons; Fundex F-12 hydraulic pile rig

GROUP 3: Derrick barge pedestal mounted under 45 tons; Self-propelled boom-type lifting device 45 tons and under; Skid/scow piledriver, any tonnage; Truck crane or crawler, land or barge mounted 45 tons and under

GROUP 4: Assistant operator in lieu of assistant to engineer; Forklift, 10 tons and over; Heavy-duty repairperson/welder

GROUP 5: Deck engineer

GROUP 6: Deckhand; Fire tender

STEEL ERECTORS

GROUP 1: Crane over 100 tons; Derrick over 100 tons; Self-propelled boom-type lifting device over 100 tons

GROUP 2: Crane over 45 tons to 100 tons; Derrick under 100 tons; Self-propelled boom-type lifting device over 45 tons to 100 tons; Tower crane

GROUP 3: Crane, 45 tons and under; Self-propelled boom-type lifting device, 45 tons and under

GROUP 4: Chicago boom; Forklift, 10 tons and over; Heavy-duty repair person/welder

GROUP 5: Boom cat

TUNNEL AND UNDERGROUND WORK

GROUP 1-A: Tunnel bore machine operator, 20' diameter or more

GROUP 1: Heading shield operator; Heavy-duty repairperson; Mucking machine (rubber tired, rail or track type); Raised bore operator (tunnels); Tunnel mole bore operator

GROUP 2: Combination slusher and motor operator; Concrete pump or pumpcrete gun; Power jumbo operator

GROUP 3: Drill doctor; Mine or shaft hoist

GROUP 4: Combination slurry mixer cleaner; Grouting Machine operator; Motorman

GROUP 5: Bit Sharpener; Brakeman; Combination mixer and compressor (gunite); Compressor operator; Oiler; Pump operator; Slusher operator

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AREA DESCRIPTIONS:

POWER EQUIPMENT OPERATORS, CRANES AND ATTACHMENTS,TUNNEL AND UNDERGROUND [These areas do not apply to Piledrivers and Steel Erectors]

AREA 1: DEL NORTE, HUMBOLDT, LAKE, MENDOCINO
AREA 2 -NOTED BELOW

THE REMAINING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2 AS NOTED BELOW:

DEL NORTE COUNTY:
Area 1: Extreme Southwest corner
Area 2: Remainder

HUMBOLDT COUNTY:
Area 1: Except Eastern and Southwestern parts
Area 2: Remainder

LAKE COUNTY:
Area 1: Southern part
Area 2: Remainder

MENDOCINO COUNTY:
Area 1: Central and Southeastern Parts
Area 2: Remainder

ENGI0003-019 06/29/2020

SEE AREA DESCRIPTIONS BELOW

	Rates	Fringes
OPERATOR: Power Equipment (LANDSCAPE WORK ONLY)		
GROUP 1		
AREA 1	$ 39.95	30.28
AREA 2	$ 41.95	30.28
GROUP 2		
AREA 1	$ 36.35	30.28
AREA 2	$ 38.35	30.28
GROUP 3		
AREA 1	$ 31.74	30.28
AREA 2	$ 33.74	30.28

GROUP DESCRIPTIONS:

GROUP 1: Landscape Finish Grade Operator: All finish grade work regardless of equipment used, and all equipment with a rating more than 65 HP.

GROUP 2: Landscape Operator up to 65 HP: All equipment with a manufacturer's rating of 65 HP or less except equipment covered by Group 1 or Group 3. The following equipment shall be included except when used for finish work as long as manufacturer's rating is 65 HP or less: A-Frame and Winch Truck, Backhoe, Forklift, Hydragraphic Seeder Machine, Roller, Rubber-Tired and Track Earthmoving Equipment, Skiploader, Straw Blowers, and Trencher 31 HP up to 65 HP.

GROUP 3: Landscae Utility Operator: Small Rubber-Tired Tractor, Trencher Under 31 HP.

AREA DESCRIPTIONS:

AREA 1: ALAMEDA, BUTTE, CONTRA COSTA, KINGS, MARIN, MERCED, NAPA, SACRAMENTO, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ, SOLANO, STANISLAUS, SUTTER, YOLO, AND YUBA COUNTIES

AREA 2 - MODOC COUNTY

THE REMAINING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2 AS NOTED BELOW:

ALPINE COUNTY:
Area 1: Northernmost part
Area 2: Remainder

CALAVERAS COUNTY:
Area 1: Except Eastern part
Area 2: Eastern part

COLUSA COUNTY:
Area 1: Eastern part
Area 2: Remainder

DEL NORTE COUNTY:
Area 1: Extreme Southwestern corner
Area 2: Remainder

ELDORADO COUNTY:
Area 1: North Central part
Area 2: Remainder

FRESNO COUNTY
Area 1: Except Eastern part
Area 2: Eastern part

GLENN COUNTY:
Area 1: Eastern part
Area 2: Remainder

HUMBOLDT COUNTY:
Area 1: Except Eastern and Southwestern parts
Area 2: Remainder

LAKE COUNTY:
Area 1: Southern part
Area 2: Remainder

LASSEN COUNTY:
Area 1: Western part along the Southern portion of border with Shasta County
Area 2: Remainder

MADERA COUNTY
Area 1: Remainder
Area 2: Eastern part

MARIPOSA COUNTY
Area 1: Remainder
Area 2: Eastern part

MENDOCINO COUNTY:
Area 1: Central and Southeastern parts
Area 2: Remainder

MONTEREY COUNTY

Area 1: Remainder
Area 2: Southwestern part

NEVADA COUNTY:
Area 1: All but the Northern portion along the border of Sierra County
Area 2: Remainder

PLACER COUNTY:
Area 1: All but the Central portion
Area 2: Remainder

PLUMAS COUNTY:
Area 1: Western portion
Area 2: Remainder

SHASTA COUNTY:
Area 1: All but the Northeastern corner
Area 2: Remainder

SIERRA COUNTY:
Area 1: Western part
Area 2: Remainder

SISKIYOU COUNTY:
Area 1: Central part
Area 2: Remainder

SONOMA COUNTY:
Area 1: All but the Northwestern corner
Area 2: Reaminder

TEHAMA COUNTY:
Area 1: All but the Western border with mendocino & Trinity Counties
Area 2: Remainder

TRINITY COUNTY:
Area 1: East Central part and the Northeaster border with Shasta County
Area 2: Remainder

TULARE COUNTY;
Area 1: Remainder
Area 2: Eastern part

TUOLUMNE COUNTY:
Area 1: Remainder
Area 2: Eastern Part

IRON0377-004 01/01/2023

DEL NORTE COUNTY

	Rates	Fringes
Ironworkers:		
Fence Erector	$ 41.28	25.66
Ornamental, Reinforcing and Structural	$ 41.00	33.70

PREMIUM PAY:

$6.00 additional per hour at the following locations:

China Lake Naval Test Station, Chocolate Mountains Naval Reserve-Niland,
Edwards AFB, Fort Irwin Military Station, Fort Irwin Training Center-Goldstone, San Clemente Island, San Nicholas Island, Susanville Federal Prison, 29 Palms - Marine Corps, U.S. Marine Base - Barstow, U.S. Naval Air Facility - Sealey, Vandenberg AFB

$4.00 additional per hour at the following locations:

Army Defense Language Institute - Monterey, Fallon Air Base, Naval Post Graduate School - Monterey, Yermo Marine Corps Logistics Center

$2.00 additional per hour at the following locations:

Port Hueneme, Port Mugu, U.S. Coast Guard Station - Two Rock

IRON0377-005 01/01/2023

HUMBOLDT, LAKE and MENDOCINO COUNTIES

	Rates	Fringes
Ironworkers:		
Fence Erector	$ 41.28	25.66
Ornamental, Reinforcing and Structural	$ 46.20	34.30

PREMIUM PAY:

$6.00 additional per hour at the following locations:

China Lake Naval Test Station, Chocolate Mountains Naval Reserve-Niland,
Edwards AFB, Fort Irwin Military Station, Fort Irwin Training Center-Goldstone, San Clemente Island, San Nicholas Island, Susanville Federal Prison, 29 Palms - Marine Corps, U.S. Marine Base - Barstow, U.S. Naval Air Facility - Sealey, Vandenberg AFB

$4.00 additional per hour at the following locations:

Army Defense Language Institute - Monterey, Fallon Air Base, Naval Post Graduate School - Monterey, Yermo Marine Corps Logistics Center

$2.00 additional per hour at the following locations:

Port Hueneme, Port Mugu, U.S. Coast Guard Station - Two Rock

LABO0067-006 03/04/2023

AREA ""1"" - ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA COUNTIES

AREA ""2"" - CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, STANISLAUS, AND TUOLUMNE COUNTIES

	Rates	Fringes

LABORER (ASBESTOS/MOLD/LEAD LABORER)

Area 1	$ 35.25	27.09
Area 2	$ 34.25	27.09

ASBESTOS REMOVAL-SCOPE OF WORK: Site mobilization; initial site clean-up; site preparation; removal of asbestos-containing materials from walls and ceilings; or from pipes, boilers and mechanical systems only if they are being scrapped; encapsulation, enclosure and disposal of asbestos-containing materials by hand or with equipment or machinery; scaffolding; fabrication of temporary wooden barriers; and assembly of decontamination stations.

LABO0261-006 07/01/2022

MARIN COUNTY

	Rates	Fringes
LABORER		
Mason Tender-Brick	$ 36.54	25.21

FOOTNOTE: Refractory work where heat-protective clothing is required: $2.00 per hour additional.

LABO0324-003 06/28/2021

DEL NORTE, HUMBOLDT, LAKE, AND MENDOCINO COUNTIES

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person	$ 33.48	26.21
Traffic Control Person I	$ 33.78	26.21
Traffic Control Person II	$ 31.28	26.21

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO0324-005 06/25/2018

	Rates	Fringes
Laborers: (CONSTRUCTION CRAFT LABORERS)		
Construction Specialist Group	$ 30.49	23.20
GROUP 1	$ 29.79	23.20
GROUP 1-a	$ 30.01	23.20
GROUP 1-c	$ 29.84	23.20
GROUP 1-e	$ 30.34	23.20
GROUP 1-f	$ 29.37	23.20
GROUP 2	$ 29.64	23.20
GROUP 3	$ 29.54	23.20
GROUP 4	$ 23.23	23.20

See groups 1-b and 1-d under laborer classifications

Laborers: (GUNITE)		
GROUP 1	$ 28.35	18.66
GROUP 2	$ 27.85	18.66
GROUP 3	$ 27.26	18.66
GROUP 4	$ 27.14	18.66
Laborers: (WRECKING)		
GROUP 1	$ 29.79	23.20
GROUP 2	$ 29.64	23.20
Landscape Laborer (Gardeners, Horticultural & Landscape Laborers)		
Establishment Warranty Period	$ 23.23	23.20
New Construction	$ 29.54	23.20

FOOTNOTES:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts (not applicable to workers entitled to receive the wage rate set forth in Group 1-a): $0.25 per hour additional.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Masonry and plasterer tender; Cast-in-place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and bucker; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2"" or over, 100 lbs. pressure/over); Hydro seeder and similar ype; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive $4.00 per day above Group 1 wage rates. ""Sewer cleaner"" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes, shall receive $5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds (underground structures). All employees performing work covered herein shall receive $ .25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: All clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.
B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.
The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO0324-007 06/25/2018

DEL NORTE, HUMBOLDT, LAKE, AND MENDOCINO COUNTIES

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1	$ 37.82	24.11
GROUP 2	$ 37.59	24.11
GROUP 3	$ 37.34	24.11
GROUP 4	$ 36.89	24.11
GROUP 5	$ 36.35	24.11
Shotcrete Specialist	$ 38.34	24.11

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman; Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute

materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang - muckers, trackmen; Concrete crew - includes rodding and spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0324-009 07/01/2022

DEL NORTE, HUMBOLDT, LAKE, MENDOCINO, NAPA, SOLANO, AND SONOMA COUNTIES

	Rates	Fringes
LABORER		
Mason Tender-Brick	$ 35.84	25.91

FOOTNOTE: Refractory work where heat-protective clothing is required: $2.00 per hour additional.

PAIN0016-021 01/01/2023

LAKE AND MENDOCINO COUNTIES

	Rates	Fringes
Painters:	$ 47.42	27.28

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* PAIN1034-001 06/01/1993

DEL NORTE AND HUMBOLDT COUNTIES

	Rates	Fringes
Painters:		
Brush & Roller	$ 13.35 **	2.94
Sandblaster, spray, structural steel & swing stage	$ 13.60 **	2.94

PAIN1176-001 07/01/2022

HIGHWAY IMPR0VEMENT

	Rates	Fringes
Parking Lot Striping/Highway Marking:		
GROUP 1	$ 40.83	17.62
GROUP 2	$ 34.71	17.62
GROUP 3	$ 35.11	17.62

CLASSIFICATIONS

GROUP 1: Striper: Layout and application of painted traffic stripes and marking; hot thermo plastic; tape, traffic stripes and markings

GROUP 2: Gamecourt & Playground Installer

GROUP 3: Protective Coating, Pavement Sealing

PLAS0300-005 07/01/2016

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 32.15	23.27

PLUM0038-004 07/01/2022

LAKE AND MENDOCINO COUNTIES

	Rates	Fringes
Landscape/Irrigation Fitter (Underground/Utliity Fitter)	$ 69.70	33.15
PLUMBER		
Work on wooden frame structures 5 stories or less excluding high-rise buildings and commercial work such as hospitals, prisons, hotels, schools, casinos, wastewater treatment plants, and research facilities as well as refrigeration pipefitting, service and repair work - MARKET RECOVERY RATE	$ 69.70	46.38
All other work - NEW CONSTRUCTION RATE	$ 82.00	48.18

PLUM0355-005 07/01/2022

DEL NORTE AND HUMBOLDT COUNTIES:

	Rates	Fringes
Underground Utility Worker /Landscape Fitter	$ 32.22	17.55

SHEE0104-016 06/29/2020

	Rates	Fringes
SHEET METAL WORKER		
Mechanical contracts $200,000 or less	$ 55.92	45.29
All other work	$ 64.06	46.83

TEAM0094-001 07/01/2022

	Rates	Fringes
Truck drivers:		
GROUP 1	$ 36.95	31.14
GROUP 2	$ 37.25	31.14
GROUP 3	$ 37.55	31.14
GROUP 4	$ 37.90	31.14
GROUP 5	$ 38.25	31.14

FOOTNOTES:

Articulated dump truck; Bulk cement spreader (with or without

auger); Dumpcrete truck; Skid truck (debris box); Dry pre-batch concrete mix trucks; Dumpster or similar type; Slurry truck: Use dump truck yardage rate.
Heater planer; Asphalt burner; Scarifier burner; Industrial lift truck (mechanical tailgate); Utility and clean-up truck: Use appropriate rate for the power unit or the equipment utilized.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Dump trucks, under 6 yds.; Single unit flat rack (2-axle unit); Nipper truck (when flat rack truck is used appropriate flat rack shall apply); Concrete pump truck (when flat rack truck is used appropriate flat rack shall apply); Concrete pump machine; Fork lift and lift jitneys; Fuel and/or grease truck driver or fuel person; Snow buggy; Steam cleaning; Bus or personhaul driver; Escort or pilot car driver; Pickup truck; Teamster oiler/greaser and/or serviceperson; Hook tender (including loading and unloading); Team driver; Tool room attendant (refineries)

GROUP 2: Dump trucks, 6 yds. and under 8 yds.; Transit mixers, through 10 yds.; Water trucks, under 7,000 gals.; Jetting trucks, under 7,000 gals.; Single-unit flat rack (3-axle unit); Highbed heavy duty transport; Scissor truck; Rubber-tired muck car (not self-loaded); Rubber-tired truck jumbo; Winch truck and ""A"" frame drivers; Combination winch truck with hoist; Road oil truck or bootperson; Buggymobile; Ross, Hyster and similar straddle carriers; Small rubber-tired tractor

GROUP 3: Dump trucks, 8 yds. and including 24 yds.; Transit mixers, over 10 yds.; Water trucks, 7,000 gals. and over; Jetting trucks, 7,000 gals. and over; Vacuum trucks under 7500 gals. Trucks towing tilt bed or flat bed pull trailers; Lowbed heavy duty transport; Heavy duty transport tiller person; Self- propelled street sweeper with self-contained refuse bin; Boom truck - hydro-lift or Swedish type extension or retracting crane; P.B. or similar type self-loading truck; Tire repairperson; Combination bootperson and road oiler; Dry distribution truck (A bootperson when employed on such equipment, shall receive the rate specified for the classification of road oil trucks or bootperson); Ammonia nitrate distributor, driver and mixer; Snow Go and/or plow

GROUP 4: Dump trucks, over 25 yds. and under 65 yds.; Water pulls - DW 10's, 20's, 21's and other similar equipment when pulling Aqua/pak or water tank trailers; Helicopter pilots (when transporting men and materials); Lowbedk Heavy Duty Transport up to including 7 axles; DW10's, 20's, 21's and other similar Cat type, Terra Cobra, LeTourneau Pulls, Tournorocker, Euclid and similar type equipment when pulling fuel and/or grease tank trailers or other miscellaneous trailers; Vacuum Trucks 7500 gals and over and truck repairman

GROUP 5: Dump trucks, 65 yds. and over; Holland hauler; Low bed Heavy Duty Transport over 7 axles

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($16.20) or 13658 ($12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

FUNDING ENTITY REQUIREMENT NO. 6 - Guidelines for Enhancing Public Awareness of SRF Assistance Agreements, comprised of 7 pages

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN - 3 2015

OFFICE OF WATER

MEMORANDUM

SUBJECT: Guidelines for Enhancing Public Awareness of SRF Assistance Agreements

FROM: Andrew D. Sawyers, Ph.D., Director
Office of Wastewater Management (4201M)

Peter C. Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I-X

Last year, the Environmental Protection Agency (EPA) implemented an agency-wide initiative to enhance public awareness of EPA assistance agreements nationwide. The Office of Water has developed guidelines to inform states how this initiative should be implemented in the State Revolving Fund (SRF) Programs.

The guidelines were developed with input from EPA and state SRF staff. The guidelines recognize that each of the state SRF programs and the projects they fund are different and that one implementation method will not work for everyone. Therefore, as a result of input from the states, the guidelines offer a number of options that can be used to enhance public awareness of SRF assistance agreements.

Implementation of these guidelines will begin with the awarding of the FY 2015 SRF capitalization grants. A term and condition on compliance with the guidelines is to be included in all new SRF grants.

Please have your staff provide copies of the guidelines to your states. Questions regarding the guidelines should be directed to Sheila Platt (202/564-0686) or Howard Rubin (202/564-2051).

Attachment

Enhancing Public Awareness of SRF Assistance Agreements

Introduction

The Environmental Protection Agency (EPA) is currently implementing an agency-wide initiative focused on signage to enhance public awareness of EPA assistance agreements nationwide. The intention of this effort is to communicate the positive impact and benefits of EPA funding around the country and increase awareness surrounding the improvements communities receive as a result of State Revolving Fund (SRF) assistance. Projects implemented with Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Fund (DWSRF) monies are included in this initiative, as many CWSRF and DWSRF assistance agreements have direct and tangible benefits to populations around the country.

EPA's Office of Water developed these guidelines as a way to inform states of this directive and how it should be implemented in the SRF programs. The primary objective is to enhance public understanding of the positive benefits of CWSRF and DWSRF funding to towns, cities, municipalities and water systems. To that end, states are presented with a range of options for implementing these guidelines. All of these options achieve the ultimate goal of communicating to a broad audience the positive role EPA funding of the state CWSRF and DWSRF programs plays in communities across the country.

The information in the guidelines was developed with input from EPA and state staff across the country as well as the members of the State-EPA Workgroup. The guidelines recognize the wide range of project types, varied locations and different institutional approaches among states and communities. Therefore, providing states and SRF assistance recipients maximum flexibility is optimal. The guidelines allow selection of the implementation method which best balances two goals. First, it should satisfy the overall objective of communicating EPA's role in funding assistance agreements that achieve positive benefit. Second, the implementation method should be practically and financially viable for states and communities and avoid any overly burdensome investment of time and resources. In some cases, it might be appropriate for a state to select a combination of options listed below, provided this does not result in excessive cost to communities.

Project Selection Requirements

Signage requirements will not be required to apply to all SRF projects. Signage will be considered an equivalency requirement for SRF programs. States should select a set of borrowers and/or projects totaling a funding amount equivalent to the amount of their federal capitalization grant to satisfy the signage requirement. There are no other requirements or restrictions on which projects should or should not participate in this initiative. Therefore, it is at the discretion of the state SRF program to select projects most able to efficiently and effectively comply in a way that

meets the intention to enhance public awareness without significant financial hardship to the state or its borrowers. This can be done either through the selection of specific projects or borrowers, or by setting a threshold within the state for which projects will be requested to meet signage requirements. States should note that they have the option of selecting different implementation options for different borrowers depending on the location, project type and available resources. Borrowers and/or projects complying with the signage requirement must ensure limited English proficient individuals have meaningful access to activities receiving EPA funds, consistent with Executive Order 13166 and EPA Order 1000.32.

In this regard, to increase public awareness of projects serving communities where English is not the predominant language, States should encourage recipients when implementing a particular signage option to translate the language used (excluding the EPA logo or seal) into the appropriate non-English language(s). The costs of such translation are allowable, provided the costs are reasonable.

Although the signage requirement does not apply to all SRF projects, we recommend that states encourage all borrowers/projects to notify the public of the benefits of the projects and the role of the SRF, using one of the options below.

Summary of Options

The guidelines present a number of options which communities can explore to implement EPA's signage policy. The option selected should meet all of the above basic requirements while remaining cost-effective and accessible to a broad audience. The guidelines describe the following strategies as acceptable options for communities to follow:

- Standard signage
- Posters or wall signage in a public building or location
- Newspaper or periodical advertisement for project construction, groundbreaking ceremony, or operation of the new or improved facility
- Online signage placed on community website or social media outlet
- Press release

Each of these options is described in more detail in the sections below.

Implementation Option: Standard Signage

EPA recommends that large projects that involve significant expansion or construction of a new facility elect to publicize through standard signage. This option should be selected for projects where the sign would be near a major road or thoroughfare or where the facility is in a location at which this would effectively publicize the upgrades. Some facilities will not find this an appropriate or cost-effective solution. For example, investing in a large road sign for a facility that is located in a rural area or where access is limited to a smaller service road would likely not be an optimal solution.

Signs can also be located away from the project site if there is another reasonable alternative. For example, a community may elect to place a sign advertising the project near a body of water that receives discharge from a particular facility.

States selecting projects that will implement this requirement through use of a traditional sign should ensure the following are included:

- The name of the facility, project and community
- Project cost
- The State Agency/SRF administering the program
- The EPA and State Agency logos (EPA logo may only be used on a sign)

If the EPA logo is displayed along with logos of other participating entities, the EPA logo must not be displayed in a manner that implies that EPA itself is conducting the project. Instead, the EPA logo must be accompanied with a statement indicating that the recipient received financial assistance from EPA for the project. As provided in the sign specifications from the EPA Office of Public Affairs (OPA), the EPA logo is the identifier for assistance agreement projects. States are required to ensure that recipients comply with the sign specifications provided by the OPA, available at http://www.epa.gov/ogd/tc/epa_logo_seal_specifications for_infrastructure grants.pdf. To obtain the appropriate EPA logo graphic file, the recipient should send a request directly to OPA and include the EPA Project Officer in the communication.

Implementation Option: Posters or Brochures

Smaller projects, projects located in rural areas, and other efforts may find that it is more cost-effective and practical to advertise efforts through creation of a poster or smaller sign. If the project involves nonpoint source or green infrastructure components, those can be described at the discretion of the state or community.

The poster or brochure and acknowledgement should be visible, as well as a website or other source of information for individuals that may be curious about the SRF program. The community could also implement this option as a short pamphlet or brochure that is placed in one of these locations for community members to read.

Posters or brochures should be placed in a public location that is accessible to a wide audience of community members. This can include, but is not limited to:

- Town or City Hall
- Community Center
- Locally owned or operated park or recreational facility
- Public Library
- County/municipal government facilities
- Court house or other public meeting space

Given the low cost for producing multiple copies of the same poster, pamphlet, or brochure, communities can explore options for displaying these posters in several locations simultaneously. This would achieve the overall objective of reaching a broad audience and publicizing the project.

States have the option of creating a template verbiage and layout to provide to borrowers, particularly smaller or disadvantaged communities. This could reduce the burden on small municipalities which may or may not have the staffing capacity to meet signage requirements on their own.

States selecting projects that will implement this requirement through use of posters or brochures should ensure the following are included:

- Name of facility, project and community
- State SRF administering the program
- Project is wholly or partially funded with EPA funding
- Brief description of project
- Brief description of the water quality benefits the project will achieve

Implementation Option: Newsletter, Periodical or Press Release

For communities where there is no suitable public space or where advertisement through signage is unlikely to reach community members effectively, projects can be advertised in a community newsletter or similar periodical. States can use guidelines from their standard public notice practices. For new construction, if a groundbreaking ceremony is to be held, an announcement could publicize or accompany publicity for this event.

In some cases, it may be appropriate for the state agency to issue a formal press release announcing construction of a new facility. Distributing a single prepared statement concisely summarizing the project purpose and the joint funding from EPA and state resources can reach a wide audience as the statement goes through multiple news outlets. Programs should consider whether or not this is an option that is likely to effectively publicize the CWSRF or DWSRF program in local news sources.

If a recipient decides on a public or media event to publicize the accomplishment of significant events related to construction as a result of EPA support, EPA must be provided with at least a ten working day notice of the event and provided the opportunity to attend and participate in the event.

States selecting projects that will implement this requirement through use of a newsletter, periodical or press release should ensure the following are included:

- Name of facility, project and community
- State SRF administering the program

- Project is wholly or partially funded with EPA funding
- Brief description of the project
- Brief listing of water quality benefits to be achieved

Implementation Option: Insert or Pamphlet in Water/Sewer Bill
Utilities can consider including a single-page insert within water and sewer bills that are mailed to residents and users in the area. This approach would effectively publicize the project to those individuals directly benefitting from the project. The flyer or insert could emphasize the interest rate and financial savings that the community achieved by taking advantage of SRF funds as well as the environmental and public health benefits to the community.

States selecting projects that will implement this requirement through use of an insert or pamphlet in water/sewer bill should ensure the following are included:

- Name of facility, project and community
- State SRF administering the program
- Project is wholly or partially funded with EPA funding
- Brief description of the project
- Brief listing of water quality benefits to be achieved

Implementation Option: Online & Social Media Publicity
Many communities are increasingly finding that the online forum is the most cost-effective approach to publicizing their SRF programs and reaching a broad audience of stakeholders. Online "signage" should follow the minimum information guidelines above and may appear on the town, community or facility website if available. In some cases, communities may be active on social media sites such as Facebook or Twitter. These can be used as an opportunity for publicizing projects and information about how SRF funds are being used in the community. These online announcements/notices may be appropriate for settings where physical signage would not be visible to a wide audience. They can be a more cost-effective option than traditional signs or publicity in print media outlets. This option may be most useful where the community's website is a well-recognized source of information for its residents.

In the case of some projects, such as nonpoint source or sponsorship projects, there might be additional opportunities for online publicity through partner agencies or organizations. This could take place either on the organization's website or again through social media outlets.

States selecting projects that will implement this requirement through use of online & social media publicity should ensure the following are included:

- Name of facility, project and community
- State SRF administering the program
- Project was wholly or partially funded with EPA funding
- Brief description of the project

- Brief listing of water quality benefits to be achieved

Suggested Language for Alternate Options

For any of the alternate implementation options listed above, SRF programs have discretion to structure their signage as they see appropriate. The language below is offered as an option for use in posters, pamphlets, brochures, press releases, or online materials. States may consider using the following:

> "Construction of upgrades and improvements to the [Name of Facility, Project Location, or WWTP] were financed by the [Clean Water/Drinking Water] State Revolving Fund. The [CWSRF/DWSRF] program is administered by [State Agency] with joint funding from the U.S. Environmental Protection Agency and [State Name]. This project will (description of project) and will provide water quality benefits [details specifying particular benefits] for community residents and businesses in and near [name of town, city, and/or water body or watershed to benefit from project.] [CWSRF/DWSRF] programs operate around the country to provide states and communities the resources necessary to maintain and improve the infrastructure that protects our valuable water resources nationwide. "

For projects in certain areas, states should consider whether or not it is appropriate to include additional details about the projects. Specific benefits, such as reduction of CSO events, lessening of nutrient pollution, reducing contaminant levels or water pumping costs, or improvements to a particular water body, may be of interest to community residents. In these cases, including them would further serve to showcase positive efforts financed by the SRF programs. Additionally, for projects with components that meet Green Project Reserve (GPR) criteria, States may elect to detail these particular improvements. For example, the state could include quantitative improvements in energy efficiency or water conservation achieved by project upgrades. If the project includes green infrastructure components such as rain gardens and green roofs that have environmental and aesthetic benefits to the community, these can be described briefly as well. Again, this additional information can be included at the discretion of the state when it is appropriate, given the project type, location, and the type of signage or publicity effort selected.

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31 23 33 TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 12 16 ASPHALTIC CONCRETE VEHICULAR PAVING

DIVISION 33 - UTILITIES

33 05 16 PRECAST CONCRETE STRUCTURES
33 47 13 GEOMEMBRANE LINER

DIVISION 40 - PROCESS INTERCONNECTIONS

40 05 00	PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS
40 05 07	PIPE SUPPORT SYSTEMS
40 05 19	PIPE: DUCTILE
40 05 31	PIPE: PLASTIC
40 05 51	VALVES: BASIC REQUIREMENTS
40 05 52	MISCELLANEOUS VALVES
40 05 61	GATE VALVES
40 05 62	THREE-WAY PLUG VALVES
40 05 64	BUTTERFLY VALVES
40 05 66	CHECK VALVES
40 90 00	INSTRUMENTATION FOR PROCESS CONTROL: BASIC REQUIREMENTS
40 90 05	CONTROL LOOP DESCRIPTIONS
40 91 10	PRIMARY METERS AND TRANSMITTERS
40 97 00	CONTROL AUXILIARIES
40 98 00	CONTROL PANELS AND ENCLOSURES

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT

43 11 34	REGENERATIVE BLOWERS
43 21 00	PUMPING EQUIPMENT: BASIC REQUIREMENTS
43 24 27	PUMPING EQUIPMENT VERTICAL TURBINE (LINE SHAFT)

DIVISION 46 - WATER EQUIPMENT

46 07 13	FILTER TREATMENT UNITS RETROFIT
46 33 44	PUMPING EQUIPMENT: CHEMICAL METERING PUMPS
46 41 13	INLINE RAPID MIXER

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SECTION 01 11 00
SUMMARY OF WORK, SEQUENCING, AND CONSTRAINTS

PART 1 - GENERAL

1.1 SUMMARY

A. The water treatment facility must be kept in continuous operation throughout the construction period. No interruption will be permitted which adversely affects the normal facility operation. The Contractor shall provide all temporary facilities and make all temporary modifications as necessary to keep the existing facilities in operation during the construction period. Any temporary facilities, materials, equipment and labor required to achieve this objective shall be provided by the Contractor and included in the original bid price. At the completion of work, all such temporary facilities, materials, and equipment remaining shall be removed from the site.

B. Work shall be scheduled, sequenced, and performed in a manner which minimizes disruption to the operation and maintenance of the existing facilities.

C. The Contractor is solely responsible for developing a detailed sequence of work that accomplishes the tasks shown and specified with the minimum possible interruption to the existing facilities and that complies with all limitations and restrictions specified herein.

D. Flow varies based on season. “high demand season” is defined as the period of March 1 through October 31. “low demand season” is defined as the period of November 1 through February 28.

E. The Contractor’s schedule must minimize the number and duration of power outages. Contractor shall provide standby generators and all labor and fuel needed during periods of power outage to keep generator(s) fueled. Contractor is not allowed to modify existing standby generator power distribution system.

F. All existing instrumentation must remain in service at all times unless specifically noted otherwise on drawings or in specifications.

G. All existing utilities must remain in service during modifications unless specifically noted otherwise on drawing or in specifications.

H. Temporary lighting, controls, instrumentation, alarms, security devices, ventilation, and all required safety devices shall be provided by the Contractor whenever the work, or interruption due to the work, affects the operation of existing facilities.

I. Not all valves and gates that may be used to isolate lines and facilities will completely seal. The Contractor shall allow for leakage in planning its work and may, with the Owner’s concurrence, test certain valves and gates before work involving isolation is begun. The Contractor shall provide adequate temporary pumping and piping facilities to clear the work areas as necessary of water, backwash, or miscellaneous items commonly found in a water treatment facility.

J. The Contractor shall drain and clean all work areas, including tanks and basins, as required to perform work. Contractor shall provide all temporary pumps and piping required, and dispose of all waste materials generated. Contractor to coordinate all draining/cleaning work with Owner.

K. Construction activities that interfere with the operation of or access to the existing facilities shall be thoroughly planned in advance. All required equipment, materials, and labor shall be on hand at the time of the undertaking.

L. The Contractor shall provide appropriate staff (including subcontractors, equipment suppliers, etc.) for 2 hours following system resumption after all shutdowns to monitor and ensure the proper operation of affected systems.

M. Facility Access:
   1. Safe access to all areas of the WTP shall be provided and maintained by the Contractor at all times for the Owner's operations and maintenance personnel.
   2. Access for large vehicles, e.g. chemical delivery, diesel, and sludge hauling trucks shall be maintained at all times. An access plan detailing internal plant routes shall be submitted by the Contractor for approval by the Owner for each major construction stage.
   3. Maintain access to diesel storage. Contractor must make every reasonable effort to maintain a minimum level of access for generator fueling as required to maintain backup power.
   4. The Contractor may have no more than 40 FT of open trench open at any one time unless greater lengths specifically identified and approved as part of work area access plan.

N. Operation of Existing Equipment:
   1. Operational functions or shutdown of the existing facilities and/or systems required to facilitate Contractor's operations will be performed by Owner's personnel only. This includes operation of all electrical and instrumentation facilities, gates, valves and pumps.
   2. While work is being performed, the Contractor shall provide access to all operating equipment for both routine and emergency operation and maintenance by Owner's personnel.

O. If in the opinion of the Construction Manager, any of the Contractor's proposed work will unduly impact the Owner's operations then the Construction Manager may require the Contractor to revise and resubmit its plan.

1.2 WORK COVERED BY CONTRACT

A. The Work of this Contract under the Base Bid generally includes the following:
   1. Site demolition of clarifier, control building, water treatment building roof, and site piping.
   2. Site grading, paving, and piping.
   3. Rehabilitation of two Trident filter treatment units (FTUs). The rehabilitation includes recoating of all carbon steel surfaces and replacement of filter unit elements.
   4. Rehabilitation of existing finish water and raw water pumps.
   5. New raw water transfer pump
   6. Liner in raw water storage ponds
   7. Concrete liner in backwash storage ponds
   8. Replacement of control building including a new foundation.
   9. New laboratory and office.
   10. Chemical metering equipment.
   11. Electrical and controls.
   12. Rehabilitation of finish storage tank no. 1.

1.3 DESCRIPTION

A. General:
   1. Furnish all labor, materials, tools, equipment, and services as indicated in accordance with provisions of Contract Documents.
   2. It is the intent of the Contract Documents to describe a functionally complete project. Furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, complete, and functional installation.

1.4 OWNER OCCUPANCY

A. Owner will occupy the premises during the entire period of construction for the conduct of his normal operations. Contractor shall coordinate with Owner in all construction operations to minimize conflicts and to facilitate Owner usage.

1.5 GENERAL CONSTRUCTION CONSTRAINTS AND SEQUENCING

A. Filter treatment units (FTUs) No.1 and No. 2:
   1. All work on both FTUs shall be executed during one low demand season. Refer to section 1.1 of this Specification for the definition of low demand season. The Owner requires both FTUs to be operational during high demand season.

2. All procurement shall be completed and stored onsite prior to the start of work.
3. The two new regenerative blowers shall be fully functional prior to the start of work.
4. There shall be a minimum of one fully operational FTU at any given time. Therefore, contractor may only work on one FTU at a time. The first rehabilitated FTU must be fully operational before contractor commences work on the second FTU.
5. For additional sequencing and constraints related to the FTUs refer to sheet R01 of the drawings.
6. FTUs No. 1 and No. 2 are both powered and controlled by one control panel. Contractor must sequence the work related to the panel and/or provide temporary provisions, as necessary, to maintain continuous, uninterrupted, FTU operation.

B. Raw water storage ponds (RWSPs) No. 1 and No. 2:
1. The Owner currently utilizes both RWSPs, however, plant operations require only one RWSP for continuous operation. Contractor must sequence the work to limit pond related work to one RWSP at any given time.
2. Contractor may not commence work on the second RWSP until Owner takes beneficial use of the first upgraded pond.
3. All RWSP related work shall be completed in one construction season.
4. Both RWSPs are covered with floating plastic hexagonal tiles. Coordinate with Owner for removal of the hexagonal tiles. Owner is responsible for complete removal and storage of the floating hexagonal tiles.

C. Backwash storage ponds (BWSPs) No. 1 and No. 2:
1. Plant operations require at least one BWSP to be available at any given time, without any exceptions.
2. Contractor shall start work on BWSP No. 2 first, since it is empty and is available for construction.
3. After completion of work in BWSP No. 2 and upon commencement of Owner's beneficial use of the first upgraded pond, plant staff will remove and spread backwash sludge, for drying, out of BWSP No. 1. Contractor is solely responsible for hauling sludge offsite.
4. The sludge drying process may take up to 7 months.
5. The completion of work related to BWSPs No. 1 and No. 2 may take up to two construction seasons.

D. Raw and finish water pumps:
1. There are two raw water and two finish water vertical turbine pumps located inside the control building. All four pumps require rehabilitation as shown on the drawings.
2. Contractor shall limit rehabilitation work to one vertical turbine pump, regardless of its usage type, raw or finish water, at any given time during the low demand season.

E. Control building:
1. Contractor is responsible for protection and support of process and electrical equipment throughout the demolition and construction of control building to provide uninterrupted usage. Contractor is solely responsible for providing temporary provisions necessary to maintain continuous process and electrical service/utility throughout construction.

1.6 OUTAGE PLANS AND REQUESTS

A. Modifications to existing facilities, the construction of new facilities, and the connection of new to existing facilities will require the temporary outage or bypass of existing treatment processes or facilities. The Contractor shall submit a detailed outage plan and time schedule for all construction activities which will make it necessary to remove a tank, pipeline, channel, electrical circuit, equipment, structure, road or other facilities from service. All outage plans shall be approved by the Owner.

B. The outage plans shall be submitted for the Owner's review and acceptance a minimum of three (3) weeks in advance of the time that such outages are required. A System Outage Request form, included at the end of this section, shall accompany each outage plan. The outage plans shall be coordinated with the construction schedule and shall meet the restrictions and conditions of this Section. The outage plans shall describe the Contractor's method for preventing bypassing of other treatment units; the length of time required to complete said operation; any necessary temporary power, controls, instrumentation or alarms required to maintain control, monitoring and alarms for the treatment plant processes; and the manpower, plant, and equipment which the Contractor shall provide in order to ensure proper operation of associated treatment units.

C. The Owner shall be notified in writing at least one week in advance if the schedule for performing any outage has changed, or if revisions to the outage plan are required. The owner has the option to reschedule any outages due to plant operations and flows at no additional cost. Prior to the outage, the Contractor and Owner shall meet to review outage plan, inventory of parts, Contractor's emergency back-up plan, and safety program. Outage request shall be rescheduled at no cost to Owner if Owner determines that the Contractor is unprepared to safely conduct the outage.

D. The Contractor shall provide written confirmation of the shutdown date and time two working days prior to the actual shutdown.

E. The Contractor shall observe the following outage requirements:
   1. Systems or individual equipment items shall be isolated, dewatered, decommissioned, de-energized, or depressurized in accordance with the detailed outage plan and schedule.
   2. Whenever the construction work requires dewatering or bypassing portions of the facilities, the Contractor shall provide the necessary pumping and bypassing facilities to maintain the water flow.
   3. Whenever temporary relocation of existing facilities is required for execution of the work, the Contractor shall provide the necessary labor and temporary piping and wiring as required.
   4. Any temporary facilities and equipment not required after completion of the final work shall be promptly removed.
   5. The Contractor shall not begin an alteration until specific permission has been granted by the Construction Manager in each case. The Construction Manager will coordinate the Contractor's planned procedure with the operation of the system. The making of connections to existing facilities or other operations that interfere with the operation of the existing equipment shall be completed as quickly as possible and with as little delay as possible.
   6. The Construction Manager will be the sole judge of when the Contractor's operations are causing interference with existing facilities, and the Construction Manager's orders and instructions shall be carried out without delay.

1.7 CONTRACTOR-FURNISHED PRODUCTS

A. Contractor shall furnish all products.

B. Components required to be supplied in quantity within a specification section shall all be the same and shall be interchangeable.

1.8 PERMITS AND LICENSES

A. Contractor shall obtain, at their expense, all other permits and licenses necessary for the construction of the Work in accordance with Paragraph 7.08. of the General Conditions Section 00 72 13.

1.9 TREE TRIMMING, CLEARING, AND TREE REMOVAL

A. Contractor shall provide all required labor and equipment for trimming, clearing, and tree removal.

1.10 PHASING

A. The Contractor shall be responsible for determining phasing of the existing system and insuring that the phasing of the new system is correct.

1.11 FENCES

A. All fences affected by the Work shall be maintained by the Contractor until completion of the Work. Fences disturbed by the construction shall be restored by the Contractor to their original or better condition and to their original location.

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

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

END OF SECTION

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SECTION 01 25 13
PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The procedure for requesting the approval of substitution of a product that is not equivalent to a product which is specified by descriptive or performance criteria or defined by reference to one or more of the following:
      a. Name of manufacturer.
      b. Name of vendor.
      c. Trade name.
      d. Catalog number.
   2. Substitutions are not "or-equals."
   3. This Specification Section does not address substitutions for major equipment.

B. Request for Substitution - General:
   1. Base all bids on materials, equipment, and procedures specified.
   2. Certain types of equipment and kinds of material are described in specifications by means of references to names of manufacturers and vendors, trade names, or catalog numbers.
      a. When this method of specifying is used, it is not intended to exclude from consideration other products bearing other manufacturer's or vendor's names, trade names, or catalog numbers, provided said products are "or-equals," as determined by Engineer.
   3. Other types of equipment and kinds of material may be acceptable substitutions under the following conditions:
      a. Or-equals are unavailable due to strike, discontinued production of products meeting specified requirements, or other factors beyond control of Contractor; or,
      b. Contractor proposes a cost and/or time reduction incentive to the Owner.

1.2 QUALITY ASSURANCE

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

1.3 DEFINITIONS

A. Product: Manufactured material or equipment.

1.4 PROCEDURE FOR REQUESTING SUBSTITUTION

A. Substitution shall be considered only:
   1. After Award of Contract.
   2. Under the conditions stated herein.

B. Written request through Contractor only.

C. Transmittal Mechanics:
   1. Follow the transmittal mechanics prescribed for Shop Drawings in Specification Section 01 33 00.
      a. Product substitution will be treated in a manner similar to "deviations," as described in Specification Section 01 33 00.

b. List the letter describing the deviation and justifications on the transmittal form in the space provided under the column with the heading DESCRIPTION.
    1) Include in the transmittal letter, either directly or as a clearly marked attachment, the items listed in Paragraph D below.

D. Transmittal Contents:
1. Product identification:
    a. Manufacturer's name.
    b. Telephone number and representative contact name.
    c. Specification Section or Drawing reference of originally specified product, including discrete name or tag number assigned to original product in the Contract Documents.
2. Manufacturer's literature clearly marked to show compliance of proposed product with Contract Documents.
3. Itemized comparison of original and proposed product addressing product characteristics including but not necessarily limited to:
    a. Size.
    b. Composition or materials of construction.
    c. Weight.
    d. Electrical or mechanical requirements.
4. Product experience:
    a. Location of past projects utilizing product.
    b. Name and telephone number of persons associated with referenced projects knowledgeable concerning proposed product.
    c. Available field data and reports associated with proposed product.
5. Data relating to changes in construction schedule.
6. Data relating to changes in cost.
7. Samples:
    a. At request of Engineer.
    b. Full size if requested by Engineer.
    c. Held until substantial completion.
    d. Engineer not responsible for loss or damage to samples.

1.5 APPROVAL OR REJECTION

A. Written approval or rejection of substitution given by the Engineer.

B. Engineer reserves the right to require proposed product to comply with color and pattern of specified product if necessary to secure design intent.

C. In the event the substitution is approved, the resulting cost and/or time reduction will be documented by Change Order in accordance with the General Conditions.

D. Substitution will be rejected if:
1. Submittal is not through the Contractor with his stamp of approval.
2. Request is not made in accordance with this Specification Section.
3. In the Engineer's opinion, acceptance will require substantial revision of the original design.
4. In the Engineer's opinion, substitution will not perform adequately the function consistent with the design intent.

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

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

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

END OF SECTION

EXHIBIT A

Substitution Request Form
(One Item per each Form)

Project:	Date:
Substitution Requestor:	
Contractor:	

Specification Section No:	Paragraph No. (i.e. 2.1.A.1.c):	Specified Item:

Proposed Substitution:

Provide Product Data Sheets, Manufacturer's written installation instructions, drawings, diagrams, or any other information as an attached to this Form that will demonstrate the proposed substitution is an Approved Equal.

In the lines provided state differences between proposed substitutions and specified item. Differences include but are not limited to interrelationship with other items; materials, equipment, function, utility, life cycle costs, applied finished, appearances, and quality.

_____
_____
_____

In the lines provided demonstrate how the proposed substitution is compatible with or modifies other systems, parts, equipment or components of the Project and Work under the Contract
:

_____
_____
_____

In the lines provided, describe what effect the proposed substitution has on dimensions indicated on the Drawings and previously reviewed Shop Drawings?

_____
_____
_____

In the lines provided, describe what effect the proposed substitution has on the Construction Schedule and Contract Time.

_____
_____
_____

In the lines provided, describe what effect the proposed substitution has on the Contract Price. This includes all direct, indirect, impact and delay costs.

_____
_____
_____

Manufacturer's guarantees of the proposed and specified items are:

☐ Same ☐ Different (explain on attachment)

The undersigned state that the function, utility, life cycle costs, applied finishes, appearance and quality of the proposed substitution are equal or superior to those of the specified item.

For use by Project Representative:

☐ Accepted ☐ Accepted as Noted
☐ Not Accepted ☐ Received Too Late

_____
(Date)

_____
(Telephone)

_____
(Contractor's Signature)

_____
(Contractor's Firm)

_____
(Firms Address)

_____

Comments:

_____
_____
_____

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SECTION 01 30 00
SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for:
      a. Contractor's Superintendent's Field Office.
      b. Special considerations related to adjacent properties and facilities.
   2. Removal of asbestos and backwash sludge.
      a. The contractor shall furnish all labor, material, facilities, equipment, services, employee training and testing, permits and agreements necessary to perform the work required for removal, encapsulation, decontamination, transportation, disposal, and all other work in accordance with these specifications, the latest regulations from the US. Environmental Protections Agency (EPA), Cal-EPA, the Occupational Safety and Health Administration (OSHA), the State of California Department of Industrial Relations (Cal/OSHA), the recommendations of the National Institute of Occupations Safety and Health (NIOSH), and any other applicable federal state and local government regulations. Whenever there is a conflict or overlap of the above references, the most stringent provision shall apply.
   3. Laboratory analysis of backwash sludge.

1.2 SUBMITTALS

A. Work Plan:
   1. Contractor shall submit a plan describing their approach to abatement, mitigation measures, sampling approach and procedures, certifications for all personnel, certification of transportation subcontractor, location and certifications of disposal facility.
   2. Submit copies of any notifications, authorizations and permits required to perform the Work including but not limited to asbestos and demolition permits.
      a. At a minimum, the Work Plan shall include:
         1) Schedule of activities.
         2) Method of excavation and equipment to be used.
         3) Shoring or side-wall slopes proposed.
         4) Dewatering plan.
         5) Storage methods and locations for waste material.
         6) Haul routes.
         7) Decontamination procedures.
         8) Spill contingency plan.
   3. Field Quality-Control Submittals:
      a. Indicate results of Contractor-furnished tests and inspections.
   4. Submit copy of post-asbestos abatement survey that certifies all asbestos has been cleared from excavation.
   5. Qualifications Statements:
      a. Submit qualifications for contractor, on-Site representative, and disposal firm. A qualified contractor shall maintain a State of California C-22 Licensed Asbestos Abatement Contractor and shall be Division of Occupational Safety & Health (DOSH) registered.

1.3 REGULATORY REQUIREMENTS

A. Permits and Licenses:
   1. The Contractor shall obtain required federal, state, and local permits for removal and storage of contaminated material. Permits shall be obtained at no additional cost to the Owner.

2. Air Emissions: Air emissions shall be monitored and controlled in accordance with Owner's Environmental Requirements.

1.4 CHEMICAL TESTING

A. Required sampling and chemical analysis shall be conducted in accordance with local requirements and the Owner's requirements.

1.5 CONTRACTOR'S SUPERINTENDENT'S FIELD OFFICE

A. Establish at site of Project.

B. Equipment: Telephone, telecopy, mailing address, and sanitary facilities.

C. Ensure attendance at this office during the normal working day.

D. At this office, maintain complete field file of Shop Drawings, posted Contract Drawings and Specifications, and other files of field operations including provisions for maintaining "As Recorded Drawings."

E. Remove field office from site upon acceptance of the entire work by the Owner.

1.6 SPECIAL CONSIDERATIONS RELATED TO ADJACENT PROPERTIES AND FACILITIES

A. Contractor shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to and from the site.

B. Access, Traffic Control, and Parking:
1. Maintain conditions of access road to site such that access is not hindered as the result of construction related deterioration.
2. Do not permit driving across or transporting materials or equipment across areas outside the construction limits shown on the Drawings.
3. Provide traffic control devices and personnel necessary to ensure a safe interface of construction traffic with business traffic to and from adjacent sites.
4. Provide access routes for emergency vehicles at all times.
5. Provide daily sweeping of hard-surface roadways to remove soils tracked onto roadway.
6. Provide on site parking for all staff to limit interference with adjacent properties and businesses.

1.7 ASBESTOS ABATEMENT

A. An existing asbestos cement pipe is to be demolished at the 16" finish water tie-in in the area of Storage Tank No. 1. The Contractor will be required to perform this demolition using a certified asbestos removal crew or subcontractor.

B. The contractor shall perform an asbestos survey prior to demolition of the pipelines. This survey shall be performed by a certified asbestos professional, and the Contractor shall follow all recommendations contained in the report of the asbestos survey. The Contractor may be required to perform this demolition using a certified asbestos removal crew or subcontractor.

C. Asbestos Hazard:
1. Asbestos-containing material when damaged or disturbed is subject to fiber releases. Wet methods are a primary means of controlling fiber release. Strict compliance with each of the provisions outlined in these specifications for the encapsulation, repair and handling of asbestos-containing material is of great importance, because:
   a. The inhalation of airborne asbestos fibers can cause very serious often fatal diseases.
   b. Workers may not be aware they are inhaling asbestos fibers.
   c. Symptoms of the diseases do no appear for many years.
   Only the contractor and his employees can prevent the inhalation of asbestos fibers which can lead to the development of asbestos-related disease.

2. Proposition 65 Notice: Under California Health and Safety Code Sections 25249.5 through 25249.13, asbestos has been listed as a chemical known to the State of California to cause cancer. As a Contractor, you and your employees will be working in areas in which asbestos-containing materials are present. This notice constitutes the warning of the presence of a known carcinogen required by Proposition 65. It is your duty to follow all requirements of Proposition 65.

1.8 BACKWASH SLUDGE REMOVAL

A. The contractor shall remove, transport, and dispose of the backwash sludge at the Water Treatment Plant, as shown on sheet X01 of the Drawings. Disposal shall be at a site secured by the contractor.

B. Material to be removed consists of dirt, heavy metals, and sludge, and the vegetation, which has grown on top of the sludge pile. Refer to Exhibit A for a laboratory analysis of the backwash sludge. Disposal shall be the responsibility of the contractor. All permits, licenses, approvals for disposal, etc., shall be the responsibility of the contractor. Additional requirements are listed as follows:
   1. Remove and dispose of the backwash sludge with appropriate equipment and manpower as not to interrupt the Water Treatment Plant operations. The contractor shall perform such work as not to cause damage to the surrounding infrastructure and any other existing features such as asphalt pavement, piping, and fencing.
   2. The contractor is responsible for additional laboratory testing of the sludge if so required by the owner of the disposal site.
   3. The contractor shall be responsible for filing all applications, reports, permits and required documentation for approval of the disposal of the sludge at the contractor's secured site.
   4. Site grading and adequate erosion control shall be executed by the contractor at the Water Treatment Plant site after the complete removal of the sludge.

C. Transportation of Wastes:
   1. Transportation shall be provided in accordance with Department of Transportation (DOT) and State and local requirements, including obtaining all necessary permits, licenses, and approvals.

D. Records:
   1. Documentation of Disposal:
      a. The backwash sludge shall be taken to a storage, or disposal facility which has EPA or appropriate state permits and hazardous or special waste identification numbers and complies with the provisions of the disposal regulations. Documentation of acceptance of special waste by a facility legally permitted to dispose of those materials shall be furnished to the Owner not later than 5 working days following the delivery of those materials to the facility. A statement of agreement from the proposed disposal facility to accept special wastes shall be furnished to the Owner not less than 14 days before transporting any wastes.

E. Refer to Exhibit A for a laboratory analysis of the backwash sludge samples.

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

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

END OF SECTION

EXHIBIT A - LABORATORY ANALYSIS OF BACKWASH SLUDGE SAMPLES

Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com
Corporate: 208 Mason St., Ukiah, CA 95482 • Phone: (707) 468-0401 • Fax: (707) 468-5267
Bay Area: 6398 Dougherty Rd., Suite 35, Dublin, CA 94568 • Phone: (925) 828-6226 • Fax: (925) 828-6309
Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

ELAP Certificates 1551, 2728, and 2922

17 September 2015

Fort Bragg, City of
Attn: Heath Daniels
101 W. Cypress St.
Ft. Bragg, CA 95437
RE: Backwash Sludge
Work Order: 15I0407

Enclosed are the results of analyses for samples received by the laboratory on 09/02/15 15:15. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette L. Poplin For Sheri L. Speaks
Project Manager

Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com
Corporate: 208 Mason St., Ukiah, CA 95482 • Phone: (707) 468-0401 • Fax: (707) 468-5267
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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Backwash Sludge	15I0407-01	Soil	09/01/15 14:10	09/02/15 15:15

Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com
Corporate: 208 Mason St., Ukiah, CA 95482 • Phone: (707) 468-0401 • Fax: (707) 468-5267
Bay Area: 6398 Dougherty Rd., Suite 35, Dublin, CA 94568 • Phone: (925) 828-6226 • Fax: (925) 828-6309
Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Metals by EPA 6000/7000 Series Methods

Backwash Sludge (15I0407-01) Soil Sampled: 09/01/15 14:10 Received: 09/02/15 15:15

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Analyst	Notes
Aluminum	**34000**		**20**	**mg/kg**	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Antimony	ND		15	mg/kg	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Arsenic	**2.7**		**2.0**	**mg/kg**	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Barium	**35**		**10**	**mg/kg**	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Beryllium	ND		0.75	mg/kg	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Cadmium	ND		1.0	mg/kg	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Chromium	**7.3**		**5.0**	**mg/kg**	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Cobalt	ND		10	mg/kg	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Copper	**12**		**10**	**mg/kg**	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Lead	ND		5.0	mg/kg	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Manganese	**100**		**5.0**	**mg/kg**	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Mercury	ND		0.20	mg/kg	1	AI51626	09/16/15 07:38	09/17/15 07:35	EPA 7471A	JJM	
Molybdenum	ND		10	mg/kg	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Nickel	ND		10	mg/kg	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Selenium	ND		2.0	mg/kg	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Silver	ND		5.0	mg/kg	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Thallium	ND		7.0	mg/kg	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Vanadium	**9.0**		**5.0**	**mg/kg**	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	
Zinc	**15**		**10**	**mg/kg**	1	AI51009	09/16/15 10:20	09/16/15 14:37	EPA 6010B	MAM	

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Anions by EPA Method 300.0

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Analyst	Notes
Backwash Sludge (15I0407-01) Soil	**Sampled: 09/01/15 14:10**		**Received: 09/02/15 15:15**								
Chloride	**110**		**5.0**	**mg/kg**	1	AI51575	09/15/15 13:17	09/16/15 13:17	EPA 300.0	SMP	

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

TPH by EPA/LUFT GC Methods

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Analyst	Notes
Backwash Sludge (15I0407-01) Soil Sampled: 09/01/15 14:10 Received: 09/02/15 15:15											
TPH as Diesel	**7.9**		**5.0**	**mg/kg**	5	AI50446	09/04/15 13:00	09/08/15 20:46	8015DRO	WJH	D-09
Surrogate: Tetratetracontane		*64.2 %*	*64-123*			*AI50446*	*09/04/15 13:00*	*09/08/15 20:46*	*8015DRO*	*WJH*	

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Volatile Organic Compounds by EPA Method 8260B

Backwash Sludge (15I0407-01) Soil Sampled: 09/01/15 14:10 Received: 09/02/15 15:15

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Analyst	Notes
Acetone	ND		0.70	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Benzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Bromobenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Bromochloromethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Bromodichloromethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Bromoform	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Bromomethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
n-Butylbenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
sec-Butylbenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
tert-Butylbenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Carbon tetrachloride	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Chlorobenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Chloroethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Chloroform	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Chloromethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
2-Chlorotoluene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
4-Chlorotoluene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Dibromochloromethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,2-Dibromo-3-chloropropane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,2-Dibromoethane (EDB)	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Dibromomethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,2-Dichlorobenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,3-Dichlorobenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,4-Dichlorobenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Dichlorodifluoromethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,1-Dichloroethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,2-Dichloroethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,1-Dichloroethene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
cis-1,2-Dichloroethene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
trans-1,2-Dichloroethene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,2-Dichloropropane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,3-Dichloropropane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
2,2-Dichloropropane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,1-Dichloropropene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Volatile Organic Compounds by EPA Method 8260B

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Analyst	Notes
Backwash Sludge (15I0407-01) Soil	**Sampled: 09/01/15 14:10**		**Received: 09/02/15 15:15**								
cis-1,3-Dichloropropene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
trans-1,3-Dichloropropene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Ethylbenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Hexachlorobutadiene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Isopropylbenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
p-Isopropyltoluene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Methyl ethyl ketone	ND		0.35	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Methyl isobutyl ketone	ND		0.35	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Methyl tert-butyl ether	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Methylene chloride	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Naphthalene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
n-Propylbenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Styrene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,1,1,2-Tetrachloroethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,1,2,2-Tetrachloroethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Tetrachloroethene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Toluene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,2,3-Trichlorobenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,2,4-Trichlorobenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,1,1-Trichloroethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,1,2-Trichloroethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Trichloroethene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Trichlorofluoromethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Trichlorotrifluoroethane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,2,3-Trichloropropane	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,2,4-Trimethylbenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
1,3,5-Trimethylbenzene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Vinyl chloride	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
m,p-Xylene	ND		0.35	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
o-Xylene	ND		0.17	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Xylenes (total)	ND		0.35	mg/kg	1	AI50431	09/04/15 09:55	09/05/15 05:36	EPA 8260B	MM	
Surrogate: Bromofluorobenzene		*102 %*	*38-163*			*AI50431*	*09/04/15 09:55*	*09/05/15 05:36*	*EPA 8260B*	*MM*	
Surrogate: Dibromofluoromethane		*96.5 %*	*39-154*			*AI50431*	*09/04/15 09:55*	*09/05/15 05:36*	*EPA 8260B*	*MM*	
Surrogate: Toluene-d8		*102 %*	*51-161*			*AI50431*	*09/04/15 09:55*	*09/05/15 05:36*	*EPA 8260B*	*MM*	

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Organochlorine Pesticides and PCBs by EPA Method 8081/8082

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Analyst	Notes
Backwash Sludge (15I0407-01) Soil	**Sampled: 09/01/15 14:10**		**Received: 09/02/15 15:15**								**R-06**
Aldrin	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
alpha-BHC	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
beta-BHC	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
delta-BHC	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
gamma-BHC (Lindane)	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Chlordane (tech)	ND		8.0	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
4,4′-DDD	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
4,4′-DDE	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
4,4′-DDT	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Dieldrin	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Endosulfan I	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Endosulfan II	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Endosulfan sulfate	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Endrin	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Endrin aldehyde	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Heptachlor	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Heptachlor epoxide	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Methoxychlor	ND		0.20	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
Toxaphene	ND		8.0	mg/kg	40	AI51014	09/10/15 08:43	09/16/15 21:17	EPA 8081A/8082	MCB	
PCB-1016	ND		0.20	mg/kg	1	AI51014	09/10/15 08:43	09/15/15 02:22	EPA 8081A/8082	MCB	
PCB-1221	ND		0.20	mg/kg	1	AI51014	09/10/15 08:43	09/15/15 02:22	EPA 8081A/8082	MCB	
PCB-1232	ND		0.20	mg/kg	1	AI51014	09/10/15 08:43	09/15/15 02:22	EPA 8081A/8082	MCB	
PCB-1242	ND		0.20	mg/kg	1	AI51014	09/10/15 08:43	09/15/15 02:22	EPA 8081A/8082	MCB	
PCB-1248	ND		0.20	mg/kg	1	AI51014	09/10/15 08:43	09/15/15 02:22	EPA 8081A/8082	MCB	
PCB-1254	ND		0.20	mg/kg	1	AI51014	09/10/15 08:43	09/15/15 02:22	EPA 8081A/8082	MCB	
PCB-1260	ND		0.20	mg/kg	1	AI51014	09/10/15 08:43	09/15/15 02:22	EPA 8081A/8082	MCB	
Surrogate: Dibutylchlorendate		*107 %*	*50-120*			*AI51014*	*09/10/15 08:43*	*09/16/15 21:17*	*EPA 8081A/8082*	*MCB*	

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Metals by EPA 6000/7000 Series Methods - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51009 - EPA 3051 Microwave											
Blank (AI51009-BLK1)					Prepared: 09/09/15 Analyzed: 09/10/15						
Aluminum	ND		20	mg/kg							
Antimony	ND		15	mg/kg							
Arsenic	ND		2.0	mg/kg							
Barium	ND		10	mg/kg							
Beryllium	ND		0.75	mg/kg							
Cadmium	ND		1.0	mg/kg							
Chromium	ND		5.0	mg/kg							
Cobalt	ND		10	mg/kg							
Copper	ND		10	mg/kg							
Lead	ND		5.0	mg/kg							
Manganese	ND		5.0	mg/kg							
Molybdenum	ND		10	mg/kg							
Nickel	ND		10	mg/kg							
Selenium	ND		2.0	mg/kg							
Silver	ND		5.0	mg/kg							
Thallium	ND		7.0	mg/kg							
Vanadium	ND		5.0	mg/kg							
Zinc	ND		10	mg/kg							
LCS (AI51009-BS1)					Prepared: 09/09/15 Analyzed: 09/10/15						
Aluminum	172		20	mg/kg	200		85.9	85-115			
Antimony	17.5		15	mg/kg	20.0		87.6	85-115			
Arsenic	18.8		2.0	mg/kg	20.0		94.2	80-120			
Barium	18.9		10	mg/kg	20.0		94.4	85-115			
Beryllium	19.8		0.75	mg/kg	20.0		99.0	85-115			
Cadmium	18.3		1.0	mg/kg	20.0		91.5	85-115			
Chromium	19.5		5.0	mg/kg	20.0		97.6	85-115			
Cobalt	18.3		10	mg/kg	20.0		91.5	85-115			
Copper	20.8		10	mg/kg	20.0		104	85-115			
Lead	18.6		5.0	mg/kg	20.0		93.2	85-115			
Manganese	18.7		5.0	mg/kg	20.0		93.7	85-115			
Molybdenum	19.2		10	mg/kg	20.0		95.9	85-115			
Nickel	20.0		10	mg/kg	20.0		100	85-115			
Selenium	17.6		2.0	mg/kg	20.0		88.1	85-115			
Silver	19.4		5.0	mg/kg	20.0		97.2	78-108			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Metals by EPA 6000/7000 Series Methods - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51009 - EPA 3051 Microwave											
LCS (AI51009-BS1)					Prepared: 09/09/15 Analyzed: 09/10/15						
Thallium	18.4		7.0	mg/kg	20.0		92.1	85-115			
Vanadium	19.6		5.0	mg/kg	20.0		97.8	85-115			
Zinc	19.0		10	mg/kg	20.0		94.8	85-115			
Duplicate (AI51009-DUP1)		**Source: 15H2519-01**			Prepared: 09/09/15 Analyzed: 09/10/15						
Aluminum	6020		20	mg/kg		6430			6.60	20	
Antimony	0.584		15	mg/kg		0.342			52.4	20	
Arsenic	1.28		2.0	mg/kg		1.22			4.36	20	
Barium	65.5		10	mg/kg		70.5			7.44	20	
Beryllium	0.234		0.75	mg/kg		0.256			9.21	20	
Cadmium	ND		1.0	mg/kg		ND				20	
Chromium	10.8		5.0	mg/kg		12.1			11.4	20	
Cobalt	4.76		10	mg/kg		4.89			2.55	20	
Copper	12.4		10	mg/kg		12.6			2.00	20	
Lead	7.63		5.0	mg/kg		4.01			62.2	20	QM-04
Manganese	318		5.0	mg/kg		324			1.99	20	
Molybdenum	1.07		10	mg/kg		1.07			0.0629	20	
Nickel	12.1		10	mg/kg		12.3			1.45	20	
Selenium	ND		2.0	mg/kg		ND				20	
Silver	ND		5.0	mg/kg		ND				20	
Thallium	ND		7.0	mg/kg		ND				20	
Vanadium	24.6		5.0	mg/kg		25.3			3.02	20	
Zinc	33.4		10	mg/kg		34.5			3.35	20	
Matrix Spike (AI51009-MS1)		**Source: 15H2519-01**			Prepared: 09/09/15 Analyzed: 09/10/15						
Aluminum	5980		20	mg/kg	200	6430	NR	70-130			QM-4X
Antimony	16.8		15	mg/kg	20.0	0.342	82.4	70-130			
Arsenic	18.8		2.0	mg/kg	20.0	1.22	87.8	70-130			
Barium	85.4		10	mg/kg	20.0	70.5	74.4	70-130			
Beryllium	18.8		0.75	mg/kg	20.0	0.256	92.9	70-130			
Cadmium	17.0		1.0	mg/kg	20.0	ND	84.9	70-130			
Chromium	28.1		5.0	mg/kg	20.0	12.1	79.6	70-130			
Cobalt	21.2		10	mg/kg	20.0	4.89	81.7	70-130			
Copper	35.0		10	mg/kg	20.0	12.6	112	70-130			
Lead	20.8		5.0	mg/kg	20.0	4.01	84.2	70-130			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Metals by EPA 6000/7000 Series Methods - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51009 - EPA 3051 Microwave											
Matrix Spike (AI51009-MS1)		**Source: 15H2519-01**			Prepared: 09/09/15 Analyzed: 09/10/15						
Manganese	307		5.0	mg/kg	20.0	324	NR	70-130			QM-4X
Molybdenum	18.3		10	mg/kg	20.0	1.07	86.2	70-130			
Nickel	29.4		10	mg/kg	20.0	12.3	85.5	70-130			
Selenium	15.3		2.0	mg/kg	20.0	ND	76.3	70-130			
Silver	18.1		5.0	mg/kg	20.0	ND	90.4	70-130			
Thallium	16.9		7.0	mg/kg	20.0	ND	84.4	70-130			
Vanadium	40.9		5.0	mg/kg	20.0	25.3	77.7	70-130			
Zinc	50.6		10	mg/kg	20.0	34.5	80.6	70-130			
Matrix Spike (AI51009-MS2)		**Source: 15H2519-02**			Prepared: 09/09/15 Analyzed: 09/10/15						
Aluminum	8910		20	mg/kg	200	8270	324	70-130			QM-4X
Antimony	16.2		15	mg/kg	20.0	ND	81.0	70-130			
Arsenic	17.6		2.0	mg/kg	20.0	0.522	85.3	70-130			
Barium	96.3		10	mg/kg	20.0	80.2	80.6	70-130			
Beryllium	18.5		0.75	mg/kg	20.0	0.321	90.8	70-130			
Cadmium	16.8		1.0	mg/kg	20.0	ND	84.0	70-130			
Chromium	27.5		5.0	mg/kg	20.0	10.3	86.1	70-130			
Cobalt	22.8		10	mg/kg	20.0	6.07	83.5	70-130			
Copper	34.1		10	mg/kg	20.0	14.0	101	70-130			
Lead	20.9		5.0	mg/kg	20.0	3.74	85.7	70-130			
Manganese	374		5.0	mg/kg	20.0	342	161	70-130			QM-4X
Molybdenum	17.9		10	mg/kg	20.0	0.824	85.3	70-130			
Nickel	31.0		10	mg/kg	20.0	13.4	88.2	70-130			
Selenium	13.7		2.0	mg/kg	20.0	ND	68.7	70-130			QM-01
Silver	17.6		5.0	mg/kg	20.0	ND	88.1	70-130			
Thallium	16.6		7.0	mg/kg	20.0	ND	82.8	70-130			
Vanadium	46.2		5.0	mg/kg	20.0	28.5	88.7	70-130			
Zinc	65.9		10	mg/kg	20.0	47.4	92.1	70-130			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Metals by EPA 6000/7000 Series Methods - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51009 - EPA 3051 Microwave											
Matrix Spike Dup (AI51009-MSD1)		**Source: 15H2519-01**			Prepared: 09/09/15 Analyzed: 09/10/15						
Aluminum	7300		20	mg/kg	200	6430	437	70-130	20.0	20	QM-4X
Antimony	16.6		15	mg/kg	20.0	0.342	81.4	70-130	1.20	20	
Arsenic	19.2		2.0	mg/kg	20.0	1.22	90.1	70-130	2.49	20	
Barium	97.0		10	mg/kg	20.0	70.5	132	70-130	12.7	20	QM-04
Beryllium	19.0		0.75	mg/kg	20.0	0.256	93.6	70-130	0.735	20	
Cadmium	16.6		1.0	mg/kg	20.0	ND	82.9	70-130	2.28	20	
Chromium	29.1		5.0	mg/kg	20.0	12.1	84.6	70-130	3.48	20	
Cobalt	22.1		10	mg/kg	20.0	4.89	85.9	70-130	3.89	20	
Copper	34.5		10	mg/kg	20.0	12.6	109	70-130	1.62	20	
Lead	21.0		5.0	mg/kg	20.0	4.01	85.0	70-130	0.792	20	
Manganese	390		5.0	mg/kg	20.0	324	331	70-130	23.8	20	QM-4X
Molybdenum	18.6		10	mg/kg	20.0	1.07	87.7	70-130	1.61	20	
Nickel	30.3		10	mg/kg	20.0	12.3	90.1	70-130	3.09	20	
Selenium	15.1		2.0	mg/kg	20.0	ND	75.7	70-130	0.750	20	
Silver	17.7		5.0	mg/kg	20.0	ND	88.3	70-130	2.29	20	
Thallium	16.9		7.0	mg/kg	20.0	ND	84.6	70-130	0.190	20	
Vanadium	44.2		5.0	mg/kg	20.0	25.3	94.2	70-130	7.77	20	
Zinc	52.8		10	mg/kg	20.0	34.5	91.3	70-130	4.15	20	
Batch AI51626 - EPA 7471A Hg Soil											
Blank (AI51626-BLK1)					Prepared: 09/16/15 Analyzed: 09/17/15						
Mercury	ND		0.20	mg/kg							
LCS (AI51626-BS1)					Prepared: 09/16/15 Analyzed: 09/17/15						
Mercury	0.980		0.20	mg/kg	1.00		98.0	80-120			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Metals by EPA 6000/7000 Series Methods - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51626 - EPA 7471A Hg Soil											
Duplicate (AI51626-DUP1)		**Source: 15I0538-01**			Prepared: 09/16/15 Analyzed: 09/17/15						
Mercury	0.0700		0.20	mg/kg		0.0750			6.90	20	
Matrix Spike (AI51626-MS1)		**Source: 15I0538-01**			Prepared: 09/16/15 Analyzed: 09/17/15						
Mercury	0.990		0.20	mg/kg	1.00	0.0750	91.5	60-140			
Matrix Spike Dup (AI51626-MSD1)		**Source: 15I0538-01**			Prepared: 09/16/15 Analyzed: 09/17/15						
Mercury	0.965		0.20	mg/kg	1.00	0.0750	89.0	60-140	2.56	20	

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Anions by EPA Method 300.0 - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51575 - General Preparation											
Blank (AI51575-BLK1)					Prepared: 09/15/15 Analyzed: 09/16/15						
Chloride	ND		5.0	mg/kg							
LCS (AI51575-BS1)					Prepared: 09/15/15 Analyzed: 09/16/15						
Chloride	103		5.0	mg/kg	100		103	90-110			
Duplicate (AI51575-DUP1)		**Source: 15I0407-01**			Prepared: 09/15/15 Analyzed: 09/16/15						
Chloride	105		5.0	mg/kg		106			0.940	20	
Matrix Spike (AI51575-MS1)		**Source: 15I0407-01**			Prepared: 09/15/15 Analyzed: 09/16/15						
Chloride	194		25	mg/kg	100	106	88.4	80-120			
Matrix Spike Dup (AI51575-MSD1)		**Source: 15I0407-01**			Prepared: 09/15/15 Analyzed: 09/16/15						
Chloride	193		25	mg/kg	100	106	87.1	80-120	0.697	20	

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

TPH by EPA/LUFT GC Methods - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI50446 - CA LUFT - orb shaker											
Blank (AI50446-BLK1)					Prepared: 09/04/15 Analyzed: 09/08/15						
TPH as Diesel	ND		1.0	mg/kg							
Surrogate: Tetratetracontane	*0.863*			*mg/kg*	*1.12*		*77.2*	*64-123*			
LCS (AI50446-BS1)					Prepared: 09/04/15 Analyzed: 09/08/15						
TPH as Diesel	29.6		1.0	mg/kg	40.1		73.7	65-95			
Surrogate: Tetratetracontane	*1.01*			*mg/kg*	*1.12*		*90.5*	*64-123*			
LCS (AI50446-BS2)					Prepared: 09/04/15 Analyzed: 09/08/15						
Surrogate: Tetratetracontane	*1.02*			*mg/kg*	*1.12*		*91.7*	*64-123*			
LCS Dup (AI50446-BSD1)					Prepared: 09/04/15 Analyzed: 09/08/15						
TPH as Diesel	33.4		1.0	mg/kg	40.1		83.2	65-95	12.0	25	
Surrogate: Tetratetracontane	*0.981*			*mg/kg*	*1.12*		*87.9*	*64-123*			
LCS Dup (AI50446-BSD2)					Prepared: 09/04/15 Analyzed: 09/08/15						
Surrogate: Tetratetracontane	*0.915*			*mg/kg*	*1.12*		*81.9*	*64-123*			
Matrix Spike (AI50446-MS1)		**Source: 15H2425-01**			Prepared: 09/04/15 Analyzed: 09/08/15						
TPH as Diesel	709		50	mg/kg	40.1	444	661	65-95			QM-4X
Surrogate: Tetratetracontane	*1.18*			*mg/kg*	*1.12*		*105*	*64-123*			
Matrix Spike Dup (AI50446-MSD1)		**Source: 15H2425-01**			Prepared: 09/04/15 Analyzed: 09/08/15						
TPH as Diesel	528		50	mg/kg	40.1	444	210	65-95	29.3	25	QM-4X
Surrogate: Tetratetracontane	*0.921*			*mg/kg*	*1.12*		*82.5*	*64-123*			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI50431 - VOAs in Soil GCMS											
Blank (AI50431-BLK1)					Prepared: 09/03/15 Analyzed: 09/05/15						
Acetone	ND		0.70	mg/kg							
Benzene	ND		0.17	mg/kg							
Bromobenzene	ND		0.17	mg/kg							
Bromochloromethane	ND		0.17	mg/kg							
Bromodichloromethane	ND		0.17	mg/kg							
Bromoform	ND		0.17	mg/kg							
Bromomethane	ND		0.17	mg/kg							
n-Butylbenzene	ND		0.17	mg/kg							
sec-Butylbenzene	ND		0.17	mg/kg							
tert-Butylbenzene	ND		0.17	mg/kg							
Carbon tetrachloride	ND		0.17	mg/kg							
Chlorobenzene	ND		0.17	mg/kg							
Chloroethane	ND		0.17	mg/kg							
Chloroform	ND		0.17	mg/kg							
Chloromethane	ND		0.17	mg/kg							
2-Chlorotoluene	ND		0.17	mg/kg							
4-Chlorotoluene	ND		0.17	mg/kg							
Dibromochloromethane	ND		0.17	mg/kg							
1,2-Dibromo-3-chloropropane	ND		0.17	mg/kg							
1,2-Dibromoethane (EDB)	ND		0.17	mg/kg							
Dibromomethane	ND		0.17	mg/kg							
1,2-Dichlorobenzene	ND		0.17	mg/kg							
1,3-Dichlorobenzene	ND		0.17	mg/kg							
1,4-Dichlorobenzene	ND		0.17	mg/kg							
Dichlorodifluoromethane	ND		0.17	mg/kg							
1,1-Dichloroethane	ND		0.17	mg/kg							
1,2-Dichloroethane	ND		0.17	mg/kg							
1,1-Dichloroethene	ND		0.17	mg/kg							
cis-1,2-Dichloroethene	ND		0.17	mg/kg							
trans-1,2-Dichloroethene	ND		0.17	mg/kg							
1,2-Dichloropropane	ND		0.17	mg/kg							
1,3-Dichloropropane	ND		0.17	mg/kg							
2,2-Dichloropropane	ND		0.17	mg/kg							
1,1-Dichloropropene	ND		0.17	mg/kg							

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI50431 - VOAs in Soil GCMS											
Blank (AI50431-BLK1)					Prepared: 09/03/15 Analyzed: 09/05/15						
cis-1,3-Dichloropropene	ND		0.17	mg/kg							
trans-1,3-Dichloropropene	ND		0.17	mg/kg							
Ethylbenzene	ND		0.17	mg/kg							
Hexachlorobutadiene	ND		0.17	mg/kg							
Isopropylbenzene	ND		0.17	mg/kg							
p-Isopropyltoluene	ND		0.17	mg/kg							
Methyl ethyl ketone	ND		0.35	mg/kg							
Methyl isobutyl ketone	ND		0.35	mg/kg							
Methyl tert-butyl ether	ND		0.17	mg/kg							
Methylene chloride	ND		0.17	mg/kg							
Naphthalene	ND		0.17	mg/kg							
n-Propylbenzene	ND		0.17	mg/kg							
Styrene	ND		0.17	mg/kg							
1,1,1,2-Tetrachloroethane	ND		0.17	mg/kg							
1,1,2,2-Tetrachloroethane	ND		0.17	mg/kg							
Tetrachloroethene	ND		0.17	mg/kg							
Toluene	ND		0.17	mg/kg							
1,2,3-Trichlorobenzene	ND		0.17	mg/kg							
1,2,4-Trichlorobenzene	ND		0.17	mg/kg							
1,1,1-Trichloroethane	ND		0.17	mg/kg							
1,1,2-Trichloroethane	ND		0.17	mg/kg							
Trichloroethene	ND		0.17	mg/kg							
Trichlorofluoromethane	ND		0.17	mg/kg							
Trichlorotrifluoroethane	ND		0.17	mg/kg							
1,2,3-Trichloropropane	ND		0.17	mg/kg							
1,2,4-Trimethylbenzene	ND		0.17	mg/kg							
1,3,5-Trimethylbenzene	ND		0.17	mg/kg							
Vinyl chloride	ND		0.17	mg/kg							
m,p-Xylene	ND		0.35	mg/kg							
o-Xylene	ND		0.17	mg/kg							
Xylenes (total)	ND		0.35	mg/kg							
Surrogate: Bromofluorobenzene	*5.00*			*mg/kg*	*4.32*		*116*	*38-163*			
Surrogate: Dibromofluoromethane	*4.79*			*mg/kg*	*4.32*		*111*	*39-154*			
Surrogate: Toluene-d8	*5.01*			*mg/kg*	*4.32*		*116*	*51-161*			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Batch AI50431 - VOAs in Soil GCMS

Blank (AI50431-BLK2) Prepared: 09/04/15 Analyzed: 09/05/15

Acetone	ND		0.70	mg/kg							
Benzene	ND		0.17	mg/kg							
Bromobenzene	ND		0.17	mg/kg							
Bromochloromethane	ND		0.17	mg/kg							
Bromodichloromethane	ND		0.17	mg/kg							
Bromoform	ND		0.17	mg/kg							
Bromomethane	ND		0.17	mg/kg							
n-Butylbenzene	ND		0.17	mg/kg							
sec-Butylbenzene	ND		0.17	mg/kg							
tert-Butylbenzene	ND		0.17	mg/kg							
Carbon tetrachloride	ND		0.17	mg/kg							
Chlorobenzene	ND		0.17	mg/kg							
Chloroethane	ND		0.17	mg/kg							
Chloroform	ND		0.17	mg/kg							
Chloromethane	ND		0.17	mg/kg							
2-Chlorotoluene	ND		0.17	mg/kg							
4-Chlorotoluene	ND		0.17	mg/kg							
Dibromochloromethane	ND		0.17	mg/kg							
1,2-Dibromo-3-chloropropane	ND		0.17	mg/kg							
1,2-Dibromoethane (EDB)	ND		0.17	mg/kg							
Dibromomethane	ND		0.17	mg/kg							
1,2-Dichlorobenzene	ND		0.17	mg/kg							
1,3-Dichlorobenzene	ND		0.17	mg/kg							
1,4-Dichlorobenzene	ND		0.17	mg/kg							
Dichlorodifluoromethane	ND		0.17	mg/kg							
1,1-Dichloroethane	ND		0.17	mg/kg							
1,2-Dichloroethane	ND		0.17	mg/kg							
1,1-Dichloroethene	ND		0.17	mg/kg							
cis-1,2-Dichloroethene	ND		0.17	mg/kg							
trans-1,2-Dichloroethene	ND		0.17	mg/kg							
1,2-Dichloropropane	ND		0.17	mg/kg							
1,3-Dichloropropane	ND		0.17	mg/kg							
2,2-Dichloropropane	ND		0.17	mg/kg							
1,1-Dichloropropene	ND		0.17	mg/kg							

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI50431 - VOAs in Soil GCMS											
Blank (AI50431-BLK2)					Prepared: 09/04/15 Analyzed: 09/05/15						
cis-1,3-Dichloropropene	ND		0.17	mg/kg							
trans-1,3-Dichloropropene	ND		0.17	mg/kg							
Ethylbenzene	ND		0.17	mg/kg							
Hexachlorobutadiene	ND		0.17	mg/kg							
Isopropylbenzene	ND		0.17	mg/kg							
p-Isopropyltoluene	ND		0.17	mg/kg							
Methyl ethyl ketone	ND		0.35	mg/kg							
Methyl isobutyl ketone	ND		0.35	mg/kg							
Methyl tert-butyl ether	ND		0.17	mg/kg							
Methylene chloride	ND		0.17	mg/kg							
Naphthalene	ND		0.17	mg/kg							
n-Propylbenzene	ND		0.17	mg/kg							
Styrene	ND		0.17	mg/kg							
1,1,1,2-Tetrachloroethane	ND		0.17	mg/kg							
1,1,2,2-Tetrachloroethane	ND		0.17	mg/kg							
Tetrachloroethene	ND		0.17	mg/kg							
Toluene	ND		0.17	mg/kg							
1,2,3-Trichlorobenzene	ND		0.17	mg/kg							
1,2,4-Trichlorobenzene	ND		0.17	mg/kg							
1,1,1-Trichloroethane	ND		0.17	mg/kg							
1,1,2-Trichloroethane	ND		0.17	mg/kg							
Trichloroethene	ND		0.17	mg/kg							
Trichlorofluoromethane	ND		0.17	mg/kg							
Trichlorotrifluoroethane	ND		0.17	mg/kg							
1,2,3-Trichloropropane	ND		0.17	mg/kg							
1,2,4-Trimethylbenzene	ND		0.17	mg/kg							
1,3,5-Trimethylbenzene	ND		0.17	mg/kg							
Vinyl chloride	ND		0.17	mg/kg							
m,p-Xylene	ND		0.35	mg/kg							
o-Xylene	ND		0.17	mg/kg							
Xylenes (total)	ND		0.35	mg/kg							
Surrogate: Bromofluorobenzene	*4.70*			*mg/kg*	*4.32*		*109*	*38-163*			
Surrogate: Dibromofluoromethane	*4.40*			*mg/kg*	*4.32*		*102*	*39-154*			
Surrogate: Toluene-d8	*4.66*			*mg/kg*	*4.32*		*108*	*51-161*			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI50431 - VOAs in Soil GCMS											
LCS (AI50431-BS1)					Prepared: 09/03/15 Analyzed: 09/05/15						
Benzene	3.87		0.17	mg/kg	4.32		89.6	58-143			
Chlorobenzene	3.99		0.17	mg/kg	4.32		92.3	76-145			
1,1-Dichloroethene	3.92		0.17	mg/kg	4.32		90.7	77-142			
Toluene	3.99		0.17	mg/kg	4.32		92.5	55-158			
Trichloroethene	3.49		0.17	mg/kg	4.32		80.7	71-139			
Surrogate: Bromofluorobenzene	*4.85*			*mg/kg*	*4.32*		*112*	*38-163*			
Surrogate: Dibromofluoromethane	*4.63*			*mg/kg*	*4.32*		*107*	*39-154*			
Surrogate: Toluene-d8	*4.81*			*mg/kg*	*4.32*		*111*	*51-161*			
LCS Dup (AI50431-BSD1)					Prepared: 09/03/15 Analyzed: 09/05/15						
Benzene	3.95		0.17	mg/kg	4.32		91.5	58-143	2.04	25	
Chlorobenzene	4.12		0.17	mg/kg	4.32		95.4	76-145	3.33	25	
1,1-Dichloroethene	4.01		0.17	mg/kg	4.32		92.9	77-142	2.40	25	
Toluene	4.14		0.17	mg/kg	4.32		95.8	55-158	3.58	25	
Trichloroethene	3.56		0.17	mg/kg	4.32		82.3	71-139	1.92	25	
Surrogate: Bromofluorobenzene	*4.94*			*mg/kg*	*4.32*		*114*	*38-163*			
Surrogate: Dibromofluoromethane	*4.74*			*mg/kg*	*4.32*		*110*	*39-154*			
Surrogate: Toluene-d8	*4.96*			*mg/kg*	*4.32*		*115*	*51-161*			
Matrix Spike (AI50431-MS1)		**Source: 15H2610-01**			Prepared: 09/03/15 Analyzed: 09/05/15						
Benzene	4.38		0.17	mg/kg	4.26	ND	103	37-149			
Chlorobenzene	4.55		0.17	mg/kg	4.26	ND	107	44-157			
1,1-Dichloroethene	4.35		0.17	mg/kg	4.26	ND	102	38-165			
Toluene	4.59		0.17	mg/kg	4.26	ND	108	22-166			
Trichloroethene	4.05		0.17	mg/kg	4.26	ND	95.0	51-146			
Surrogate: Bromofluorobenzene	*5.21*			*mg/kg*	*4.26*		*122*	*38-163*			
Surrogate: Dibromofluoromethane	*4.78*			*mg/kg*	*4.26*		*112*	*39-154*			
Surrogate: Toluene-d8	*5.25*			*mg/kg*	*4.26*		*123*	*51-161*			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI50431 - VOAs in Soil GCMS											
Matrix Spike Dup (AI50431-MSD1)		**Source: 15H2610-01**			Prepared: 09/03/15 Analyzed: 09/05/15						
Benzene	3.98		0.17	mg/kg	4.26	ND	93.4	37-149	9.68	25	
Chlorobenzene	4.17		0.17	mg/kg	4.26	ND	97.9	44-157	8.89	25	
1,1-Dichloroethene	4.09		0.17	mg/kg	4.26	ND	96.1	38-165	6.14	25	
Toluene	4.17		0.17	mg/kg	4.26	ND	98.0	22-166	9.43	25	
Trichloroethene	3.64		0.17	mg/kg	4.26	ND	85.5	51-146	10.5	25	
Surrogate: Bromofluorobenzene	*4.67*			*mg/kg*	*4.26*		*110*	*38-163*			
Surrogate: Dibromofluoromethane	*4.16*			*mg/kg*	*4.26*		*97.7*	*39-154*			
Surrogate: Toluene-d8	*4.75*			*mg/kg*	*4.26*		*112*	*51-161*			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Organochlorine Pesticides and PCBs by EPA Method 8081/8082 - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51014 - EPA 3540C Soxhlet											
Blank (AI51014-BLK1)					Prepared: 09/10/15 Analyzed: 09/16/15						
Aldrin	ND		0.0050	mg/kg							
alpha-BHC	ND		0.0050	mg/kg							
beta-BHC	ND		0.0050	mg/kg							
delta-BHC	ND		0.0050	mg/kg							
gamma-BHC (Lindane)	ND		0.0050	mg/kg							
Chlordane (tech)	ND		0.20	mg/kg							
4,4´-DDD	ND		0.0050	mg/kg							
4,4´-DDE	ND		0.0050	mg/kg							
4,4´-DDT	ND		0.0050	mg/kg							
Dieldrin	ND		0.0050	mg/kg							
Endosulfan I	ND		0.0050	mg/kg							
Endosulfan II	ND		0.0050	mg/kg							
Endosulfan sulfate	ND		0.0050	mg/kg							
Endrin	ND		0.0050	mg/kg							
Endrin aldehyde	ND		0.0050	mg/kg							
Heptachlor	ND		0.0050	mg/kg							
Heptachlor epoxide	ND		0.0050	mg/kg							
Methoxychlor	ND		0.0050	mg/kg							
Toxaphene	ND		0.20	mg/kg							
PCB-1016	ND		0.20	mg/kg							
PCB-1221	ND		0.20	mg/kg							
PCB-1232	ND		0.20	mg/kg							
PCB-1242	ND		0.20	mg/kg							
PCB-1248	ND		0.20	mg/kg							
PCB-1254	ND		0.20	mg/kg							
PCB-1260	ND		0.20	mg/kg							
Surrogate: Dibutylchlorendate	*0.0276*			*mg/kg*	*0.0415*		*66.4*	*50-120*			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Organochlorine Pesticides and PCBs by EPA Method 8081/8082 - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51014 - EPA 3540C Soxhlet											
LCS (AI51014-BS1)					Prepared: 09/10/15 Analyzed: 09/16/15						
Aldrin	0.00766		0.0050	mg/kg	0.0120		63.8	30-143			
alpha-BHC	0.00822		0.0050	mg/kg	0.0120		68.5	18-155			
beta-BHC	0.00949		0.0050	mg/kg	0.0120		79.1	25-190			
delta-BHC	0.00865		0.0050	mg/kg	0.0120		72.1	33-157			
gamma-BHC (Lindane)	0.00812		0.0050	mg/kg	0.0120		67.7	33-134			
4,4´-DDD	0.00690		0.0050	mg/kg	0.0120		57.5	41-139			
4,4´-DDE	0.00770		0.0050	mg/kg	0.0120		64.2	39-146			
4,4´-DDT	0.00849		0.0050	mg/kg	0.0120		70.8	42-146			
Dieldrin	0.00760		0.0050	mg/kg	0.0120		63.4	39-138			
Endosulfan I	0.00849		0.0050	mg/kg	0.0120		70.8	39-146			
Endosulfan II	0.00728		0.0050	mg/kg	0.0120		60.6	43-142			
Endosulfan sulfate	0.00910		0.0050	mg/kg	0.0120		75.9	45-148			
Endrin	0.00903		0.0050	mg/kg	0.0120		75.2	41-164			
Endrin aldehyde	0.00840		0.0050	mg/kg	0.0120		70.0	16-166			
Heptachlor	0.00839		0.0050	mg/kg	0.0120		69.9	33-148			
Heptachlor epoxide	0.00923		0.0050	mg/kg	0.0120		76.9	37-142			
Methoxychlor	0.0106		0.0050	mg/kg	0.0120		88.5	36-148			
Surrogate: Dibutylchlorendate	*0.0251*			*mg/kg*	*0.0415*		*60.5*	*50-120*			
LCS Dup (AI51014-BSD1)					Prepared: 09/10/15 Analyzed: 09/16/15						
Aldrin	0.00792		0.0050	mg/kg	0.0120		66.0	30-143	3.40	30	
alpha-BHC	0.00825		0.0050	mg/kg	0.0120		68.8	18-155	0.422	30	
beta-BHC	0.00888		0.0050	mg/kg	0.0120		74.0	25-190	6.60	30	
delta-BHC	0.00857		0.0050	mg/kg	0.0120		71.4	33-157	0.966	30	
gamma-BHC (Lindane)	0.00815		0.0050	mg/kg	0.0120		67.9	33-134	0.325	30	
4,4´-DDD	0.00730		0.0050	mg/kg	0.0120		60.9	41-139	5.74	30	
4,4´-DDE	0.00801		0.0050	mg/kg	0.0120		66.7	39-146	3.95	30	
4,4´-DDT	0.00787		0.0050	mg/kg	0.0120		65.6	42-146	7.65	30	
Dieldrin	0.00802		0.0050	mg/kg	0.0120		66.8	39-138	5.33	30	
Endosulfan I	0.00880		0.0050	mg/kg	0.0120		73.3	39-146	3.60	30	
Endosulfan II	0.00843		0.0050	mg/kg	0.0120		70.2	43-142	14.6	30	
Endosulfan sulfate	0.00894		0.0050	mg/kg	0.0120		74.5	45-148	1.80	30	
Endrin	0.00897		0.0050	mg/kg	0.0120		74.8	41-164	0.600	30	
Endrin aldehyde	0.00620		0.0050	mg/kg	0.0120		51.6	16-166	30.1	30	QL-04
Heptachlor	0.00852		0.0050	mg/kg	0.0120		71.0	33-148	1.46	30	

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Organochlorine Pesticides and PCBs by EPA Method 8081/8082 - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51014 - EPA 3540C Soxhlet											
LCS Dup (AI51014-BSD1)					Prepared: 09/10/15 Analyzed: 09/16/15						
Heptachlor epoxide	0.00924		0.0050	mg/kg	0.0120		77.0	37-142	0.0823	30	
Methoxychlor	0.00827		0.0050	mg/kg	0.0120		68.9	36-148	24.8	30	
Surrogate: Dibutylchlorendate	*0.0263*			*mg/kg*	*0.0415*		*63.3*	*50-120*			
Matrix Spike (AI51014-MS1)		**Source: 15I0407-01**			Prepared: 09/10/15 Analyzed: 09/16/15						**QM-05**
Aldrin	0.00840		0.050	mg/kg	0.0120	ND	70.0	51-122			
alpha-BHC	0.00986		0.050	mg/kg	0.0120	ND	82.2	54-116			
beta-BHC	0.00885		0.050	mg/kg	0.0120	ND	73.7	27-193			
delta-BHC	0.0107		0.050	mg/kg	0.0120	ND	89.6	64-141			
gamma-BHC (Lindane)	0.00941		0.050	mg/kg	0.0120	ND	78.4	55-121			
4,4′-DDD	ND		0.050	mg/kg	0.0120	ND		46-144			
4,4′-DDE	ND		0.050	mg/kg	0.0120	ND		57-128			
4,4′-DDT	0.0113		0.050	mg/kg	0.0120	ND	93.9	44-154			
Dieldrin	ND		0.050	mg/kg	0.0120	ND		58-124			
Endosulfan I	ND		0.050	mg/kg	0.0120	ND		58-125			
Endosulfan II	ND		0.050	mg/kg	0.0120	ND		51-139			
Endosulfan sulfate	ND		0.050	mg/kg	0.0120	ND		51-138			
Endrin	ND		0.050	mg/kg	0.0120	ND		55-158			
Endrin aldehyde	0.00727		0.050	mg/kg	0.0120	ND	60.5	34-146			
Heptachlor	ND		0.050	mg/kg	0.0120	ND		42-150			
Heptachlor epoxide	ND		0.050	mg/kg	0.0120	ND		53-120			
Methoxychlor	ND		0.050	mg/kg	0.0120	ND		41-157			
Surrogate: Dibutylchlorendate	*0.0600*			*mg/kg*	*0.0415*		*145*	*50-120*			
Matrix Spike Dup (AI51014-MSD1)		**Source: 15I0407-01**			Prepared: 09/10/15 Analyzed: 09/16/15						**QM-05**
Aldrin	0.00786		0.050	mg/kg	0.0120	ND	65.5	51-122		30	
alpha-BHC	0.00971		0.050	mg/kg	0.0120	ND	80.9	54-116		30	
beta-BHC	0.00783		0.050	mg/kg	0.0120	ND	65.3	27-193		30	
delta-BHC	0.0121		0.050	mg/kg	0.0120	ND	101	64-141		30	
gamma-BHC (Lindane)	0.00864		0.050	mg/kg	0.0120	ND	72.0	55-121		30	
4,4′-DDD	ND		0.050	mg/kg	0.0120	ND		46-144		30	
4,4′-DDE	ND		0.050	mg/kg	0.0120	ND		57-128		30	
4,4′-DDT	0.0105		0.050	mg/kg	0.0120	ND	87.3	44-154		30	
Dieldrin	ND		0.050	mg/kg	0.0120	ND		58-124		30	
Endosulfan I	ND		0.050	mg/kg	0.0120	ND		58-125		30	

Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com
Corporate: 208 Mason St., Ukiah, CA 95482 • Phone: (707) 468-0401 • Fax: (707) 468-5267
Bay Area: 6398 Dougherty Rd., Suite 35, Dublin, CA 94568 • Phone: (925) 828-6226 • Fax: (925) 828-6309
Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Organochlorine Pesticides and PCBs by EPA Method 8081/8082 - Quality Control

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AI51014 - EPA 3540C Soxhlet											
Matrix Spike Dup (AI51014-MSD1)		**Source: 15I0407-01**			Prepared: 09/10/15 Analyzed: 09/16/15						**QM-05**
Endosulfan II	0.00865		0.050	mg/kg	0.0120	ND	72.1	51-139		30	
Endosulfan sulfate	ND		0.050	mg/kg	0.0120	ND		51-138		30	
Endrin	ND		0.050	mg/kg	0.0120	ND		55-158		30	
Endrin aldehyde	0.00824		0.050	mg/kg	0.0120	ND	68.7	34-146		30	
Heptachlor	ND		0.050	mg/kg	0.0120	ND		42-150		30	
Heptachlor epoxide	ND		0.050	mg/kg	0.0120	ND		53-120		30	
Methoxychlor	ND		0.050	mg/kg	0.0120	ND		41-157		30	
Surrogate: Dibutylchlorendate	*0.0559*			*mg/kg*	*0.0415*		*135*	*50-120*			

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Fort Bragg, City of	Project Manager: Heath Daniels	
101 W. Cypress St.	Project: Backwash Sludge	Reported:
Ft. Bragg CA, 95437	Project Number: [none]	09/17/15 14:38

Notes and Definitions

D-09	Results in the diesel organics range are primarily due to overlap from a heavy oil range product.
QL-04	The LCS/LCSD RPD for this analyte was outside of established control limits. Batch accepted based on acceptable recovery for both LCS/LCSD.
QM-01	The spike recovery for this QC sample is outside of established control limits possibly due to a sample matrix interference.
QM-04	High RPD and/or poor percent recovery may reflect sample non-homogeneity.
QM-05	The spike recovery was outside acceptance limits for the MS and/or MSD due to matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.
QM-4X	The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to analyte concentration at 4 times or greater the spike concentration. The QC batch was accepted based on LCS and/or LCSD recoveries within the acceptance limits.
R-06	The Reporting Limits for this analysis have been raised to account for matrix interference.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
MDL	Method detection limit
Rec	Recovery
RPD	Relative Percent Difference

Alpha Analytical Laboratories Inc.
www.alpha-labs.com
WATERS, SEDIMENTS, SOLIDS

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707-468-0401 F) 707-468-5267
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ELAP Certifications
Ukiah 1551 / Dublin 2728 / Elk Grove

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925-828-6226 F) 925-828-6309

Central Valley Laboratory
909 Union Park Way #113, Elk Grove CA 95624
916-686-5190 F) 916-686-5192

Chain of Custody - Work Order

Reports and Invoices delivered by email in PDF format

Lab No 151 0407 Pg ____ of ____

Signature below authorizes work under terms stated on reverse side.

Report to	Invoice to (if different)	Project Information
Company: City of Fort Bragg	Contact:	Project ID:
Attn: Heath Daniels	Email address:	Project No:
Address: 416 N Franklin Street, Fort Bragg, CA 95437	Address:	PO Number:
Phone/Fax: (707)961-4138	Phone/Fax:	
Email Address: fkemper@fortbragg.com		

Field Sampler - Printed Name & Signature: F. Kemper

Sample Identification	Sampling Date	Sampling Time	Container: 40ml Vial	Container: Poly	Container: Glass	Container: Sleeve	Container: Other	Preservative: HCl	Preservative: HNO3	Preservative: H2SO4	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil	Matrix: Other	Total Number of Containers	CAM 17-TTLC	TPH	VOCs - Total	PCB - Total	Pesticides - Total	Aluminum and Manganese	Chloride
Backwash Sludge	9/1/15	1410			X							X		X		6	X	X	X	X	X	X	X

Analysis Request

TAT
Standard 10 days ●
RUSH: 5 days ○ 48 hours ○ Other: ___days ○ Lab preapproval required

Temp upon Receipt °C
Ukiah temp: 14.6
Dublin temp:
Elk Grove temp:

Sample Notes or CDPH Source Numbers:
TPH = TPHD
PER FRANK
9.3.15

Relinquished by	Received by	Date	Time
F. Kemper	DEH	9/2/15	11:AM
		9/2/15	1515

CDPH Write On EDT Transmission? ○ Yes ○ No
State System Number: _____
If "Y" please enter the Source Number(s) in the column above

CA Geotracker EDF Report? ○ Yes ○ No
Global ID: Sampling Company Log Code:
EDF to (Email Address):
Travel and Site Time: | Mileage: | Misc. Supplies:

SECTION 01 33 00
SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mechanics and administration of the submittal process for:
      a. Shop Drawings.
      b. Samples.
      c. Informational submittals.
   2. General content requirements for Shop Drawings.

1.2 DEFINITIONS

A. Shop Drawings:
   1. See General Conditions.
   2. Product data and samples are Shop Drawing information.

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

1.3 SUBMITTAL SCHEDULE

A. Schedule of Shop Drawings:
   1. Submitted and approved within 20 days of receipt of Notice to Proceed.
   2. Account for multiple transmittals under any specification section where partial submittals will be transmitted.

B. Shop Drawings: Submittal and approval prior to 30 percent completion of project.

C. Informational Submittals:
   1. Reports and installation certifications submitted within five (5) working days of conducting testing or examination.

D. The submittal schedule shall include the following columns as a minimum:

SUBMITTAL SECTION	SUBMITTAL DESCRIPTION	PLANNED SUBMITTAL DATE	SUBMITTAL NEED DATE	ACTUAL SUBMITTAL DATE	ACTUAL RETURN DATE	DISPOSITION

1.4 PREPARATION OF SUBMITTALS

A. General:
   1. All submittals and all pages of all copies of a submittal shall be completely legible.
   2. Submittals which, in the Engineer’s sole opinion, are illegible will be returned without review.
   3. Minimize extraneous information for equipment and products not relevant to the submittal.
   4. Contractors or vendors written comments on the submittal drawings shall be in green

B. Shop Drawings, Product Data, and Samples:
   1. Scope of any submittal and letter of transmittal:
      a. Limited to one (1) Specification Section.
      b. Submittals with more than one Specification section included will be rejected.
      c. Do not submit under any Specification Section entitled (in part) "Basic Requirements" unless the product or material submitted is specified, in total, in a "Basic Requirements" Specification Section.
   2. Numbering letter of transmittal:
      a. Include as prefix the Specification Section number followed by a series number, "-xx", beginning with "01" and increasing sequentially with each additional transmittal for that Specification Section.
      b. If more than one (1) submittal under any Specification Section, assign consecutive series numbers to subsequent transmittal letters.
   3. Describing transmittal contents:
      a. Provide listing of each component or item in submittal capable of receiving an independent review action.
      b. Identify for each item:
         1) Manufacturer and Manufacturer's Drawing or data number.
         2) Contract Document tag number(s).
         3) Unique page numbers for each page of each separate item.
      c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.
   4. Contractor certification of review and approval:
      a. Contractor's review and approval certification stamp shall be applied either to the letter of transmittal or a separate sheet preceding each independent item in the submittal.
         1) Stamp may be either a wet ink stamp or electronically embedded.
         2) Clearly identify the person who reviewed the submittal and the date it was reviewed.
         3) Shop Drawing submittal stamp shall read "(Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval as stipulated in the General Conditions."
      b. Submittals containing multiple independent items shall be prepared with each item listed on the letter of transmittal or on an index sheet for all items listing the discrete page numbers for each page of each item, which shall be stamped with the Contractor's review and approval stamp.
         1) Each independent item shall have a cover sheet with the transmittal number and item number recorded.
            a) Provide clear space of 3 IN SQ for Engineer stamping.
         2) Individual pages or sheets of independent items shall be numbered in a manner that permits the entire contents of a particular item to be readily recognized and associated with Contractor's certification.
   5. Resubmittals:
      a. Number with original Specification Section and series number with a suffix letter starting with "A" on a (new) duplicate transmittal form.
      b. Do not increase the scope of any prior transmittal.
      c. Provide cover letter indicating how each "B", "C", or "D" Action from previous submittal was addressed and where the correction is found in the resubmittal.
      d. Account for all components of prior transmittal.

1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
    a) Do not include submittal information for items listed with prior "A" or "B" Action in resubmittal.
2) Indicate "Outstanding-To Be Resubmitted At a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
    a) Obtain Engineer's approval to exclude items.

6. For 8-1/2 x 11 IN, 8-1/2 x 14 IN, and 11 x 17 IN size sheets, provide five (5) copies of each submittal for Engineer plus the number required by the Contractor.
    a. The number of copies required by the Contractor will be defined at the Preconstruction Conference, but shall not exceed three (3).
    b. All other size sheets:
        1) Submit one (1) reproducible transparency or high resolution print and one (1) additional print of each Drawing until approval is obtained.
        2) Utilize mailing tube; do not fold.
        3) The Engineer will mark and return the reproducible to the Contractor for reproduction and distribution.
7. Contractor shall not use red color for marks on transmittals.
    a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
    b. Engineer will use red marks or enclose marks in a cloud.
8. Transmittal contents:
    a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.
    b. Provide submittal information or marks defining specific equipment or materials utilized on the Project.
        1) Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.
    c. Identify equipment or material project use, tag number, Drawing detail reference, weight, and other Project specific information.
    d. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
    e. Do not modify the manufacturer's documentation or data except as specified herein.
    f. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets not exceeding 11 x 17 IN pages.
        1) Indicate exact item or model and all options proposed by arrow and leader.
    g. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the Specification Section.
        1) Arrange data and performance information in format similar to that provided in Contract Documents.
        2) Provide, at minimum, the detail specified in the Contract Documents.
    h. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet. Any deviation from plans or specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Engineer shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.

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

C. Informational Submittals:
    1. Prepare in the format and detail specified in Specification requiring the informational submittal.

1.5 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings and Samples:
    1. Transmit all submittals to:

        HDR
        2365 Iron Point Road, Suite 300
        Folsom, CA 95630
        Attn: Mr. Arashdeep Singh

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

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

        HDR
        2365 Iron Point Road, Suite 300
        Folsom, CA 95630
        Attn: Mr. Arashdeep Singh

C. Electronic Transmission of Submittals:
    1. Transmittals shall be made electronically.
        a. Use commercial project collaboration application.
        b. Protocols and processes will be determined at the Pre-Construction Conference.
    2. Provide documents in Adobe Acrobat Portable Document Format (PDF), latest version.
    3. Create one (1) PDF file for each equipment Operation and Maintenance Manual.
    4. Do not password protect or lock the PDF document.
    5. Drawings or other graphics must be converted to PDF file format from the original drawing file format and made part of the PDF document.
        a. Scanning of drawings is to be used only where actual file conversion is not possible and drawings must be scanned at a resolution of 300 dpi or greater.
        b. Required signatures may be applied prior to scanning for transmittal.
    6. Electronic drawings shall be formatted to be at full-scale (or half-scale when printed to 11x17).

a. Do not reduce drawings by more than 50% in size.
b. Reduced drawings shall be clearly marked "HALF-SIZE" and shall scale accurately at that size.

7. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.
8. Create bookmarks in the bookmarks panel for the Operation and Maintenance Manual cover, the Table of Contents and each major section of the Table of Contents.
9. Using Adobe Acrobat Standard or Adobe Acrobat Professional, set the PDF document properties, initial view as follows:
   a. Select File →Properties→Initial View.
   b. Select the Navigation tab: Bookmarks Panel and Page.
   c. Select the Page layout: Single Page.
   d. Select the Magnification: Fit Page.
   e. Select Open to page: 1.
   f. Set the file to open to the cover page with bookmarks to the left, and the first bookmark linked to the cover page.
10. Set the PDF file "Fast Web View" option to open the first several pages of the document while the rest of the document continues to load.
    a. To do this:
       1) Select Edit→Preferences→ Documents→Save Settings.
       2) Check the Save As optimizes for Fast Web View box.
11. File naming conventions:
    a. File names shall use a "ten dot three" convention (XXXXXX-YY-Z.PDF) where XXXXXX is the Specification Section number, YY is the Shop Drawing Root number and Z is an ID number used to designate the associated volume.
12. Labeling:
    a. As a minimum, include the following labeling on all CD-ROM discs and jewel cases:
       1) Project Name.
       2) Equipment Name and Project Tag Number.
       3) Project Specification Section.
       4) Manufacturer Name.
       5) Vendor Name.
13. Binding:
    a. Include labeled CD(s) in labeled jewel case(s).
       1) Bind jewel cases in standard three-ring binder Jewel Case Page(s), inserted at the front of the Final paper copy submittal.
       2) Jewel Case Page(s) to have means for securing Jewel Case(s) to prevent loss (e.g., flap and strap).

1.6 ENGINEER'S REVIEW ACTION

A. Shop Drawings and Samples:
   1. Items within transmittals will be reviewed for overall design intent and will receive one (1) of the following actions:
      a. A - FURNISH AS SUBMITTED.
      b. B - FURNISH AS NOTED (BY ENGINEER).
      c. C - REVISE AND RESUBMIT.
      d. D - REJECTED.
      e. E - ENGINEER'S REVIEW NOT REQUIRED.
   2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
      a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned rejected.
   3. In relying on the representation on the Contractor’s review and approval stamp, Owner and Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:

a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
    1) Review and approval will be limited to the single item described on the transmittal letter.
    2) Other items identified in the submittal will:
        a) Not be logged as received by the Engineer.
        b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.
        c) Be submitted by the Contractor as a new series number, not as a re-submittal number.
b. Engineer, at Engineer's discretion, may revise the transmittal letter item list and descriptions, and conduct review.
    1) Unless Contractor notifies Engineer in writing that the Engineer's revision of the transmittal letter item list and descriptions was in error, Contractor's review and approval stamp will be deemed to have applied to the entire contents of the submittal package.

4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.
    a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.
    b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
    a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
        1) One (1) copy or the one (1) transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.
            a) Correct and resubmit items so marked.
    b. Items marked "A" or "B" will be fully distributed.
    c. If a portion of the items or system proposed are acceptable, however, the major part of the individual Drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
        1) This is at the sole discretion of the Engineer.
        2) In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."
        3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).
6. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.
7. Calculations required in individual Specification Sections will be received for information purposes only, as evidence calculations have been stamped by the professional as defined in the specifications and for limited purpose of checking conformance with given performance and design criteria. The Engineer is not responsible for checking the accuracy of the calculations and the calculations will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.
8. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

9. Transmittals of submittals which the Engineer considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" action in a prior submittal, will be returned with action "E. Engineer's Review Not Required."
10. Samples may be retained for comparison purposes.
    a. Remove samples when directed.
    b. Include in bid all costs of furnishing and removing samples.
11. Approved samples submitted or constructed, constitute criteria for judging completed work.
    a. Finished work or items not equal to samples will be rejected.

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

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

END OF SECTION

EXHIBIT A

Shop Drawing Transmittal No. _____-_____

(Spec Section) (Series)

Project Name:		Date Received:	
Project Owner:		Checked By:	
Contractor:	HDR Engineering, Inc.	Log Page:	
Address:	Address:	HDR No.:	
		Spec Section:	
		Drawing/Detail No.:	
Attn:	Attn:	1st. Sub	ReSub.
Date Transmitted:	Previous Transmittal Date:		

Item No.	No. Copies	Description	Manufacturer	Mfr/Vendor Dwg or Data No.	Action Taken*

Remarks:

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

A - Furnish as Submitted

B - Furnish as Noted

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

D - Rejected

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

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

Comments:

By Date

Distribution: Contractor | File | Field | Owner | Other

EXHIBIT AA

Contractor's Submittal Certification

Shop Drawing Transmittal No.: _____

Contract/Project Name: _____

_____

Company Name: _____

has

1. reviewed and coordinated this Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

2. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

3. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

4. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

☐ This Submittal **does not** contain any variations from the requirements of the Contract Documents.

☐ This Submittal **does** contain variations from the requirements of the Contract Documents. A separate description of said variations and a justification for them is provided in an attachment hereto identified as:

"Shop Drawing Transmittal No. _____Variation and Justification Documentation"

Insert picture file or electronic signature of Authorized Representative

_____ _____

Authorized Representative Date

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SECTION 01 33 04
OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administration of the submittal process for Operation and Maintenance Manuals.
   2. Content requirements for Operation and Maintenance Manuals.

1.2 DEFINITIONS

A. Equipment Operation and Maintenance Manuals:
   1. Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.

B. Building Materials and Finishes Operation and Maintenance Manuals:
   1. Contain the information required for proper installation and maintenance of building materials and finishes.

1.3 SUBMITTALS

A. List of all the Operation and Maintenance Manuals required by the Contract as identified in the Technical Specification Sections. These may be referred to as "Operation and Maintenance Data" submittals.

B. Operation and Maintenance Manuals:
   1. Draft and final electronic copies.
   2. Final paper copies: One (1).

1.4 SUBMITTAL SCHEDULE

A. List of Required Operation and Maintenance Manuals:
   1. Submit list with Specification Section number and title within 90 days after Notice to Proceed.

B. Draft Operation and Maintenance Manuals:
   1. Submit approvable draft manuals in electronic format (PDF) within 30 days following approval of the respective Shop Drawing.
      a. Include placeholders or fly sheet pages where information is not final or is missing from the draft manual.
   2. All Draft Operation and Maintenance Manuals shall be received by no later than 50 percent project completion.

C. Final Operation and Maintenance Manuals:
   1. Final approval of Operation and Maintenance Manuals in electronic format (PDF) must be obtained 45 days prior to equipment start-up.
   2. Provide paper copies and CD-ROMs of approved final Operation and Maintenance Manuals in electronic format (PDF), a minimum of 30 days prior to equipment start-up.
   3. Issue addenda to Final Approved Operation and Maintenance Manual to include:
      a. Equipment data that requires collection after start-up, for example but not limited to HVAC balancing reports, electrical switchgear, automatic transfer switch and circuit breaker settings.
      b. Equipment field testing data.
      c. Equipment start-up reports.

1.5 PREPARATION OF SUBMITTALS

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

B. Operation and Maintenance Manual Format and Delivery:
   1. Draft electronic submittals:
      a. Provide manual in Adobe Acrobat Portable Document Format (PDF), latest version.
      b. Create one (1) PDF file for each equipment Operation and Maintenance Manual.
      c. Do not password protect or lock the PDF document.
      d. Drawings or other graphics must be converted to PDF file format from the original drawing file format and made part of the PDF document.
      e. Scanning of drawings is to be used only where actual file conversion is not possible and drawings must be scanned at a resolution of 300 dpi or greater.
      f. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.
      g. Create bookmarks in the bookmarks panel for the Operation and Maintenance Manual cover, the Table of Contents and each major section of the Table of Contents.
      h. Using Adobe Acrobat Standard or Adobe Acrobat Professional, set the PDF document properties, initial view as follows:
         1) Select File →Properties→Initial View.
         2) Select the Navigation tab: Bookmarks Panel and Page.
         3) Select the Page layout: Single Page.
         4) Select the Magnification: Fit Page.
         5) Select Open to page: 1.
         6) Set the file to open to the cover page of the manual with bookmarks to the left, and the first bookmark linked to the cover page.
      i. Set the PDF file "Fast Web View" option to open the first several pages of the document while the rest of the document continues to load.
         1) To do this:
            a) Select Edit→Preferences→ Documents→Save Settings.
            b) Check the Save As optimizes for Fast Web View box.
      j. PDF file naming convention:
         1) Use the Specification Section number, the manufacturer's name and the equipment description, separated by underscores.
         2) Example: 46 51 21_Sanitaire_Coarse_Bubble_Diffusers.pdf.
         3) Do not put spaces in the file name.

2. Final electronic submittals:
    a. Submit two (2) copies in PDF file format on two (2) CD-ROM discs (one (1) copy per CD-ROM), each secured in a jewel case.
    b. CD-ROM Labeling:
        1) Provide the following printed labeling on all CD-ROM discs:
            a) Project name.
            b) Specification Section.
            c) Equipment names and summary of tag(s) covered.
            d) Manufacturer name.
            e) Date (month, year).
    c. CD-ROM Jewel Case Holder:
        1) Insert jewel cases containing labeled CD-ROM discs in three-ring binder holder (C-Line Products, www.c-lineproducts.com stock number CLI-61968 or equivalent) at the front of each final paper copy.
3. Final paper copy submittals:
    a. Quantity: Provide two (2) copies.
    b. Paper: 8.5 x 11 IN or 11 x 17 IN bright white, 20 pound paper with standard three-hole punching.
    c. 3-Ring Binder:
        1) Provide D-ring binder with clear vinyl sleeves (i.e. view binder) on front and spine.
        2) Insert binder title sheet with the following information under the front and spine sleeves:
            a) Project name.
            b) Specification Section.
            c) Equipment names and summary of tag(s) covered.
            d) Manufacturer name.
            e) Date (month, year).
        3) Provide plastic sheet lifters prior to first page and following last page.
    d. Drawings:
        1) Provide all drawings at 11 x 17 IN size, triple folded and three-hole punched for insertion into manual.
        2) Where reduction is not practical to ensure readability, fold larger drawings separately and place in three-hole punched vinyl envelopes inserted into the binder.
        3) Identify vinyl envelopes with drawing numbers.
    e. Use plastic coated dividers to tab each section of each manual in accordance with the Table of Contents.

C. Equipment Operation and Maintenance Manual Content:
1. Provide a cover page as the first page of each manual with the following information:
    a. Manufacturer(s) Name and Contact Information.
    b. Vendor’s Name and Contact Information.
    c. Date (month, year).
    d. Project Owner and Project Name.
    e. Specification Section.
    f. Project Equipment Tag Numbers.
    g. Model Numbers.
    h. Engineer’s Name.
    i. Contractor’s Name.
2. Provide a Table of Contents for each manual.
3. Provide Equipment Record sheets as follows:
    a. Printed copies of the Equipment Record (Exhibits B1, B2 and B3), as the first tab following the Table of Contents.
    b. Exhibits B1-B3 are available as Fillable PDF Form documents from the Engineer.
    c. Each section of the Equipment Record must be completed in detail; simply referencing the related equipment Operation and Maintenance Manual sections for nameplate, maintenance, spare parts or lubricant information is not acceptable.

d. For equipment involving separate components (for example, a motor and gearbox), a fully completed Equipment Record is required for each component.
e. Submittals that do not include the Equipment Record(s) will be rejected without further content review.

4. Provide a printed copy of the Manufacturer's Field Services report as required by Specification Section 01 75 00 following the Equipment Record sheets.
5. Provide the following detailed information, as applicable:
   a. Use equipment tag numbers from the Contract Documents to identify equipment and system components.
   b. Equipment function, normal and limiting operating characteristics.
   c. Instructions for assembly, disassembly, installation, alignment, adjustment, and inspection.
   d. Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.
   e. Lubrication and maintenance instructions.
   f. Troubleshooting guide.
   g. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project; delete or cross out information that does not specifically apply to the Project.
   h. Parts lists:
      1) A parts list and identification number of each component part of the equipment.
      2) Exploded view or plan and section views of the equipment with a detailed parts callout matching the parts list.
      3) A list of recommended spare parts.
      4) List of spare parts provided as specified in the associated Specification Section.
      5) A list of any special storage precautions which may be required for all spare parts.
   i. General arrangement, cross-section, and assembly drawings.
   j. Electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, and interconnection diagrams.
   k. Test data and performance curves.
   l. As-constructed fabrication or layout drawings and wiring diagrams.
   m. Copy of the equipment manufacturer's warranty meeting the requirements of the Contract.
   n. Copy of any service contracts provided for the specific piece of equipment as part of the Contract.
6. Additional information as required in the associated equipment or system Specification Section.

1.6 TRANSMITTAL OF SUBMITTALS

A. Operation and Maintenance Manuals.
   1. Transmit all submittals to:
      a. The address specified in Specification Section 01 33 00 - SUBMITTALS.

   2. Transmittal form: Use Operation and Maintenance Manual Transmittal, Exhibit A.
   3. Transmittal numbering:
      a. Number each submittal with the Specification Section number followed by a series number beginning with "-01" and increasing sequentially with each additional transmittal, followed by "-OM" (for example: 43 23 14-01-OM).
   4. Submit draft and final Operation and Maintenance Manual in electronic format (PDF) to Engineer, until manual is approved.

1.7 ENGINEER'S REVIEW ACTION

A. Draft Electronic (PDF) Submittals:
   1. Engineer will review and indicate one of the following review actions:
      a. A - ACCEPTABLE
      b. B - FURNISH AS NOTED

c. C - REVISE AND RESUBMIT
d. D - REJECTED

2. Submittals marked as Acceptable or Furnish As Noted will be retained; however, the transmittal form will be returned with a request for the final paper and electronic documents to be submitted.
3. Copies of submittals marked as Revise and Resubmit or Rejected will be returned with the transmittal form marked to indicate deficient areas.
4. Resubmit until approved.

B. Final Paper Copy Submittals:
1. Engineer will review and indicate one (1) of the following review actions:
a. A - ACCEPTABLE
b. D - REJECTED
2. Submittals marked as Acceptable will be retained with the transmittal form returned as noted.
3. Submittals marked as Rejected will be returned with the transmittal form marked to indicate deficient areas.
4. Resubmit until approved.

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

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

END OF SECTION

EXHIBIT A

Operation and Maintenance Manual Transmittal _____-_____ - OM

(Spec Section) (Series)

Project Name: Date Received:

Project Owner: Checked By:

Contractor: Owner: Log Page:

Address: Address: HDR No.:

Attn: Attn:

1st. Sub. ReSub.

Date Transmitted: Previous Transmittal Date:

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

Remarks:

To: From:

HDR Engineering, Inc.

Date:

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

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

Comments:

By Date

Distribution: Contractor | File | Field | Owner | Other

EXHIBIT B1

Equipment Record

Equipment Data and Spare Parts Summary

Project Name	Specification Section:
Equipment Name	Year Installed:
Project Equipment Tag No(s).	

Equipment Manufacturer		Project/ Order No.
Address		Phone
Fax	Web Site	E-mail
Local Vendor/Service Center		
Address		Phone
Fax	Web Site	E-mail

MECHANICAL NAMEPLATE DATA

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

ELECTRICAL NAMEPLATE DATA

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

SPARE PARTS PROVIDED PER CONTRACT

Part No.	Part Name	Quantity

RECOMMENDED SPARE PARTS

Part No.	Part Name	Quantity

EXHIBIT B2

Equipment Record

Recommended Maintenance Summary

Equipment Description	Project Equip. Tag No(s).	

RECOMMENDED BREAK-IN MAINTENANCE (FIRST OIL CHANGES, ETC.)	INITIAL COMPLETION * FOLLOWING START-UP							
	D	W	M	Q	S	A	RT	Hours

RECOMMENDED PREVENTIVE MAINTENANCE	PM TASK INTERVAL *							
	D	W	M	Q	S	A	RT	Hours

* D = Daily W = Weekly M = Monthly Q = Quarterly S = Semiannual A = Annual Hours = Run Time I

EXHIBIT B3

Equipment Record

Lubrication Summary

Equipment Description	Project Equip. Tag No(s).

Lubricant Point

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

Lubricant Point

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

Lubricant Point

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

Lubricant Point

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

Lubricant Point

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

Lubricant Point

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

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SECTION 01 61 03
EQUIPMENT: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Requirements of this Specification Section apply to all equipment provided on the Project including those found in other Divisions even if not specifically referenced in individual "Equipment" Articles of those Specification Sections.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. American Bearing Manufacturers Association (ABMA).
2. American Gear Manufacturers Association (AGMA).
3. ASTM International (ASTM):
   a. E1934, Standard Guide for Examining Electrical and Mechanical Equipment with Infrared Thermography.
   b. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
4. Hydraulic Institute (HI):
   a. 9.6.4, Centrifugal and Vertical Pumps for Vibration Measurements and Allowable Valves.
5. International Electrotechnical Commission (IEC).
6. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
7. International Organization for Standardization (ISO):
   a. 1940, Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance Tolerances.
8. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. ICS 6, Enclosures for Industrial Control and System.
   c. MG 1, Motors and Generators.
9. InterNational Electrical Testing Association (NETA):
   a. ATS, Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems.
10. National Fire Protection Association (NFPA):
    a. 70, National Electrical Code (NEC):
       1) Article 430, Motors, Motor Circuits, and Controllers.
11. National Institute for Certification in Engineering Technologies (NICET).
12. National Institute of Standards and Technology (NIST).
13. Occupational Safety and Health Administration (OSHA):
    a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
14. Underwriters Laboratories, Inc. (UL).
    a. 508, Standard for Safety Industrial Control Equipment.
    b. 508A, Standard for Safety Industrial Control Panels.

B. Miscellaneous:
1. A single manufacturer of a "product" shall be selected and utilized uniformly throughout Project even if:
   a. More than one (1) manufacturer is listed for a given "product" in Specifications.
   b. No manufacturer is listed.

2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations shown on Electrical Power Drawings and defined in the Electrical specifications.
3. Variable speed equipment applications: The driven equipment manufacturer shall have single source responsibility for coordination of the equipment and VFD system and verify their compatibility.

1.3 DEFINITIONS

A. Product: Manufactured materials and equipment.

B. Major Equipment Supports - Supports for Equipment:
1. Located on or suspended from elevated slabs with supported equipment weighing 2000 LBS or greater, or;
2. Located on or suspended from roofs with supported equipment weighing 500 LBS or greater, or;
3. Located on slab-on-grade or earth with supported equipment weighing 5000 LBS or more.

C. Equipment:
1. One (1) or more assemblies capable of performing a complete function.
2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.
3. Not limited to items specifically referenced in "Equipment" articles within individual Specifications.

D. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
1. General for all equipment:
a. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
b. Data sheets that include manufacturer's name and complete product model number.
1) Clearly identify all optional accessories that are included.
c. Acknowledgement that products submitted comply with the requirements of the standards referenced.
d. Manufacturer's delivery, storage, handling, and installation instructions.
e. Equipment identification utilizing numbering system and name utilized in Drawings.
f. Equipment installation details:
1) Location of anchorage.
2) Type, size, and materials of construction of anchorage.
3) Anchorage setting templates.
4) Manufacturer's installation instructions.
g. Equipment area classification rating.
h. Shipping and operating weight.
i. Equipment physical characteristics:
1) Dimensions (both horizontal and vertical).
2) Materials of construction and construction details.
j. Equipment factory primer and paint data.
k. Manufacturer's recommended spare parts list.
l. Equipment lining and coatings.
m. Equipment utility requirements include air, natural gas, electricity, and water.
n. Ladders and platforms provided with equipment:
1) Certification that all components comply fully with OSHA requirements.

2) Full details of construction/fabrication.
3) Scaled plan and sections showing relationship to equipment.

2. Mechanical and process equipment:
   a. Operating characteristics:
      1) Technical information including applicable performance curves showing specified equipment capacity, rangeability, and efficiencies.
      2) Brake horsepower requirements.
      3) Copies of equipment data plates.
   b. Piping and duct connection size, type and location.
   c. Equipment bearing life certification.
   d. Equipment foundation data:
      1) Equipment center of gravity.
      2) Criteria for designing vibration, special or unbalanced forces resulting from equipment operation.
3. Electric motor:
   a. Motor manufacturer and model number.
   b. Complete motor nameplate data.
   c. Weight.
   d. NEMA design type.
   e. Enclosure type.
   f. Frame size.
   g. Winding insulation class and temperature rise.
   h. Starts per hour.
   i. Performance data:
      1) Guaranteed minimum efficiencies at 100 percent, 75 percent, and 50 percent of full load
      2) Guaranteed minimum power factor at 100 percent, 75 percent, and 50 percent of full load.
      3) Locked rotor and full load current at rated terminal voltage and minimum permissible or specified terminal voltage.
      4) Starting, full load, and breakdown torque at rated terminal voltage and minimum permissible or specified terminal voltage.
   j. Bearing data and lubrication system.
   k. Thermal protection system including recommended alarm and trip settings for winding and bearing RTD's.
   l. Fabrication and/or layout drawings:
      1) Dimensioned outlined drawing.
      2) Connection diagrams including accessories (strip heaters, thermal protection, etc.).
   m. Certifications:
      1) When utilized with a reduced voltage starter, certify that motor and driven equipment are compatible.
      2) When utilized with a variable frequency controller, certify motor is inverter duty and the controller and motor are compatible.
         a) Include minimum speed at which the motor may be operated for the driven machinery.
   n. Electrical gear:
      1) Unless specified in a narrow-scope Specification Section, provide the following:
         a) Equipment ratings: Voltage, continuous current, kVa, watts, short circuit with stand, etc., as applicable.
      2) Control panels:
         a) Panel construction.
         b) Point-to-point ladder diagrams.
         c) Scaled panel face and subpanel layout.
         d) Technical product data on panel components.
         e) Panel and subpanel dimensions and weights.
         f) Panel access openings.

g) Nameplate schedule.
h) Panel anchorage.

4. Systems schematics and data:
   a. Provide system schematics where required in system specifications.
      1) Acknowledge all system components being supplied as part of the system.
      2) Utilize equipment, instrument and valving tag numbers defined in the Contract Documents for all components.
      3) Provide technical data for each system component showing compliance with the Contract Document requirements.
      4) For piping components, identify all utility connections, vents and drains which will be included as part of the system.
5. For factory painted equipment, provide paint submittals in accordance with Specification Section 09 91 00.

B. Contract Closeout Information:
1. Operation and Maintenance Data:
   a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

C. Informational Submittals:
1. Sample form letter for equipment field certification.
2. Certification that equipment has been installed properly, has been initially started up, has been calibrated and/or adjusted as required, and is ready for operation.
3. Certification for major equipment supports that equipment foundation design loads shown on the Drawings or specified have been compared to actual loads exhibited by equipment provided for this Project and that said design loadings are equal to or greater than the loads produced by the equipment provided.
4. Field noise testing reports if such testing is specified in narrow-scope Specification Sections.
5. Notification, at least one (1) week in advance, that motor testing will be conducted at factory.
6. Certification from equipment manufacturer that all manufacturer-supplied control panels that interface in any way with other controls or panels have been submitted to and coordinated with the supplier/installer of those interfacing systems.
7. Motor test reports.
8. Certification prior to Project closeout that electrical panel drawings for manufacturer-supplied control panels truly represent panel wiring including any field-made modifications.
9. Provide three (3) bound final written reports documenting vibration monitoring and testing for specified equipment.
   a. Include the acceptance criteria of all equipment tested.
   b. Provide individual tabbed sections for information associated with each piece of tested equipment.
10. Preliminary field quality control testing format to be used as a basis for final field quality control reporting.
11. Testing and monitoring reports in accordance with PART 3 of this Specification Section.
12. Certification that driven equipment and VFD are compatible.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Motors:
   a. Baldor.
   b. General Electric.
   c. Marathon Electric.

d. Reliance Electric.
e. Siemens.
f. Teco-Westinghouse.
g. U.S. Motors.
h. WEG.

2.2 MANUFACTURED UNITS

A. Electric Motors:
1. Where used in conjunction with adjustable speed AC or DC drives, provide motors that are fully compatible with the speed controllers.
2. Design for frequent starting duty equivalent to duty service required by driven equipment.
3. Design for full voltage starting.
4. Design bearing life based upon actual operating load conditions imposed by driven equipment.
5. Size for altitude of Project.
6. Furnish with stainless steel nameplates which include all data required by NEC Article 430.
7. Use of manufacturer's standard motor will be permitted on integrally constructed motor driven equipment specified by model number in which a redesign of the complete unit would be required in order to provide a motor with features specified.
8. AC electric motors less than 1/3 HP:
   a. Single phase, 60 Hz, designed for the supply voltage shown on the Drawings.
   b. Permanently lubricated sealed bearings conforming to ABMA standards.
   c. Built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element with stainless steel enclosure.
9. AC electric motors 1/3 to 1 HP:
   a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
   b. Permanently lubricated sealed bearings conforming to ABMA standards.
      1) For single phase motors, provide built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element.
10. AC electric motors 1-1/2 to 10 HP:
    a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
    b. Permanently lubricated sealed bearings conforming to ABMA standards.
    c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
11. AC electric motors greater than 10 HP:
    a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
    b. Oil or grease lubricated antifriction bearings conforming to ABMA standards.
       1) Design bearing life for 90 percent survival rating at 50,000 HRS of operation for motors up to and including 100 HP.
    c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
12. Severe duty motor to have the following minimum features:
    a. All cast iron construction.
    b. Gasketed conduit box.
    c. Epoxy finish for corrosion protection.
    d. Hydroscopic varnish on windings for corrosion protection.
    e. Drain plug and breather.

B. NEMA Design Squirrel Cage Induction Motors:
1. Provide motors designed and applied in compliance with NEMA and IEEE for the specific duty imposed by the driven equipment.
2. Motors to meet NEMA MG 1 (NEMA Premium) efficiencies.
3. Do not provide motors having a locked rotor kVA per HP exceeding the NEMA standard for the assigned NEMA code letter.
4. For use on variable frequency type adjustable speed drives, provide:
   a. Induction motors that are in compliance with NEMA MG 1, Part 31.

b. Nameplate identification meeting NEMA MG 1 Part 31 requirements.
c. Insulated drive end bearing on all motors.
d. Shaft grounding ring on all motors:
1) Factory installed, maintenance free, circumferential, bearing protection ring with conductive microfiber shaft contacting material.
2) Electro Static Technology AEGIS SGR Bearing Protection Ring or approved equal.

5. Design motor insulation in accordance with NEMA standards for Class F insulation with Class B temperature rise above a 40 DegC ambient.
6. Design motors for continuous duty.
7. Size motors having a 1.0 service factor so that nameplate HP is a minimum of 15 percent greater than the maximum HP requirements of the driven equipment over its entire operating range.
a. As an alternative, furnish motors with a 1.15 service factor and size so that nameplate HP is at least equal to the maximum HP requirements of the driven equipment over its entire operating range.
8. Motor enclosure and winding insulation application:
a. The following shall apply unless modified by specific Specification Sections:

MOTOR LOCATION	MOTOR ENCLOSURE / WINDING INSULATION
Unclassified Indoor Areas	DPFG (for horizontal motors), TEFC, Standard Insulation
Wet indoor Areas	TEFC, Standard Insulation WP-II (for vertical motors)
Wet outdoor Areas	TEFC, Extra Dip and Bake for Moisture WP-II (for vertical motors)

NOTE: Provide TENV motors in the smaller horsepower ratings where TEFC is not available.

9. Provide oversize conduit box complete with clamp type grounding terminals inside the conduit box.

C. Submersible Motors: Refer to individual narrow-scope Specification Sections for submersible motor requirements.

2.3 COMPONENTS

A. Gear Drives and Drive Components:
1. Size drive equipment capable of supporting full load including losses in speed reducers and power transmission.
2. Provide nominal input horsepower rating of each gear or speed reducer at least equal to nameplate horsepower of drive motor.
3. Design drive units for 24 HR continuous service, constructed so oil leakage around shafts is precluded.
4. Utilize gears, gear lubrication systems, gear drives, speed reducers, speed increasers and flexible couplings meeting applicable standards of AGMA.
5. Gear reducers:
a. Provide gear reducer totally enclosed and oil lubricated.
b. Utilize antifriction bearings throughout.
c. Provide worm gear reducers having a service factor of at least 1.20.
d. Furnish other helical, spiral bevel, and combination bevel-helical gear reducers with a service factor of at least 1.50.

2.4 ACCESSORIES

A. Guards:
1. Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
2. Interior applications:
a. Construct from 16 GA stainless steel rolled to conform to shaft or coupling surface.
b. Utilize non-flattened type 16 GA stainless steel with nominal 1/2 IN spacing.

c. Connect to equipment frame with stainless steel bolts and wing nuts.

3. Exterior applications:
   a. Construct from 16 GA stainless steel.
   b. Construct to preclude entrance of rain, or moisture.
   c. Roll to conform to shaft or coupling surface.
   d. Connect to equipment frame with stainless steel bolts and wing nuts.

B. Anchorage:
1. Cast-in-place anchorage:
   a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
   b. Configuration and number of anchor bolts shall be per manufacturer's recommendations.
   c. Provide two (2) nuts for each bolt.
2. Drilled anchorage:
   a. Adhesive anchors per Specification Section 05 50 00.
   b. Epoxy grout per Specification Section 03 09 00.
   c. Threaded rods same as cast-in-place.

C. Data Plate:
1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
2. Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.

D. Gages:
1. Provide gages in accordance with Specification Section 40 91 10.
2. Provide at the following locations:
   a. Inlet and outlet of all reciprocating, centrifugal and positive displacement mechanical and process equipment.
   b. At locations identified on Drawings.
3. Utilize tapping sleeves for mounting per Specification Section 40 05 00.

E. Lifting Eye Bolts or Lugs:
1. Provide on all equipment 50 LBS or greater.
2. Provide on other equipment or products as specified in the narrow-scope Specification Sections.

2.5 FABRICATION

A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.

B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.

C. Furnish like parts of duplicate units to be interchangeable.

D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.

E. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.
1. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.

F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.
1. Provide drain connection for 3/4 IN PVC tubing.

G. Machine the mounting feet of rotating equipment.

H. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that can not be properly prepared and painted.
   1. When such back to back fabrication can not be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.
   2. Where continuous welds are not practical, after painting seal the back to back surfaces from the environment in accordance with Specification Section 07 92 00.

I. Critical Speed:
   1. All rotating parts accurately machined and in as near perfect rotational balance as practicable.
   2. Excessive vibration is sufficient cause for equipment rejection.
   3. Ratio of all rotative speeds to critical speed of a unit or components: Greater than 1.2.

J. Control Panels Engineered and Provided with the Equipment by the Manufacturer:
   1. Manufacturer's standard design for components and control logic unless specific requirements are specified in the specific equipment Specification Section.
   2. NEMA or IEC rated components are acceptable, whichever is used in the manufacturer's standard engineered design, unless specific requirements are required in the specific equipment Specification Section.
   3. Affix entire assembly with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to delivery.
      a. Control panels without an affixed UL 508A label shall be rejected.

2.6 SHOP OR FACTORY PAINT FINISHES

A. Electrical Equipment:
   1. Provide factory-applied paint coating system(s) for all electrical equipment components except those specified in Specification Section 09 91 00 to receive field painting.
      a. Field painted equipment: See Specification Section 09 91 00 for factory applied primer/field paint compatibility requirements.

B. Field paint other equipment in accordance with Specification Section 09 91 00.
   1. See Specification Section 09 91 00 for factory applied primer/field paint compatibility requirements.

2.7 SOURCE QUALITY CONTROL

A. Motor Tests:
   1. Test motors in accordance with NEMA and IEEE standards.
   2. Provide routine test for all motors.
   3. The Owner reserves the right to select and have tested, either routine or complete, any motor included in the project.
      a. The Owner will pay all costs, including shipping and handling, for all motors successfully passing the tests.
      b. The Contractor shall pay all costs, including shipping and handling, for all motors failing the tests.
      c. If two (2) successive motors of the same manufacturer fail testing, the Owner has the right to reject all motors from that manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment as shown on Drawings and in accordance with manufacturer's directions.

B. Utilize templates for anchorage placement for slab-mounted equipment.

C. For equipment having drainage requirements such as seal water, provide 3/4 IN PVC or clear plastic tubing from equipment base to nearest floor or equipment drain.
   1. Route clear of major traffic areas and as approved by Engineer.

D. DO NOT construct foundations until major equipment supports are approved.

E. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings from closest operating floor level.

F. Equipment Base:
   1. Construct level in both directions.
   2. Take particular care at anchor bolt locations so these areas are flat and level.

G. Machine Base:
   1. Mount machine base of rotating equipment on equipment base.
      a. Level in both directions, using a machinist level, according to machined surfaces on base.
   2. Level machine base on equipment base and align couplings between driver and driven unit using steel blocks and shims.
      a. Size blocks and shims to provide solid support at each mounting bolt location.
         1) Provide area size of blocks and shims approximately 1-1/2 times area support surface at each mounting bolt point.
      b. Provide blocks and shims at each mounting bolt.
         1) Furnish blocks and shims that are square shape with "U" cut out to allow blocks and shims to be centered on mounting bolts.
      c. After all leveling and alignment has been completed and before grouting, tighten mounting bolts to proper torque value.

H. Rotating equipment Couplings:
   1. Align in the annular and parallel positions.
      a. For equipment rotating at 1200 rpm or less, align both annular and parallel within 0.001 IN tolerance for couplings 4 IN size and smaller.
      b. Couplings larger than 4 IN size: Increase tolerance 0.0005 IN per inches of coupling diameter, i.e., allow 6 IN coupling 0.002 IN tolerance, and allow a 10 IN coupling 0.004 IN tolerance.
      c. For equipment rotating at speeds greater than 1200 rpm allow both annular and parallel positions within a tolerance rate of 0.00025 IN per inch coupling diameter.
   2. If equipment is delivered as a mounted unit from factory, verify factory alignment on site after installation and realigned if necessary.
   3. Check surfaces for runout before attempting to trim or align units.

I. Grouting:
   1. After machine base has been shimmed, leveled onto equipment base, couplings aligned and mounting bolts tightened to correct torque value, place a dam or formwork around base to contain grouting between equipment base and equipment support pad.
      a. Extend dam or formwork to cover leveling shims and blocks.
      b. Do not use nuts below the machine base to level the unit.
   2. Saturate top of roughened concrete subbase with water before grouting.
      a. Add grout until entire space under machine base is filled to the top of the base underside.
      b. Puddle grout by working a stiff wire through the grout and vent holes to work grout in place and release any entrained air in the grout or base cavity.
   3. When the grout has sufficiently hardened, remove dam or formwork and finish the exposed grout surface to fine, smooth surface.
      a. Cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too rapid evaporation of water from the grout.
      b. When the grout has fully hardened (after a minimum of seven (7) days) tighten all anchor bolts to engage equipment base to grout, shims, and equipment support pad.
      c. Recheck driver-driven unit for proper alignment.

3.2 INSTALLATION CHECKS

A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.
   1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.

B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
   1. Has been properly installed and lubricated.
   2. Is in accurate alignment.
   3. Is free from any undue stress imposed by connecting piping or anchor bolts.
   4. Has been operated under full load conditions and that it operated satisfactorily.
      a. Secure and deliver a field written report to Owner immediately prior to leaving jobsite.

C. No separate payment shall be made for installation checks.
   1. All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

3.3 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS

A. Identify equipment and install hazard warning signs in accordance with Specification Section 10 14 00.

3.4 WIRING CONNECTIONS AND TERMINATION

A. Clean wires before installing lugs and connectors.

B. Coat connection with oxidation eliminating compound for aluminum wire.

C. Terminate motor circuit conductors with copper lugs bolted to motor leads.

D. Tape stripped ends of conductors and associated connectors with electrical tape.
   1. Wrapping thickness shall be 150 percent of the conductor insulation thickness.

E. Connections to carry full ampacity of conductors without temperature rise.

F. Terminate spare conductors with electrical tape.

3.5 FIELD QUALITY CONTROL

A. General:
   1. Furnish equipment manufacturer’s field quality control services and testing as specified in the individual equipment Specification Sections.
   2. Execute pre-demonstration requirements in accordance with Specification Section 01 75 00.
   3. Perform and report on all tests required by the equipment manufacturer’s Operation and Maintenance Manual.
   4. Provide testing of electrical equipment and connections in accordance with the Electrical specifications.
   5. Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
      a. Contract Drawings and Specifications.
      b. Related construction change documentation.
      c. Approved Shop Drawings.
      d. Approved Operation and Maintenance Manuals.
      e. Other pertinent information as required.

B. Equipment Monitoring and Testing Plans:
   1. Approved in accordance with Shop Drawing submittal schedule.
   2. Included as a minimum:
      a. Qualifications of firm, field personnel, and analysis personnel doing the Work.

b. List and description of testing and analysis equipment to be utilized.
c. List of all equipment to be testing, including:
1) Name and tag numbers identified in the Contract Documents.
2) Manufacturer’s serial numbers.
3) Other pertinent manufacturer identification,

C. Instruments Used in Equipment and Connections Quality Control Testing:
1. Minimum calibration frequency:
a. Field analog instruments: Not more than 6 months.
b. Field digital instruments: Not more than 12 months.
c. Laboratory instruments: Not more than 12 months.
d. If instrument manufacturer’s calibration requirements are more stringent, those requirements shall govern.
2. Carry current calibration status and labels on all testing instruments.
3. See individual testing programs for additional instrumentation compliance requirements.

D. Testing and Monitoring Program Documentation:
1. Provide reports with tabbed sections for each piece of equipment tested.
2. Include all testing results associated with each piece of equipment under that equipment’s tabbed section.
a. Include legible copies of all forms used to record field test information.
3. Prior to start of testing, submit one (1) copy of preliminary report format for Engineer review and comment
a. Include data gathering and sample test report forms that will be utilized.
4. In the final report, include as a minimum, the following information for all equipment tested:
a. Equipment identification, including:
1) Name and tag numbers identified in the Contract Documents.
2) Manufacturer’s serial numbers.
3) Other pertinent manufacturer identification,
b. Date and time of each test.
c. Ambient conditions including temperature, humidity, and precipitation.
d. Visual inspection report.
e. Description of test and referenced standards, if any, followed while conducting tests.
f. Results of initial and all retesting.
g. Acceptance criteria.
h. "As found" and "as left" conditions.
i. Corrective action, if required, taken to meet acceptance.
j. Verification of corrective action signed by the Contractor, equipment supplier, and Owner’s representative.
k. Instrument calibration dates of all instruments used in testing.
5. Provide three (3) bound final reports prior to Project final completion.

3.6 DEMONSTRATION

A. Demonstrate equipment in accordance with Specification Section 01 75 00.

END OF SECTION

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SECTION 01 65 50
PRODUCT DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Scheduling of product delivery.
   2. Packaging of products for delivery.
   3. Protection of products against damage from:
      a. Handling.
      b. Exposure to elements or harsh environments.

B. Payment:
   1. No payment will be made to Contractor for equipment or materials not properly stored and insured or without approved Shop Drawings.
      a. Previous payments for items will be deducted from subsequent progress estimate(s) if proper storage procedures are not observed.

1.2 DELIVERY

A. Scheduling: Schedule delivery of products or equipment as required to allow timely installation and to avoid prolonged storage.

B. Packaging: Deliver products or equipment in manufacturer's original unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.

C. Identification: Clearly and fully mark and identify as to manufacturer, item, and installation location.

D. Protection and Handling: Provide manufacturer's instructions for storage and handling.

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

PART 3 - EXECUTION

3.1 PROTECTION, STORAGE AND HANDLING

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

3.2 STORAGE FACILITIES

A. Temporary Storage Building:
   1. Provide a weatherproof temporary storage building specifically for the purpose of providing for protection of products and equipment.
      a. Size building to accommodate anticipated storage items; however, not less than 20 FT x 20 FT.

2. Equip building with lockable doors and lighting, and provide electrical service for equipment space heaters and heating or ventilation as necessary to provide storage environments acceptable to specified manufacturers.
3. Provide methods of storage of products and equipment off the ground.
4. Provide this structure within 60 days after Notice to Proceed.
    a. Locate building on-site where shown on the Drawings or in location approved by Engineer.
    b. Remove building from site prior to startup and demonstration period.

3.3 FIELD QUALITY CONTROL

A. Inspect Deliveries:
    1. Inspect all products or equipment delivered to the site prior to unloading.
        a. Reject all products or equipment that are damaged, used, or in any other way unsatisfactory for use on Project.

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

END OF SECTION

SECTION 01 73 20
OPENINGS AND PENETRATIONS IN CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Methods of installing and sealing openings and penetrations in construction.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 318, Building Code Requirements for Structural Concrete.
   2. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      c. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
      d. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
      e. A351, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
      f. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
      g. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      h. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
      i. A995, Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts.
   3. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC):
         1) Article 501, Class 1 Locations.
      b. 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
      c. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

1.3 DEFINITIONS

A. Hazardous Areas: Areas shown in the Contract Documents as having Class I or Class II area classifications.

B. Washdown Areas: Areas having floor drains or hose bibs.

1.4 SUBMITTALS

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

1.5 PROJECT CONDITIONS

A. For purposes of this Project, water table level is at grade.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe Sleeves and Sheet Metal Sleeves:
   1. Areas listed as Corrosive Areas in PART 1:
      a. Stainless steel, Type 316L.
   2. All other Areas:
      a. Stainless steel, type 316L.

B. Backing Rod and Sealant: See Specification Section 07 92 00.

C. Modular Mechanical Seals:
   1. Acceptable manufacturers:
      a. Link-Seal.
   2. 316 stainless steel bolts, nuts and washers.

PART 3 - EXECUTION

3.1 FABRICATION

A. Fabricate pipe sleeves in accordance with Specification Section 05 50 00.

B. Provide waterstop plate/anchor flange for piping, ducts, castings and sleeves cast-in-place in concrete.
   1. For fabricated units, weld plate to sleeve, pipe, or ductwork.
   2. For commercial castings, cast water stop/anchor with wall pipe.
   3. Plate is to be same thickness as sleeve, pipe, casting or ductwork.
   4. For fabricated units, diameter of plate or flange to be 4 IN larger than outside diameter of sleeve, pipe or ductwork.
   5. For commercial castings, waterstop/anchor size to be manufacturer standard.
   6. Provide continuous around entire circumference of sleeve, pipe, or ductwork.

C. Factory or shop-coat painted components in accordance with Specification Section 09 91 00.

3.2 INSTALLATION AND APPLICATION

A. Seal openings and penetrations in non-fire-resistance-rated construction in accordance with Specification Section 07 92 00.

B. Obtain prior approval from Engineer when any opening larger than 100 SQ IN must be made in existing or newly completed construction.

C. Perform HVAC penetrations in accordance with NFPA 90A.

D. Perform electrical penetrations in accordance with NFPA 70, Article 501.

E. Install sleeves and castings in accordance with ACI 318, Chapter #6.

F. When mechanical or electrical work cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, insets, fixtures or devices necessary to permit installation later.
   1. Lay out chases, holes or other openings which must be provided in masonry, concrete or other work.

G. Where pipes, conduits or ducts pass through floors in washdown areas, install sleeves with top 3 IN above finish floors.
   1. In non-washdown areas, install sleeves with ends flush with finished surfaces.

H. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.

I. For insulated piping and ducts, size sleeves, blockouts and cutouts large enough to accommodate full thickness of insulation.

J. Where pipes, conduits or ducts pass through grating, provide banding at the entire perimeter of the opening.
   1. Metal grating: See Specification Section 05 50 00.

K. Where pipes, conduits or ducts are removed where passing through grating:
   1. Metal grating:
      a. Provide banding at perimeter and cover opening with 1/4 IN plate of the same material of the grating.
      b. See Specification Section 05 50 00.

L. Do not cut into or core drill any beams, joists, or columns.

M. Do not install sleeves in beams, joists, or columns.

N. Do not install recesses in beams, joists, columns, or slabs.

O. Field Cutting and Coring:
   1. Saw or core drill with non-impact type equipment.
   2. Mark opening and drill small 3/4 IN or less holes through structure following opening outline.
   3. Sawcut opening outline on both surfaces.
      a. Knock out within sawcuts using impact type equipment.
      b. Do not chip or spall face of surface to remain intact.
      c. Do not allow any overcut with saw kerf.

P. Precast-Prestressed Concrete Construction:
   1. Do not cut openings or core drill vertically or horizontally through stems of members.
   2. Do not locate or install sleeves or recess sleeves vertically or horizontally through or in stems of members.
   3. Cast openings and sleeves into flanges of units.
   4. Cast openings larger than 6 IN in diameter or 6 IN maximum dimension in units at time of manufacture.
   5. Cast openings smaller than 6 IN in diameter or 6 IN maximum dimensions in flanges of units at time of manufacture or field cut.

Q. Where alterations are necessary or where new and old work join, restore adjacent surfaces to their condition existing prior to start of work.

R. Where area is blocked out to receive sheet metal sleeve at later date:
   1. If blockout size is sufficient to allow placement, utilize dowels for interface of initially placed concrete and sleeve encasement concrete which is placed later.
      a. Size blockout based on sleeve size required plus 4 to 6 IN each side of sleeve for concrete encasement.
      b. Provide #4 dowels at 12 IN spacing along each side of blockout with minimum of two (2) dowels required per side.
   2. If blockout size is not sufficient to allow placement of dowels, provide keyway along all sides of blockout.
      a. Size blockout based on sleeve size required plus 2 to 4 IN each side of sleeve for concrete encasement.

S. For interior wall applications where backer rod and sealant are specified, provide backer rod and sealant at each side of wall.

T. Use full depth expanding foam sealant for seal applications where single or multiple pipes, conduits, etc., pass through a single sleeve.

U. Do not make duct or conduit penetrations below high water levels when entering or leaving tankage, wet wells, or other water holding structures.

V. Modular Mechanical Seals:
   1. Utilize one (1) seal for concrete thickness less than 8 IN and two (2) seals for concrete, 8 IN thick or greater.
   2. Utilize two (2) seals for piping 16 IN diameter and larger if concrete thickness permits.
   3. Install seals such that bolt heads are located on the most accessible side of the penetration.

W. Backer Rod and Sealant:
   1. Install in accordance with Specification Section 07 92 00.
   2. Provide backer rod and sealant for modular mechanical seal applications.
      a. Apply on top side of slab penetrations and on interior, dry side wall penetrations.

3.3 SCHEDULES

A. General Schedule of Penetrations through Floors, Roofs, Foundation Base Slabs, Foundation Walls, Foundation Footings, Partitions and Walls for Ductwork, Piping, and Conduit:
   1. Provide the following opening and penetration types:
      a. Type A - Block out 2 IN larger than outside dimensions of duct, pipe, or conduits.
      b. Type B - Saw cut or line-drill opening. Place new concrete with integrally cast sheet metal or pipe sleeve.
      c. Type C - Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe sleeve with water ring for wet and/or washdown areas.
      d. Type D - Commercial type casting or fabrication.
      e. Type E - Saw cut or line-drill opening. Place new concrete with integrally cast pipe, duct or conduit spools.
      f. Type F - Integrally cast pipe, duct or conduit.
      g. Type G - Saw cut or line-drill and remove area 1 IN larger than outside dimensions of duct, pipe or conduit.
      h. Type H - Core drill.
      i. Type I - Block out area. At later date, place new concrete with integrally cast sheet metal or pipe sleeve.
      j. Type J- Grating Banding for any field cut openings
   2. Provide seals of material and method described as follows.
      a. Category 1 - Modular Mechanical Seal.
      b. Category 2 - Roof curb and flashing according to SMACNA specifications unless otherwise noted on Drawings. Refer to Specification Section 07 62 00 and roofing Specification Sections for additional requirements.
      c. Category 3 - 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing rod and sealant used in sleeve annulus.
      d. Category 4 - Backer rod and sealant.
      e. Category 5 - Full depth compressible sealant with escutcheons on both sides of opening.
      f. Category 6 - Full depth compressible sealant and flanges on both sides of opening. Flanges constructed of same material as duct, fastened to duct and minimum 1/2 IN larger than opening.
      g. Category 7 - Full depth compressible sealant and finish sealant or full depth expanding foam sealant depending on application.
      h. Category 8- Banding for all grating openings and banding and cover plate of similar materials for abandoned openings
   3. Furnish openings and sealing materials through new floors, roofs, grating, partitions and walls in accordance with Schedule A, Openings and Penetrations for New Construction.
   4. Furnish openings and sealing materials through existing floors, grating, roofs, partitions and walls in accordance with Schedule B, Openings and Penetrations for Existing Construction.

SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE FOR NEW CONSTRUCTION

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors on grade above water table	C F I	4 Not Req 4	C F I (1)	7 Not Req 7	C F I (1)	4 Not Req 7
Through slab on grade below water table	F	Not Req	F	Not Req	F	Not Req
Through floors in washdown areas	C I	4 4	C H (2) I (1)	4 3 4	F H (2) I (1)	Not Req 3 7
Through walls where one side is a hazardous area	C F I	7 Not Req 7	D F I (1)	Not Req Not Req 7	C F	7 Not Req
Through exterior wall below grade above water table	C F I	7 Not Req 7	C D F I (1)	1 Not Req Not Req 1	F I (1)	Not Req 7
Through exterior wall above grade	A B C	6 6 6	A B D H (2)	5 5 Not Req 5	C H (2)	5 4
Roof penetrations	A	2	A	2	A	2
Through interior walls and slabs not covered by the above applications	A C	4 4	A C	4 4	A C F	4 4 Not Req
Grating openings and penetrations	J	8	J	8	J	8

SCHEDULE B. OPENINGS AND PENETRATIONS SCHEDULE FOR EXISTING CONSTRUCTION

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through exterior wall below grade above water table	B	7	B (1) B (3) H (2)	7 1 7	B (1) (3) H (2)	7 7

(1) Multiple piping 3 IN and smaller or multiple conduits.
(2) Single pipe 3 IN and smaller or single conduit.
(3) Single pipe or conduit larger than 3 IN.

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SECTION 01 73 29
DEMOLITION, CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition, cutting and patching of existing construction where shown on Drawings, or as required to accommodate new work shown or specified.

1.2 SUBMITTALS

A. Shop Drawings:
   1. See Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Indicating manufacturer and type of:
      a. Proposed nonshrink grout.
      b. Epoxy bonding adhesive.
      c. Proposed materials and methods to be used for matching and repairing existing construction.

1.3 DELIVERY, STORAGE, AND HANDLING

A. General:
   1. Salvage items, designated for Owner's salvage, as a functional unit.
   2. Clean, list and tag for storage.
   3. Protect from damage and deliver to location designated.
   4. Salvage each item with auxiliary or associated equipment required for operation.

1.4 PROJECT CONDITIONS

A. Perform preliminary investigations as required to ascertain extent of work.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate and reschedule work as required to preclude interference with other operations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
   1. Nonshrink grout:
      a. Supreme Grout by Gifford Hill.
      b. Masterflow 713 Plus by BASF Building Systems.
      c. Sika Grout 212 by Sika.
   2. Epoxy bonding adhesive:
      a. Euco No.452 MV by Euclid Chemical Co.
      b. Sikadur 32, Hi-Mod by Sika Corporation.

2.2 MATERIALS

A. Temporary Partitions:
   1. Plywood: 1/2 IN minimum for interior or exterior use.
   2. Paneling: 1/4 IN minimum for interior use.

B. Nonshrink Grout:
   1. Nonmetallic, noncorrosive and nonstaining.
   2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
   3. Grout to produce a positive but controlled expansion. Mass expansion not to be created by gas liberation or by other means.
   4. Minimum compressive strength at 28 days to be 6500 psi.
   5. Coat exposed edges of grout with a cure/seal compound recommended by grout manufacturer.

C. Epoxy Bonding Adhesive:
   1. Two component, moisture insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide temporary partitions as required in public areas.
   1. Construct partitions of braced plywood in exterior areas.
   2. Adequately braced paneling may be used in interior areas.

B. Provide covered passageways where necessary to ensure safe passage of persons in or near areas of work.

C. Provide substantial barricades and safety lights as required.

D. Provide temporary dustproof partitions where indicated or necessary.
   1. Prevent infiltration of dust into occupied areas.

E. Provide temporary weather protection as necessary.

3.2 INSTALLATION

A. Cutting and Removal:
   1. Remove existing work indicated to be removed, or as necessary for installation of new work.
   2. Neatly cut and remove materials, and prepare all openings to receive new work.
   3. Remove masonry or concrete in small sections.

B. Modification of Existing Concrete:
   1. Where indicated, remove existing concrete and finish remaining surfaces as specified in Section 03 09 00.
      a. Protect remaining concrete from damage.
      b. Make openings by sawing through the existing concrete.
      c. Concrete may be broken out after initial saw cuts in the event concrete thickness prevents cutting through.
      d. Where sawing is not possible, make openings by drilling holes around perimeter of opening and then chipping out the concrete.
         1) Holes shall be sufficient in number to prevent damage to remaining concrete.
   2. Oversize required openings in existing concrete 1 IN on all sides and build back to required opening size by means of nonshrink grout epoxy bonded to the existing concrete.
   3. Where oversized openings cannot be made, remove the concrete to the required opening size and cut back exposed reinforcing 1 IN from face of concrete and fill resulting holes with nonshrink grout.

C. Removal of Existing Anchor Bolts or Other Protruding Elements:
   1. Removal within a distance of 8 FT above finished floor or operating level elevation.
   2. Removed to a depth of 1/2 IN from finished surface.

3. Fill void with non-shrink grout.

D. Matching and Patching:
   1. Walls, ceilings, floors or partitions:
      a. Repair abutting walls, ceilings, floors or partitions disturbed by removal.
      b. Match and patch existing construction disturbed during installation of new work.
   2. Methods and materials:
      a. Similar in appearance, and equal in quality to adjacent areas for areas or surfaces being repaired.
      b. Subject to review of Engineer.

E. Salvaged Items:
   1. Thoroughly dry and clean all metal surfaces.
   2. Prime all bare metal in accordance with Section 09 91 00.
   3. Clean and lubricate motors and other moving parts.
   4. Brace motors attached to flexible mountings until reinstallation.
   5. Dispose of items or materials not designated for Owner's salvage or reuse. Promptly remove from site.
   6. Do not store or sell Contractor salvaged items or materials on site.

F. Clean Up:
   1. Transport debris and legally dispose of off site.

END OF SECTION

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SECTION 01 74 13
CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Intermediate and final cleaning of Work not including special cleaning of closed systems specified elsewhere.

1.2 STORAGE AND HANDLING

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

1.3 SCHEDULING

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 CLEANING - GENERAL

A. Prevent accumulation of wastes that create hazardous conditions.

B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities.

C. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains or sewers.

D. Dispose of degradable debris at an approved solid waste disposal site.

E. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate manner approved by Engineer and regulatory agencies.

F. Handle materials in a controlled manner with as few handlings as possible.

G. Do not drop or throw materials from heights greater than 4 FT or less than 4 FT if conditions warrant greater care.

H. On completion of work, leave area in a clean, natural looking condition.
   1. Remove all signs of temporary construction and activities incidental to construction of required permanent Work.

I. Do not burn on-site.

3.2 INTERIOR CLEANING

A. Cleaning During Construction:

1. Keep work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations.
2. At maximum weekly intervals, dispose of waste materials, debris, and rubbish.
3. Vacuum clean interior areas when ready to receive finish painting.
    a. Continue vacuum cleaning on an as-needed basis, until substantial completion.

B. Final Cleaning:
1. Complete immediately prior to Demonstration Period.
2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed surfaces.
3. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
4. Wash and shine glazing and mirrors.
5. Polish glossy surfaces to a clear shine.
6. Ventilating systems:
    a. Clean permanent filters and replace disposable filters if units were operated during construction.
    b. Clean ducts, blowers and coils if units were operated without filters during construction.
7. Replace all burned out lamps.
8. Broom clean process area floors.
9. Mop office and control room floors.

3.3 EXTERIOR (SITE) CLEANING

A. Cleaning During Construction:
1. Construction debris:
    a. Confine in strategically located container(s):
        1) Cover to prevent blowing by wind.
        2) Haul from site minimum once a week.
    b. Remove from work area to container daily.
2. Vegetation: Keep weeds and other vegetation trimmed to 3 IN maximum height.
3. Soils, sand, and gravel deposited on paved areas and walks:
    a. Remove as required to prevent muddy or dusty conditions.
    b. Do not flush into storm sewer system.

B. Final Cleaning:
1. Remove trash and debris containers from site.
    a. Re-seed areas disturbed by location of trash and debris containers.
2. Clean paved roadways.

3.4 FIELD QUALITY CONTROL

A. Immediately prior to Demonstration Period, conduct an inspection with Engineer to verify condition of all work areas.

END OF SECTION

SECTION 01 75 00
SYSTEM START-UP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Procedures and actions, required of the Contractor, which are necessary to achieve and demonstrate Substantial Completion.
   2. Requirements for Substantial Completion Submittals.

1.2 DEFINITIONS

A. Project Classified System (PCS): A defined part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent system.

B. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from manufacturer's representatives, performs in the following sequence:
   1. Finishing type construction work to ensure the Project or each PCS has reached a state of Substantial Completion.
   2. Equipment start-up.
   3. Personnel training.

C. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates process flow through the Project Classified System and starts up and operates the Project Classified System, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the Project Classified System as evidence of Substantial Completion.

D. Substantial Completion: See the General Conditions.

1.3 SUBMITTALS

A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. Submit in the chronological order listed below prior to the completion of the Pre-Demonstration Period.
   1. Master operation and maintenance training schedule:
      a. Submit 30 days (minimum) prior to first training session for Owner's personnel.
      b. Schedule to include:
         1) Target date and time for Owner witnessing of each system initial start-up.
         2) Target date and time for Operation and Maintenance training for each system, both field and classroom.
         3) Target date for initiation of Demonstration Period.
      c. Submit for review and approval by Owner.
      d. Include holidays observed by Owner.
      e. Attend a schedule planning and coordination meeting 90 calendar days prior to first anticipated training session.
         1) Provide a status report and schedule-to-complete for requirements prerequisite to manufacturer's training.
         2) Identify initial target dates for individual manufacturer's training sessions.

f. Owner reserves the right to insist on a minimum seven (7) days' notice of rescheduled training session not conducted on master schedule target date for any reason.
g. Schedule to be resubmitted until approved.

2. Substantial Completion Submittal:
   a. File Contractor's Notice of Substantial Completion and Request for Inspection.
   b. Approved Operation and Maintenance manuals received by Engineer minimum 30 days prior to scheduled training.
   c. Written request for Owner to witness each system pre-demonstration start-up.
      1) Request to be received by Owner minimum one (1) week before scheduled training of Owner's personnel on that system.
   d. Equipment installation and pre-demonstration start-up certifications.
   e. Letter verifying completion of all pre-demonstration start-up activities including receipt of all specified items from manufacturers or suppliers as final item prior to initiation of Demonstration Period.

1.4 COST OF START-UP

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

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

PART 3 - EXECUTION

3.1 GENERAL

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

3.2 PRE-DEMONSTRATION PERIOD

A. Completion of Construction Work:
   1. Complete the work to bring the Project and PCS to a state of substantial completion.

B. Equipment Start-up:
   1. Requirements for individual items of equipment are included in the Technical Specification Sections.
   2. Prepare the equipment so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
   3. Perform Equipment Start-up to extent possible without introducing product flow.
   4. Procedures include but are not necessarily limited to the following:
      a. Test or check and correct deficiencies of:
         1) Power, control, and monitoring circuits for continuity prior to connection to power source.
         2) Voltage of all circuits.
         3) Phase sequence.
         4) Cleanliness of connecting piping systems.
         5) Alignment of connected machinery.
         6) Vacuum and pressure of all closed systems.
         7) Lubrication.
         8) Valve orientation and position status for manual operating mode.
         9) Tankage for integrity using clean water.

10) Pumping equipment using clean water.
11) Instrumentation and control signal generation, transmission, reception, and response.
a) See Specification Section 40 90 00.
12) Tagging and identification systems.
13) All equipment: Proper connections, alignment, calibration and adjustment.

b. Calibrate all safety equipment.
c. Manually rotate or move moving parts to assure freedom of movement.
d. "Bump" start electric motors to verify proper rotation.
e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.
f. Documentation:
1) Prepare a log showing each equipment item subject to this paragraph and listing what is to be accomplished during Equipment Start-up.
2) Provide a place for the Contractor to record date and person accomplishing required work.
3) Submit completed document before requesting inspection for Substantial Completion certification.

5. Obtain certifications, without restrictions or qualifications, and deliver to Engineer:
a. Manufacturer's equipment installation check letters (sometimes referred to as Manufacturer’s Field Services report).
b. Instrumentation Supplier's Instrumentation Installation Certificate.

C. Personnel Training:
1. See individual equipment specification sections.
2. Conduct all personnel training after completion of Equipment Start-up for the equipment for which training is being conducted.
a. Personnel training on individual equipment or systems will not be considered completed unless:
1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.
2) No system malfunctions occur during training.
3) All provisions of field and classroom training specifications are met.
b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to Owner.
3. Field and classroom training requirements:
a. Hold classroom training on-site.
b. Notify each manufacturer specified for on-site training that the Owner reserves the right to video record any or all training sessions.
1) Organize each training session in a format compatible with video recording.
c. Training instructor qualification: Factory trained and familiar with giving both classroom and "hands-on" instructions.
d. Training instructors:
1) Be at classes on time.
2) Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule.
3) Normal time lengths for class periods can vary, but brief rest breaks should be scheduled and taken.
e. Organize training sessions into maintenance verses operation topics and identify on schedule.
f. Plan for minimum class attendance of 4 people at each session and provide sufficient classroom materials, samples, and handouts for those in attendance.
g. Instructors to have a typed agenda and well prepared instructional material.
1) The use of visual aids, e.g., films, pictures, and slides is recommended for use during the classroom training programs.

2) Deliver agendas to the Engineer a minimum of seven (7) days prior to the classroom training.
3) Provide equipment required for presentation of films, slides, and other visual aids.

h. In the on-site training sessions, cover the information required in the Operation and Maintenance Manuals submitted according to Specification Section 01 33 04 and the following areas as applicable to PCS's.
1) Operation of equipment.
2) Lubrication of equipment.
3) Maintenance and repair of equipment.
4) Troubleshooting of equipment.
5) Preventive maintenance procedures.
6) Adjustments to equipment.
7) Inventory of spare parts.
8) Optimizing equipment performance.
9) Capabilities.
10) Operational safety.
11) Emergency situation response.
12) Takedown procedures (disassembly and assembly).

i. Address above Paragraphs 1), 2), 8), 9), 10), and 11) in the operation sessions. Address above Paragraphs 3), 4), 5), 6), 7), and 12) in the maintenance sessions.

j. Maintain a log of classroom training provided including: Instructors, topics, dates, time, and attendance.

D. Complete the filing of all required submittals:
1. Shop Drawings.
2. Operation and Maintenance Manuals.
3. Training material.

E. Filing of Contractor's Notice of Substantial Completion and Request for Inspection of Project or PCS:
1. File the notice when the following have been completed:
a. Construction work (brought to state of Substantial Completion).
b. Equipment Start-up.
c. Personnel Training.
d. Submittal of required documents.
2. Engineer will review required submittals for completeness within 5 calendar days of Contractor's notice. If complete, Engineer will complete inspection of the Work, within 10 calendar days of Contractor's notice.
3. Engineer will inform Contractor in writing of the status of the Work reviewed, within 14 calendar days of Contractor's notice.
a. Work determined not meeting state of Substantial Completion:
1) Contractor: Correct deficiencies noted or submit plan of action for correction within 5 days of Engineer's determination.
2) Engineer: Reinspect work within 5 days of Contractor's notice of correction of deficiencies.
3) Reinspection costs incurred by Engineer will be billed to Owner who will deduct them from final payment due Contractor.
b. Work determined to be in state of tentative Substantial Completion: Engineer to prepare tentative "Engineer's Certificate of Substantial Completion."
c. Engineer's Certificate of Substantial Completion:
1) Certificate tentatively issued subject to successful Demonstration of functional integrity.
2) Issued for Project as a whole or for one or more PCS.
3) Issued subject to completion or correction of items cited in the certificate (punch list).
4) Issued with responsibilities of Owner and Contractor cited.
5) Executed by Engineer.

6) Accepted by Owner.
7) Accepted by Contractor.

d. Upon successful completion of Demonstration Period, Engineer will endorse certificate attesting to the successful demonstration, and citing the hour and date of ending the successful Demonstration Period of functional integrity as the effective date of Substantial Completion.

3.3 DEMONSTRATION PERIOD

A. General:

1. Demonstrate the functional integrity of the mechanical, electrical, and control interfaces of the respective equipment and components comprising the PCS as evidence of Substantial Completion.
2. Duration of Demonstration Period: 120 consecutive hours.
3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments to any equipment or systems that renders the affected equipment or system inoperative exceed 10 percent of the Demonstration Period, the demonstration of functional integrity will be deemed to have failed.
   a. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure.
   b. The new Demonstration Period shall have the same requirements and duration as the Demonstration Period previously conducted.
4. Conduct the demonstration of functional integrity under full operational conditions.
5. Owner will provide operational personnel to provide process decisions affecting plant performance.
   a. Owner's assistance will be available only for process decisions.
   b. Contractor will perform all other functions including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period.
6. Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional integrity of automatic and manual backup systems and alternate operating modes.
7. Time of beginning and ending any Demonstration Period shall be agreed upon by Contractor, Owner, and Engineer in advance of initiating Demonstration Period.
8. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions, provide final field instruction on select systems and to respond to any system problems or failures which may occur.
9. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles or any other item necessary to operate and demonstrate all systems being demonstrated.

END OF SECTION

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SECTION 01 78 36
WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements for warranties required in the various Specifications.
   2. Provisions addressing:
      a. Suppliers' standard warranties.
      b. Suppliers' special or extended 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 to Owner, Contractor, and the entity purchasing the item (if other than Contractor) by the entity issuing such warranty.
   4. Submit Suppliers' standard warranties and special warranties as Submittals in accordance with the Schedule of Submittals accepted by Engineer.

1.3 CONTRACTOR'S GENERAL WARRANTY AND CORRECTION PERIOD OBLIGATIONS

A. Contractor's General Warranty and Guarantee: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

B. Contractor's Warranty of Title: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

C. Correction Period: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

1.4 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 the entities indicated in this Specifications Section's Article 1.2.

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 and other beneficiaries (if any) of such warranty. 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 signature by material or equipment manufacturer, Owner, and other beneficiaries indicated in Article 1.2 of this Specifications Section. 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 signed 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 signed by item manufacturer, Owner, and other beneficiaries indicated in Article 1.2 of this Specifications Section, using the required form.
   4. Refer to the Specifications for content and requirements for submitting special warranties.

1.5 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 materials and equipment incorporated into the Work.

C. Warranty of Fitness-for-Purpose:
   1. Implied warranty of fitness-for-use for materials and equipment to be incorporated into the Work, as indicated in Laws and Regulations, remains in full force and effect.
   2. 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 item will be used, submit request for interpretation. Where appropriate, such request for interpretation shall indicate the apparent discrepancy and propose appropriate, alternative materials or equipment.

1.6 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' standard warranties and special warranties commence running on the date that the associated item is certified by Engineer as substantially complete in accordance with the Contract Documents. 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 set forth in 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' standard warranties is in accordance with the applicable standard warranty document accepted for the Project 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

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SECTION 01 81 10
WIND AND SEISMIC DESIGN CRITERIA

PART 1 - GENERAL

1.1 SUMMARY

A. This Section is intended to be used for all aspects of this project. When there are conflicts between this Section and other wind and seismic design criteria given in the Contract Documents, the more stringent loading shall control unless clarified in writing during the Bid phase. Obtain clarification of all conflicts in writing prior to construction.

B. Section Includes:
   1. The wind and seismic design criteria for this project including all items directly specified in the Contract Documents as well as all items that are specified to be designed by the Contractor and submitted for approval. Items include but are not necessarily limited to the following:
      a. Anchorage of mechanical and electrical equipment.
      b. Anchorage of pipe support structures.
      c. Design and anchorage of tanks and vessels fabricated off site and shipped to Project site.
      d. Packaged equipment systems.
      e. Other structures or items as specified or indicated in the Contract Documents.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Civil Engineers (ASCE):
      a. 7-02, Minimum Design Loads for Buildings and Other Structures.
   2. International Code Council (ICC):
      1) International Building Code and associated standards, including all latest California amendments, referred to herein as California Building Code.
   3. When referenced standards conflict the most stringent shall apply unless specifically indicated otherwise in the Contract Documents or unless approved otherwise in writing by the Engineer.

B. Qualifications:
   1. Engineer for Contractor designed items: Professional Engineer licensed in the State of California.

1.3 GENERAL DESIGN CRITERIA

A. This paragraph is applicable to both wind and seismic design criteria.

B. Design in accordance with the requirements of the Building Code and all applicable referenced standards.

C. Risk Category: III.

D. Design in accordance with the Building Code load combinations for service level or factored level at Contractor's option.
   1. Mechanical and electrical equipment loads will be considered dead loads.

1.4 SEISMIC DESIGN CRITERIA

A. Seismic Design Load Criteria:
   1. Design spectral acceleration at short period: S_{DS} = 1.0 g.
   2. Design spectral acceleration at 1-second period: S_{D1} = 0.572 g.
   3. Importance Factor: Ie = 1.25.

4. Component amplification factor, a_P: In accordance with ASCE 7-10, Tables_13.5-1 and 13.6-1.
5. Component response modification factor, R_P: In accordance with ASCE 7-10, Tables_13.5-1 and 13.6-1.
6. Component importance factor:
   a. $I_P = 1.0$.

B. Seismic forces must be resisted by direct load transfer through fasteners to all seismic resisting elements. Do not use connections that use friction to transfer seismic forces.

1.5 WIND DESIGN CRITERIA

A. Wind design load criteria:
1. Basic wind speed: 115 MPH.
2. Exposure category: C.
3. Topographic factor: $K_{zt} = 1.0$.
4. Wind importance factor: $I_w = 1.00$.
5. Building Description for wind design is Closed.

B. Wind forces must be resisted by direct load transfer through fasteners to wind resisting elements. Do not use connections that use friction to transfer wind forces.

1.6 SUBMITTALS

A. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Structural Calculations:
   a. Submit calculations for each Contractor designed item under the Specification Section number for that item.
   b. Indicate compliance with specific referenced documents of the Building Code.
   c. Provide basis of design and lateral analysis as required to derive all loads and to show system stability including compatibility of deflections and compatibility with allowable soil parameters as applicable.
   d. Indicate design load to each connection.
   e. Provide a complete lateral load resisting system that transfers all wind and seismic loads through a load path to ground.
   f. Sealed by a professional engineer licensed in the State of California.

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

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

END OF SECTION

SECTION 03 09 00
CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cast-in-place concrete and grout.
   2. Concrete mixes, proportioning, and source quality control for precast concrete.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 116R, Cement and Concrete Terminology.
      b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
      c. 212.3R, Chemical Admixtures for Concrete.
      d. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
      e. 304.2R, Placing Concrete by Pumping Methods.
      f. 305R, Hot Weather Concreting.
      g. 306R, Cold Weather Concreting.
      h. 318, Building Code Requirements for Structural Concrete.
      i. 347R, Recommended Practice for Concrete Formwork.
   2. ASTM International (ASTM):
      a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
      b. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
      c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      d. A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
      e. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
      f. C33, Standard Specification for Concrete Aggregates.
      g. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      h. C94, Standard Specification for Ready-Mixed Concrete.
      i. C138, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
      j. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
      k. C150, Standard Specification for Portland Cement.
      l. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.
      m. C172, Standard Practice for Sampling Freshly Mixed Concrete.
      n. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
      o. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
      p. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
      q. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
      r. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
      s. C494, Standard Specification for Chemical Admixtures for Concrete.

t. C496, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
u. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
v. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
w. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
x. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
y. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
z. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
aa. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
bb. E96, Standard Test Methods for Water Vapor Transmission of Materials.
cc. E329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
dd. E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

3. Corps of Engineers (COE):
   a. CRD-C572, Specifications for Polyvinylchloride Waterstops.
   b. CRD-C621, Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).
4. National Sanitation Foundation (NSF):
   a. 61, Drinking Water System Components – Health Effects.

B. Quality Control:
1. Concrete testing agency:
   a. Contractor to employ and pay for services of a testing laboratory to:
      1) Perform materials evaluation.
      2) Design concrete mixes.
      3) Perform testing of concrete placed during construction.
   b. Concrete testing agency to meet requirements of ASTM E329.
2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
   a. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.
3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
   a. Do not use revised concrete mixes until submitted to and approved by Engineer.
4. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.

C. Qualifications:
1. Ready mixed concrete batch plant certified by National Ready Mixed Concrete Association (NRMCA).
2. Formwork, shoring and reshoring for slabs and beams except where cast on ground to be designed by a professional engineer currently registered in the state where the Project is located.

1.3 DEFINITIONS

A. Per ACI 116R except as modified herein:
1. Concrete fill: Non-structural concrete.
2. Concrete Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.

3. Exposed concrete: Exposed to view after construction is complete.
4. Indicated: Indicated by Contract Documents.
5. Nonexposed concrete: Not exposed to view after construction is complete.
6. Required: Required by Contract Documents.
7. Specified strength: Specified compressive strength at 28 days.
8. Submitted: Submitted to Engineer.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Concrete mix designs proposed for use.
   a. Concrete mix design submittal to include the following information:
      1) Sieve analysis and source of fine and coarse aggregates.
      2) Test for aggregate organic impurities.
      3) Test for deleterious aggregate per ASTM C289.
      4) Proportioning of all materials.
      5) Type of cement with mill certificate for cement.
      6) Type of fly ash with certificate of conformance to specification requirements.
      7) Slump.
      8) Air content.
      9) Brand, type, ASTM designation, and quantity of each admixture proposed for use.
      10) 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
      11) Shrinkage test results.
      12) Standard deviation value for concrete production facility.
      13) Contractor’s proposed pour sequence. Provide 1/8 IN = 1 FT - 0 IN minimum scaled drawings indicating:
         a) Location of all construction joints.
         b) Location and type of waterstops.
         c) Any proposed deviations from Contract Drawings must be clearly indicated.
         d) Reproductions of Contract Drawings are acceptable for this purpose.
3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Manufacturers and types:
      1) Joint fillers.
      2) Curing agents.
      3) Chemical sealer.
      4) Bonding and patching mortar.
      5) Construction joint bonding adhesive.
      6) Non-shrink grout with cure/seal compound.
      7) Waterstops.
      8) Joint sealant.
4. Reinforcing steel:
   a. Show grade, sizes, number, configuration, spacing, location lap splice lengths, concrete cover, rebar supports and all fabrication and placement details.
   b. In sufficient detail to permit installation of reinforcing without having to make reference to Contract Drawings.
   c. Obtain approval of Shop Drawings by Engineer before fabrication.
   d. Mill certificates.
   e. Rebar details in accordance with ACI SP66.
5. Strength test results of in place concrete including slump, air content and concrete temperature.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage of Material:
   1. Cement and fly ash:
      a. Store in moistureproof, weathertight enclosures.
      b. Do not use if caked or lumpy.
   2. Aggregate:
      a. Store to prevent segregation and contamination with other sizes or foreign materials.
      b. Obtain samples for testing from aggregates at point of batching.
      c. Do not use frozen or partially frozen aggregates.
      d. Do not use bottom 6 IN of stockpiles in contact with ground.
      e. Allow sand to drain until moisture content is uniform prior to use.
   3. Admixtures:
      a. Protect from contamination, evaporation, freezing, or damage.
      b. Maintain within temperature range recommended by manufacturer.
      c. Completely mix solutions and suspensions prior to use.
   4. Reinforcing steel: Support and store all rebars above ground.

B. Delivery:
   1. Concrete:
      a. Prepare a delivery ticket for each load for ready-mixed concrete.
      b. Truck operator shall hand ticket to Owner's Representative at the time of delivery.
      c. Ticket to show:
         1) Mix identification mark.
         2) Quantity delivered.
         3) Amount of each material in batch.
         4) Outdoor temp in the shade.
         5) Time at which cement was added.
         6) Numerical sequence of the delivery.
         7) Amount of water added.
   2. Reinforcing steel:
      a. Ship to jobsite with attached plastic or metal tags with permanent mark numbers.
      b. Mark numbers to match Shop Drawing mark number.
   3. Handling of Epoxy-Coated Rebar:
      a. Use padded or nonmetallic slings and padded straps to protect coated reinforcement from damage.
      b. Handle bundled bars to prevent sagging that could damage the coating.
      c. Do not drop or drag rebars.
      d. Store on wooden cribbing.
      e. Coated rebars subject to rejection by Engineer if rebar coating has been damaged.

1.6 SITE CONDITIONS

A. Volatile Organic Compounds:
   1. Form release, curing compounds, and any other products to comply with regulations of: State of California.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
   1. Nonshrink, nonmetallic grout:
      a. Sika "SikaGrout 212."
      b. Euclid Chemial "NS Grout."

c. BASF Admixtures, Inc. "Masterflow 713."
d. Or equal.

2. Epoxy grout:
   a. BASF Admixtures, Inc. "Brutem MPG."
   b. Euclid Chemical Company, "E3-G."
   c. Fosroc, "Conbextra EPHF".
   d. Or equal.
3. Expansion joint fillers:
   a. Permaglaze Co.
   b. Rubatex Corp.
   c. Williams Products, Inc.
   d. Or equal.
4. Waterstops, PVC:
   a. Greenstreak Plastic Products, Inc.
   b. W.R.Meadows, Inc.
   c. Burke Company.
   d. Or equal.
5. Form coating:
   a. Richmond "Rich Cote."
   b. Industrial Lubricants "Nox-Crete Form Coating."
   c. Euclid Chemical "Eucoslip VOX."
   d. Or equal.
6. Prefabricated forms:
   a. Simplex "Industrial Steel Frame Forms."
   b. Symons "Steel Ply."
   c. Universal "Uniform."
   d. Or equal.
7. Chemical floor sealer, hardener, densifier:
   a. L&M Construction Chemicals Inc.
   b. Euclid Chemical Company.
   c. Dayton Superior.
8. Chemical sealer:
   a. L&M Construction Chemicals, Inc.
   b. Euclid Chemical Company.
   c. Dayton Superior.
   d. Or equal.
9. Bonding agent:
   a. Euclid Chemical Co.
   b. BASF Admixtures, Inc.
   c. L&M Construction Chemicals Inc.
   d. Or equal.

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

2.2 MATERIALS

A. All concrete mix materials, additives and coating, and grouting shall be NSF-61 approved. All concrete components that have a appoint of contact with water shall be NSF-61 approved.

B. Portland Cement: Conform to ASTM C150 Type I-II, Low Alkali.

C. Fly Ash:
1. ASTM C618, Class F or Class C.
2. Nonstaining.
   a. Hardened concrete containing fly ash to be uniform light gray color.
3. Maximum loss on ignition: 4 percent.
4. Compatible with other concrete ingredients.

5. Obtain proposed fly ash from a source approved by the State Highway Department in the state where the Project is located for use in concrete for bridges.
6. Do not use for precast concrete.

D. Admixtures:
1. Air entraining admixtures: ASTM C260.
2. Water reducing, retarding, and accelerating admixtures:
   a. ASTM C494 Type A through E.
   b. Conform to provisions of ACI 212.3R.
   c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no cost to Owner.
   d. Follow manufacturer's instructions.
   e. Use chloride free admixtures only.
3. Maximum total water soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials and admixtures by weight percent of cement:
   a. 0.10 all concrete.
4. Do not use calcium chloride.
5. Pozzolanic admixtures: ASTM C618.
6. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.

E. Water: Potable, clean, free of oils, acids and organic matter.

F. Aggregates:
1. Normal weight concrete: ASTM C33, except as modified below.
2. Fine aggregate:
   a. Clean natural sand.
   b. No manufactured or artificial sand.
3. Coarse aggregate:
   a. Crushed rock, natural gravel, or other inert granular material.
   b. Maximum amount of clay or shale particles: 1 percent.
4. Gradation of coarse aggregate:
   a. Lean concrete and concrete topping: Size #7.
   b. All other concrete: Size #57 or #67.

G. Concrete Grout:
1. Nonshrink nonmetallic grout:
   a. Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added.
   b. Grout to produce a positive but controlled expansion.
   c. Mass expansion not to be created by gas liberation.
   d. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.
   e. In accordance with COE CRD-C621.
2. Epoxy grout:
   a. 3-component epoxy resin system.
      1) Two liquid epoxy components.
      2) One inert aggregate filler component.
   b. Each component packaged separately for mixing at jobsite.

H. Reinforcing Steel:
1. Reinforcing bars: ASTM A615, Grade 60.
2. Welded wire reinforcement: ASTM A185.
   a. Minimum yield strength: 60,000 psi.
3. Column spirals: ASTM A82.

I. Forms:
1. Prefabricated or job built.
2. Wood forms:
   a. New 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.

b. Built-in-place or prefabricated type panel.
c. 4 x 8 FT sheets for built-in-place type except where smaller pieces will cover entire area.
d. When approved, plywood may be reused.

3. Metal forms:
   a. Metal forms excluding aluminum may be used.
   b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.
4. Chamfer strips: Clear white pine, surface against concrete planed.
5. Form ties:
   a. Removable end, permanently embedded body type with cones on outer ends not requiring auxiliary spreaders.
   b. Cone diameter: 3/4 IN minimum to 1 IN maximum.
   c. Embedded portion 1-1/2 IN minimum back from concrete face.
   d. If not provided with threaded ends, constructed for breaking off ends without damage to concrete.
   e. Provide ties with built-in waterstops at all walls that will be in contact with process liquid during plant operation.
6. Form release: Nonstaining and shall not prevent bonding of future finishes to concrete surface.
   a. Nontoxic 30 days after application.

J. Waterstops:
1. Plastic: COE CRD-C572.
2. Serrated with center bulb.
3. Thickness: 3/8 IN.
4. Length (general use): 6 IN unless indicated otherwise.
5. Expansion joints: Serrated with center tear web.
   a. Length: 9 IN.
   b. Thickness: 3/8 IN.
   c. Capable of withstanding 2 IN horizontal without rupturing.
6. Provide hog rings or grommets spaced at maximum 12 IN OC along the length of the water stop.
7. Provide factory made waterstop fabrications at all changes of direction, intersections and transitions leaving only straight butt splices for the field.

K. Chairs, Runners, Bolsters, Spacers, and Hangers:
1. Stainless steel, epoxy coated, or plastic coated metal.
   a. Plastic coated: Rebar support tips in contact with the forms only.

L. Vapor Retarder:
1. ASTM E1745, Class A, minimum 15 mil thickness.
2. Water vapor permeance: 0.03 maximum per ASTM E96.
3. Puncture resistance: ASTM D1709, Method B, 2200 grams.
4. Minimum tensile strength: 45 LBS/IN, ASTM D882.
5. Vapor retarder tape: As recommended by vapor retarder manufacturer.

M. Membrane Curing Compound:
1. ASTM C309, Type I-D.
2. Resin based, dissipates upon exposure to UV light.
3. Curing compound shall not prevent bonding of any future coverings, coatings or finishes.
4. Curing compounds used in water treatment plant construction to be nontoxic and taste and odor free.

N. Bonding Agent:
1. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.
2. Euclid Chemical Co. "Flex-Con."

3. BASF Admixtures, Inc. "Acryl-Set."
4. L&M Construction Chemicals "Everbond."
5. Thoro System Products "Acryl 60."

O. Expansion Joint Filler:
1. In contact with water:
   a. Closed cell neoprene.
   b. ASTM D1056, Class SC (oil resistant and medium swell) of 2 to 5 psi compression deflection (Grade SCE41).
2. Exterior driveways, curbs and sidewalks:
   a. Asphalt expansion joint filler.
   b. ASTM D994.
3. Other use:
   a. Fiber expansion joint filler.
   b. ASTM D1751.

2.3 CONCRETE MIXES

A. General:
1. All concrete to be ready mixed concrete conforming to ASTM C94.
2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
3. All concrete to be normal weight concrete.

B. Strength:
1. Provide specified strength and type of concrete for each use in structure(s) as follows:

TYPE	WEIGHT	SPECIFIED STRENGTH*
All concrete	Normal weight	4000 psi

* Minimum 28-day compressive strength.

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

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

2. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.

D. Slump - 4 IN maximum, 1 IN minimum:
1. Measured at point of discharge of the concrete into the concrete construction member.
2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
3. Pumped concrete:
   a. Provide additional water at batch plant to allow for slump loss due to pumping.
   b. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified above.
4. Determine slump per ASTM C143.

E. Selection of Proportions:
1. General:
   a. Proportion ingredients to:
      1) Produce proper workability, durability, strength, and other required properties.
      2) Prevent segregation and collection of excessive free water on surface.
2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

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

3. Substitution of fly ash: Maximum of 25 percent by weight of cement at rate of 1 LB fly ash for 1 LB of cement.
4. Sand cement grout:
   a. Three parts sand.
   b. One part Portland cement.
   c. Entrained air: Six percent plus or minus one percent.
   d. Sufficient water for required workability.
   e. Minimum 28-day compressive strength: 3,000 psi.
5. Pan stair fill:
   a. Coarse aggregate: 100 percent passing a 1/2 IN sieve.
   b. Proportions:
      1) 1 sack cement.
      2) 150 LBS coarse aggregate.
      3) 150 LBS fine aggregate (sand).
   c. Adjust mix to obtain satisfactory finishing.
6. Normal weight concrete:
   a. Proportion mixture to provide desired characteristics using one of methods described below:
      1) Method 1 (Trial Mix): Per ACI 318, Chapter 5, except as modified herein.
         a) Air content within range specified above.
         b) Record and report temperature of trial mixes.
         c) Proportion trial mixes per ACI 211.1.
      2) Method 2 (Field Experience): Per ACI 318, Chapter 5, except as modified herein:
         a) Field test records must be acceptable to Engineer to use this method.
         b) Test records shall represent materials, proportions and conditions similar to those specified.
7. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of Paragraph 5.3 of ACI 318 using the standard deviation of the proposed concrete production facility as described in Paragraph 5.3.1 of ACI 318.

F. Allowable Shrinkage: 0.048 percent per ASTM C157.

G. Allowable Shrinkage: 0.040 percent at 21 days per ASTM C157 as modified by SEAOC.

PART 3 - EXECUTION

3.1 FORMING AND PLACING CONCRETE

A. Formwork:
1. Contractor is responsible for design and erection of formwork.
2. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
   a. Allowable tolerances: As recommended in ACI 347R.
3. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
   a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
   b. Do not place floor drains through beams.
4. Openings: Provide openings in formwork to accommodate work of other trades.

a. Accurately place and securely support items built into forms.

5. Chamfer strips: Place 3/4 IN chamfer strips in forms to produce 3/4 IN wide beveled edges on permanently exposed corners of members.
6. Clean and adjust forms prior to concrete placement.
7. Tighten forms to prevent mortar leakage.
8. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.

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

C. Construction, Expansion, and Contraction Joints:
   1. Provide at locations indicated.
   2. Locate wall vertical construction joints at 30 FT maximum centers and wall horizontal construction joints at 10 FT maximum centers.
   3. Locate construction joints in floor slabs and foundation base slabs so that concrete placements are approximately square and do not exceed 2500 SF.
      a. Maximum side dimension of slab placement to be less than:
         1) Twice the length of the short side.
         2) 40 FT.
   4. Locate construction joints in columns and walls:
      a. At the underside of beams, girders, haunches, drop panels, column capitals, and at floor panels.
      b. Haunches, drop panels, and column capitals are considered part of the supported floor or roof and shall be placed monolithically therewith.
      c. Column based need not be placed monolithically with the floor below.
   5. Locate construction joints in beams and girders:
      a. At the middle of the span, unless a beam intersects a girder at that point.
      b. If the middle of the span is at an intersection of a beam and girder, offset the joint in the girder a distance equal to twice the beam width.
      c. Provide satisfactory means for transferring shear and other forces through the construction joint.
   6. Locate construction joints in suspended slabs:
      a. At or near the center of span in flat slab or T-beam construction.
      b. Do not locate a joint between a slab and a concrete beam or girder unless so indicated on Drawings.
   7. In pan-formed joists:
      a. At or near span center when perpendicular to the joists.
      b. Centered in the slab, midway between joists, when parallel to the joists.

8. Install construction joints perpendicular to main reinforcement with all reinforcement continued across construction joints.
9. At least 48 HRS shall elapse between placing of adjoining concrete construction.
10. Thoroughly clean and remove all laitance and loose and foreign particles from construction joints.
11. Before new concrete is placed, coat all construction joints with an approved bonding adhesive used and applied in accordance with manufacturer's instructions.

D. Embedments:
1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
2. Use setting diagrams, templates and instructions for locating and setting.
3. Secure waterstops in correct position using hog rings or grommets spaced along the length of the waterstop and wire tie to adjacent reinforcing steel.

E. Placing Concrete:
1. Place concrete in compliance with ACI 304R and ACI 304.2R.
2. Place in a continuous operation within planned joints or sections.
3. Begin placement when work of other trades affecting concrete is completed.
4. Place concrete by methods which prevent aggregate segregation.
5. Do not allow concrete to free fall more than 4 FT.
6. Where free fall of concrete will exceed 4 FT, place concrete by means of tremie pipe or chute.

F. Consolidation: Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.

G. Protection:
1. Protect concrete from physical damage or reduced strength due to weather extremes.
2. In cold weather comply with ACI 306R except as modified herein.
a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.
b. Minimum concrete temperature at the time of mixing:

OUTDOOR TEMPERATURE AT PLACEMENT (IN SHADE)	CONCRETE TEMPERATURE AT MIXING
Below 30 DegF	70 DegF
Between 30-45 DegF	60 DegF
Above 45 DegF	50 DegF

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

H. Curing:
1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.
2. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.

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

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

3.2 CONCRETE FINISHES

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

B. Surfaces Exposed to View:
1. Provide a smooth finish for exposed concrete surfaces and surfaces that are:
    a. To be covered with a coating or covering material applied directly to concrete.
    b. Scheduled for grout cleaned finish.
2. Remove fins and projections, and patch voids, air pockets, and honeycomb areas with cement grout.
3. Fill tie holes with nonshrink nonmetallic grout.

C. Surfaces Not Exposed to View:
1. Patch voids, air pockets and honeycomb areas with cement grout.
2. Fill tie holes with nonshrink nonmetallic grout.

D. Grout Cleaned Finish:
1. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient bonding agent/water mixture to produce a grout with the consistency of thick paint.
    a. White Portland cement shall be substituted for gray Portland cement to produce a color that matches color of surrounding concrete as determined by trial patch for areas not to be painted.
2. Wet surface of concrete to prevent absorption of water by grout and uniformly apply grout with brushes or spray gun.

3. Immediately scrub the surface with a cork float or stone to coat and fill air bubbles and holes.
4. While grout is still plastic, remove all excess grout by working surface with rubber float, sack or other approved means.
5. After the surface whitens from drying, rub vigorously with clean burlap.
6. Keep final finish damp for a minimum of 36 HRS after final rubbing.

E. Slab Float Finish:
1. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
2. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation.
3. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two different angles.
4. Cut down all high spots and fill all low spots during this procedure to produce a surface within Class B tolerance throughout.
5. Refloat slab immediately to a uniform sandy texture.

F. Troweled Finish:
1. Float finish surface.
2. Next power trowel, and finally hand trowel.
3. Produce a smooth surface which is relatively free of defects with first hand troweling.
4. Perform additional trowelings by hand after surface has hardened sufficiently.
5. Final trowel when a ringing sound is produced as trowel is moved over surface.
6. Thoroughly consolidate surface by hand troweling.
7. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Class A tolerance.
8. On surfaces intended to support floor coverings remove any defects of sufficient magnitude that would show through floor covering by grinding.

G. Broom Finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom across surface.

H. Apply chemical floor hardener to permanently exposed interior concrete floor slab surfaces where indicated.
1. Apply in accordance with manufacturer's instructions.

3.3 GROUT

A. Preparation:
1. Nonshrinking nonmetallic grout:
a. Clean concrete surface to receive grout.
b. Saturate concrete with water for 24 HRS prior to grouting.
2. Epoxy grout: Apply only to clean, dry, roughened, sound surface.

B. Application:
1. Nonshrinking nonmetallic grout:
a. Mix in a mechanical mixer.
b. Use no more water than necessary to produce flowable grout.
c. Place in accordance with manufacturer's instructions.
d. Completely fill all spaces and cavities below the bottom of baseplates.
e. Provide forms where baseplates and bedplates do not confine grout.
f. Where exposed to view, finish grout edges smooth.
g. Except where a slope is indicated on Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.
h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.
i. Wet cure grout for seven (7) days, minimum.
2. Rock anchors:
a. See Item 1 above.

b. If rodded:
1) Fill each hole so that it overflows when anchor bar is inserted.
2) Force anchor bars into place.
c. If pressure placed, set anchor bar before grouting.
d. Take special care to avoid any movement of anchors that have been placed.
3. Epoxy grout:
a. Mix and place in accordance with manufacturer's instructions.
b. Completely fill all cavities and spaces around dowels and anchors without voids.
c. Obtain manufacturer's field technical assistance as required to ensure proper placement.

3.4 FIELD QUALITY CONTROL

A. Owner will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.
1. Contractor to cooperate with Owner in obtaining and testing samples.

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

C. Evaluation of Tests:
1. Strength test results:
a. Average of 28-day strength of two cylinders from each sample.
1) If one cylinder manifests evidence of improper sampling, molding, handling, curing or testing, strength of remaining cylinder will be test result.
2) If both cylinders show any of above defects, test will be discarded.

D. Acceptance of Concrete:
1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:
a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.
2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures as directed by Engineer.
a. Perform additional tests and/or corrective measures at no additional cost to Owner.

3.5 SCHEDULES

A. Form Types:
1. Surfaces exposed to view:

a. Prefabricated or job-built wood forms.
b. Laid out in a regular and uniform pattern with long dimensions vertical and joints aligned.
c. Produce finished surfaces free from offsets, ridges, waves, and concave or convex areas.
d. Construct forms sufficiently tight to prevent leakage of mortar.

2. Surfaces normally submerged or not normally exposed to view: Wood or steel forms sufficiently tight to prevent leakage of mortar.
3. Other types of forms may be used:
   a. For surfaces not restricted to plywood or lined forms.
   b. As backing for form lining.

B. Grout:
1. Nonshrinking nonmetallic grout: General use.
2. Epoxy grout:
   a. Grouting of dowels and anchor bolts into existing concrete.
   b. Other uses indicated on Drawings.
3. Sand cement grout: Keyways of precast members.

C. Concrete:
1. Precast concrete: Where indicated on Drawings.
2. Concrete fill: Where indicated on Drawings.
3. Normal weight concrete: All other concrete.

D. Concrete Finishes:
1. Grout cleaned finish: All surfaces exposed to view.
2. Slab finishes:
   a. Use following finishes as applicable, unless otherwise indicated:
      1) Floated finish: Surfaces intended to receive roofing, concrete topping, lean concrete, concrete fill and waterproofing.
      2) Troweled finish: Interior floor slabs, exposed roof slabs and base slabs of structures, equipment bases, and column bases.
      3) Broom finish: Sidewalks, docks, concrete stairs, and ramps.

END OF SECTION

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SECTION 03 15 19
ANCHORAGE TO CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Requirements for all cast-in-place anchor bolts, anchor rods, reinforcing adhesive anchorage, and post-installed concrete anchors required for the Project but not specified elsewhere in the Contract Documents.
2. Design of all concrete anchors not indicated on the Drawings including, but not limited to, installation of anchors into concrete for the following structural and nonstructural components:
   a. Structural members and accessories.
   b. Metal, wood, and plastic fabrications.
   c. Architectural components.
   d. Mechanical and electrical equipment and components.
   e. Plumbing, piping, and HVAC work.
   f. All other components requiring attachment to concrete.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. American Concrete Institute (ACI):
   a. 318, Building Code Requirements for Structural Concrete and Commentary.
   b. 350, Code Requirements for Environmental Engineering Concrete Structures and Commentary.
2. American Concrete Institute/Concrete Reinforcing Steel Institute (ACI-CRSI):
   a. Adhesive Anchor Installation Certification Program: Adhesive Anchor Installer.
3. American Institute of Steel Construction (AISC):
   a. 303, Code of Standard Practice for Steel Buildings and Bridges.
4. ASTM International (ASTM):
   a. A36, Standard Specification for Carbon Structural Steel.
   b. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
   c. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   d. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   e. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   f. A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
   g. A563, Standard Specification for Carbon and Alloy Steel Nuts.
   h. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   i. F436, Standard Specification for Hardened Steel Washers.
   j. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   k. F594, Standard Specification for Stainless Steel Nuts.
   l. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
5. ICC Evaluation Service (ICC-ES):
   a. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
   b. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
6. Building code:
   a. International Code Council (ICC):

1) California building Code, 2016 Edition, based on the International Building Code, 2015 Edition and associated standards, including all amendments, referred to herein as Building Code.

B. Qualifications:
   1. Anchor designer for Contractor-designed post-installed anchors and cast in place anchorage shall be a professional structural/civil engineer licensed in the State of California.
   2. Installer for post-installed anchors shall be trained by the manufacturer or certified by a training program approved by the Engineer.

C. Post-installed anchors and related materials shall be listed by the following agencies:
   1. ICC-ES.

1.3 DEFINITIONS

A. Adhesive Anchors:
   1. Post-installed anchors developing their strength primarily from chemical bond between the concrete and the anchor.
   2. Includes anchors using acrylics, epoxy and other similar adhesives.

B. Anchor Bolt: Any cast-in-place anchorage that is made of a headed (i.e. bolt) material.

C. Anchor Rod: Any cast-in-place or post-installed anchorage made from unheaded, threaded, rod or deformed bar material.

D. Concrete Anchor: Generic term for either an anchor bolt or an anchor rod.

E. Galvanizing: Hot-dip galvanizing per ASTM A123 or ASTM A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

F. Hardware: As defined in ASTM A153.

G. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

H. MPII: Manufacturer’s printed installation instructions.

I. Mechanical Anchors:
   1. Post-installed anchors developing their strength from attachment other than thru adhesives or chemical bond to concrete.
   2. Includes expansion anchors, expansion sleeve, screw anchors, undercut anchors, specialty inserts and other similar types of anchorages.
   3. Drop-in anchors and other similar anchors are not allowed.

J. Post-Installed Anchor: Any adhesive or mechanical anchor installed into previously placed and adequately cured concrete.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that submitted products meet requirements of referenced standards.
      b. Manufacturer material data sheet for each anchor.
         1) Clearly indicate which products on the data sheet are proposed for use on the Project.
      c. Manufacturer's printed installation instructions.
      d. Current ICC-ES report for each post-installed anchor system indicating the following:
         1) Certification that anchors meet all requirements indicated in this Specification.

2) Performance data showing that anchor is approved for use in cracked concrete.
3) Seismic design categories for which anchor system has been approved.
4) Required installation procedures.
5) Special inspection requirements for installation.

e. Anchorage layout drawings and details:
1) Indicate anchor diameter, embedment, length, anchor type, material and finish.
2) Drawings showing location, configuration, spacing and edge distance.

f. Contractor Designed Post-Installed Anchors:
1) Show diameter and embedment depth of each anchor.
2) Indicate compliance with ACI 350 Appendix D.
3) Design tension and shear loads used for anchor design.
4) Engineering design calculations:
a) Indicate design load to each anchor.
b) When the design load is not indicated on Drawings, include calculations to develop anchor forces based on Design Criteria listed herein.
c) Sealed and signed by contractor’s professional structural/civil engineer.
d) Calculations will be submitted for information purposes only.
5) Type of post-installed anchor system used.
a) Provide manufacturer's ICC-ES report for the following:
(1) Mechanical anchorage per ICC-ES AC193.
(2) Adhesive anchorage per ICC-ES AC308.

B. Samples:
1. Representative samples of concrete anchors may be requested by Engineer. Review will be for type and finish only. Compliance with all other requirements is exclusively the responsibility of the Contractor.

C. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Certification of qualifications for each installer of post-installed anchors.
a. Indicate successful completion or certification for each type of approved post-installed anchor as required by the Contract Documents.
b. Provide one of the following for each type of anchor, as required by this specification section:
1) Letter from manufacturer documenting successful training completion.
2) Certification of completion for Engineer approved program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to job site in manufacturer’s or distributor’s packaging undamaged and complete with installation instructions.

B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

C. Protect and handle materials in accordance with manufacturer’s recommendations to prevent damage or deterioration.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cast-in-place Concrete Anchors:
1. All cast-in-place concrete anchors:
a. Stainless steel with matching nut and washer.
b. Submerged application: ASTM F593, Type 316.
c. Non-submerged application: ASTM F593, Type 304 or Type 316.

B. Post-Installed Mechanical and Adhesive Concrete Anchors:
   1. Stainless steel with matching nut and washer.
   2. Submerged application: ASTM F593, Type 316.
   3. Non-submerged application: ASTM F593, Type 304 or Type 316.

C. Reinforcement: See Section 03 09 00.

D. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

E. Deformed Bar Anchors: ASTM A496 with minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.

F. Washers:
   1. If stainless steel anchorage is being used for cast-in-place anchorage, furnish washers of the same material and alloy as in the accompanying anchorage.
   2. Plate washers: Minimum 1/2 IN thick fabricated ASTM A36 square plates as required.
   3. Follow manufacturer's requirements for all post-installed anchorage.

G. Nuts:
   1. If stainless steel anchorage is being used for cast-in-place anchorage, nuts shall meet ASTM F594 and be the matching material and alloy as in the accompanying anchorage.
   2. Follow manufacturer's requirements if using post-installed anchorage.

H. Dissimilar Materials Protection: See Specification Section 09 91 00.

2.2 CONTRACTOR DESIGNED ANCHORAGE

A. Acceptable Manufacturers:
   1. Post-installed anchor systems for the listed manufacturers will be considered only if a current ICC-ES evaluation report is submitted in accordance with the SUBMITTALS Article in PART 1 of this Specification Section and if the anchor system is approved by the Engineer.
      a. Hilti.
      b. Powers Fasteners.
      c. Simpson Strong-Tie.
   2. Submit request for substitution in accordance with Specification Section 01 25 13.

B. Contractor shall design the anchorage when any of the following occur:
   1. Design load for concrete anchorage is shown on the Drawings.
   2. When specifically required by the Contract Documents.
   3. When an anchorage is required but not specified in the Drawings.
   4. When anchorage is shown on Drawings other than Structural Drawings.

C. Anchorage Design Loads:
   1. Determine all of the design loads, including wind and seismic loads, per the Building Code.
      a. Anchorage of equipment and non-structural components: Use the actual dead and operating loads provided by the manufacturer.

D. When Contract Drawings, other than the Structural Drawings, indicate an anchor diameter or length, the Contractor design shall incorporate these as "minimums."

E. Cast-in-Place Concrete Anchors:
   1. Provide the material, nominal diameter, embedment length, spacing, edge distance and design capacity to resist the calculated load based on the requirements given in the Building Code ACI 350, Appendix D.
   2. Design assuming cracked concrete.

F. Post-installed Concrete Anchors:
   1. Provide the manufacturer's system name/type, nominal diameter, embedment depth, spacing, minimum edge distance, cover, and design capacity to resist the specified or calculated load based on requirements given in the Building Code, ACI 350, Appendix D and current ICC-ES report, for the anchor to be used.

2.3 ENGINEER DESIGNED ANCHORAGE

A. When the size, length and details of anchorages are shown on Contract Structural Drawings, Contractor design of anchorage is not required unless otherwise indicated.

B. Acceptable Manufacturers:
   1. Additional newer post-installed anchor systems for the listed manufacturers will be considered only if a current evaluation agency report is submitted in accordance with the SUBMITTALS Article in PART 1 of this Specification Section, the anchor system is certified by ICC-ES for cracked concrete conditions, and if approved by the Engineer.
   2. Mechanical Anchors:
      a. Hilti:
         1) Kwik Bolt 3 (ICC-ES ESR-2302).
   3. Adhesive Concrete Anchors:
      a. Hilti:
         1) HIT RE 500-SD (ICC-ES ESR-2322).
         2) HIT RE 500 V3 (ICC ESR-3814).
   4. Screw Concrete Anchors:
      a. Hilti: Kwik HUS-EZ Screw (ICC-ES ESR-3027).
   5. Submit request for substitution in accordance with Specification Section 01 25 13.
      a. Substitution request to indicate the proposed anchor has the at least the same tension and shear strength as the specified anchor installed as indicated in the Contract Drawings.
      b. Calculations to be stamped by a Professional Engineer registered in the state that the Project is located in.

PART 3 - EXECUTION

3.1 GENERAL

A. Cast-in-Place Anchorage:
   1. Use where anchor rods or bolts are indicated on the Drawings, unless another anchor type is approved by the Engineer.
   2. Provide concrete anchorage as shown on the Drawings or as required to secure components to concrete.

B. Adhesive Anchorage:
   1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
   2. May be used where subjected to vibration or where buried or submerged.
   3. Do not use in overhead applications or sustained tension loading conditions such as utility hangers.
   4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.

C. Mechanical Anchorage:
   1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
   2. Do not use where subjected to vibration.
   3. May be used in overhead applications.
   4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.

D. Do not use powder actuated fasteners and other types of bolts and fasteners not specified herein for structural applications unless approved by the Engineer or specified in Contract Documents.

3.2 PREPARATION

A. Provide adequate time to allow for proper installation and inspection prior to placing concrete for cast-in-place concrete anchorage.

B. Prior to installation, inspect and verify areas and conditions under which concrete anchorage is to be installed.
   1. Notify Engineer of conditions detrimental to proper and timely completion of work.
   2. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

C. Special Inspection is required in accordance with the Building Code for all concrete anchorage.
   1. Notify the Special Inspector that an inspection is required prior to concrete placement (or during post-installed anchorage installation).
   2. See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section for additional requirements.

D. Post-installed anchor manufacturer's representative shall demonstrate and observe the proper installation procedures for the post-installed anchors at no additional expense to the Owner.
   1. Follow such procedures to assure acceptable installation.

3.3 INSTALLATION

A. Tie cast-in-place anchorage in position to embedded reinforcing steel using wire.
   1. Tack welding of anchorage is prohibited.
   2. Coat the projected portion of carbon steel anchors and nut threads with a heavy coat of clean grease after concrete has cured.
   3. Anchorage location tolerance shall be in accordance with AISC 303.
   4. Provide steel or durable wood templates for all column and equipment anchorage.
      a. Templates to be placed above top of concrete and not impede proper concrete placement and consolidation.

B. Unless noted or specified otherwise:
   1. Connect aluminum and steel members to concrete and masonry using stainless steel cast-in-place anchorage unless shown otherwise.
      a. Provide dissimilar materials protection per Specification Section 09 91 00.
   2. Provide washers for all anchorage.
   3. Where exposed, extend threaded anchorage a maximum of 3/4 IN and a minimum of 1/2 IN above the top of the fully engaged nut.
      a. If anchorage is cut off to the required maximum height, threads must be dressed to allow nuts to be removed without damage to the nuts.

C. Do the following after nuts are snug-tightened down:
   1. If using post-installed anchorage, follow MPII.
   2. Upset threads of anchorage to prevent nuts from backing off.
      a. Provide double nut or lock nut in lieu of upset threads for items that may require removal in the future.
   3. For all other cast-in-place anchorage material, tighten nuts down an additional 1/8 turn to prevent nuts from backing off.
   4. If two (2) nuts are used per concrete anchor above the base plate, tighten the top nut an additional 1/8 turn to "lock" the two (2) nuts together.
   5. If using post-installed anchorage, follow manufacturer's installation procedures.

D. Assure that embedded items are protected from damage and are not filled in with concrete.

E. Secure architectural components such that it will not be aesthetically distorted nor fasteners overstressed from expansion, contraction or installation.

F. Coat aluminum surfaces in contact with dissimilar materials in accordance with Specification Section 09 91 00.

G. Repair damaged galvanized surfaces in accordance with ASTM A780.
   1. Prepare damaged surfaces by abrasive blasting or power sanding.
   2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions and ASTM A780.

H. For post-installed anchors, comply with the MPII on the hole diameter and depth required to fully develop the tensile strength of the anchor or reinforcing bar.
   1. Use hammer drills to create holes.
   2. Properly clean out the hole per the ICC-ES reports utilizing a non-metallic fiber bristle brush and compressed air or as otherwise required to remove all loose material from the hole prior to installing the anchor in the presence of the Special Inspector.

3.4 CLEANING

A. After concrete has been placed, remove protection and clean all anchorage of all concrete, dirt, and other foreign matter.

B. Provide surface acceptable to receive field applied paint coatings when specified in Specification Section 09 91 00.

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be supplied under work of other Specification Sections.
2. Design of all temporary bracing not indicated on Drawings.
3. Design of systems and components, including but not limited to:
   a. Stairs at the Control building.
   b. Landings at the Control building.
   c. Ladders.
   d. Modular framing system.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. Aluminum Association (AA):
   a. ADM 1, Aluminum Design Manual.
   b. DAF 45, Designation System for Aluminum Finishes.
2. American Association of State Highway and Transportation Officials (AASHTO):
   a. HB, Standard Specifications for Highway Bridges.
3. American Institute of Steel Construction (AISC):
   a. 325, Manual of Steel Construction.
   b. 360, Specifications for Structural Steel Buildings (referred to herein as AISC Specification).
4. American National Standards Institute (ANSI):
   a. A14.3, Ladders - Fixed - Safety Requirements.
5. American Society of Civil Engineers (ASCE):
   a. 7, Minimum Design Loads for Buildings and Other Structures.
6. ASTM International (ASTM):
   a. A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   b. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   c. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
   d. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   e. A992, Standard Specification for Steel for Structural Shapes.
   f. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   g. B26, Standard Specification for Aluminum-Alloy Sand Castings.
   h. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   i. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   j. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
   k. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
   l. B632, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
   m. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
   n. F467, Standard Specification for Nonferrous Nuts for General Use.
   o. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.

p. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
q. F835, Standard Specification for Alloy Steel Socket Button and Flat Countersunk Head Cap Screws.
r. F879, Standard Specification for Stainless Steel Socket Button and Flat Countersunk Head Cap Screws.
s. F1789, Standard Terminology for F16 Mechanical Fasteners.

7. American Welding Society (AWS):
   a. A5.1/A5.1M, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
   b. D1.1, Structural Welding Code - Steel.
   c. D1.2, Structural Welding Code - Aluminum.
   d. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
   e. D10.18, Guide for Welding Ferritic/Austenitic Duplex Stainless Steel Piping and Tubing.
8. National Association of Architectural Metal Manufacturers (NAAMM):
   a. AMP 510, Metal Stairs Manual.
   b. AMP 555, Code of Standard Practice for the Architectural Metal Industry (Including Miscellaneous Iron).
   c. MBG 531, Metal Bar Grating Manual.
9. NACE International (NACE).
10. Nickel Development Institute (NiDI):
    a. Publication 11 007, Guidelines for the welded fabrication of nickel-containing stainless steels for corrosion resistant services.
11. Occupational Safety and Health Administration (OSHA):
    a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
12. Building code:
    a. International Code Council (ICC):
       1) International Building Code and associated standards, including all California latest amendments, referred to herein as California Building Code.

B. Qualifications:
1. Qualify welding procedures and welding operators in accordance with AWS.
2. Fabricator shall have minimum of 10 years experience in fabrication of metal items specified.
3. Engineer for contractor-designed systems and components: Professional structural engineer licensed in the State of California.

1.3 DEFINITIONS

A. Fasteners: As defined in ASTM F1789.

B. Hardware: As defined in ASTM A153/A153M.

C. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Fabrication and/or layout drawings and details:
   a. Submit drawings for all fabrications and assemblies.
      1) Include erection drawings, plans, sections, details and connection details.
   b. Identify materials of construction, shop coatings and third party accessories.
3. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's installation instructions.
c. Provide manufacturer's standard allowable load tables for the following:
1) Grating.
2) Castings, trench covers and accessories.
3) Modular framing systems.
4) Alternating tread stairs.
d. Provide ICC report on the following:
1) Mechanical anchor bolts.
2) Adhesive anchor bolts.

4. Contractor designed systems and components:
a. Certification that manufactured units meet all design loads specified.
b. Shop Drawings and engineering design calculations:
1) Indicate design live loads.
2) Sealed by a licensed professional engineer, registered in the State of California.
3) Engineer will review for general compliance with Contract Documents.
c. Contractor designed systems and components include the following:
1) Metal Stairs and associated landings at the Control building.
2) Ladders.

B. Contract Closeout Information:
1. Operation and Maintenance Data:
a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle fabrications to avoid damage.

B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Abrasive stair nosings (embedded in concrete stairs):
a. American Safety Tread.
b. Balco.
2. Headed studs and deformed bar anchors:
a. Nelson Stud Welding Div., TRW Inc.
b. Stud Welding Products, Inc.
3. Mechanical anchor bolts:
a. See Section 03 15 19.
4. Epoxy adhesive anchor bolts:
a. See Section 03 15 19.
5. Manhole steps:
a. Neenah Foundry.
6. Ladder safety extension post:
a. Bilco.
7. Alternating tread stair:

a. Lapeyre Stair.

8. Ladder fall protection system:
   a. DBI/SALA.
   b. Miller Equipment.
   c. North Specialty Products.
9. Ladder security door:
   a. O'Keeffe's, Inc.

B. No like, equivalent or "or-equal" item {or substitution} is permitted.

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

2.2 MATERIALS

A. Stainless Steel:
   1. Stainless steel in welded applications: Low carbon 'L' type.
   2. Minimum yield strength of 30,000 psi and minimum tensile strength of 75,000 psi.
      a. Bars, shapes: ASTM A276, Type 304.
      b. Tubing and pipe: ASTM A269, ASTM A312 or ASTM A554, Type 304 or 316.
      c. Strip, plate and flat bars: ASTM A666, Type 304 or 316.
      d. Bolts and nuts: ASTM F593, Type 304 or 316.
   3. Minimum yield strength of 25,000 psi and minimum tensile strength of 70,000 psi.
      a. Strip, plate and flat bar for welded connections, ASTM A666, Type 304L or 316L.
   4. Welding electrodes: In accordance with AWS for metal alloy being welded.

B. Aluminum:
   1. Alloy 6061-T6 marine grade, 32,000 psi tensile yield strength minimum.
      a. ASTM B221 and ASTM B308 for shapes including beams, channels, tubes, angles, tees and zees.
   2. ASTM F468, alloy 2024 T4 for bolts.
   3. ASTM F467, alloy 2024 T4 for nuts.
   4. Electrodes for welding aluminum: AWS D1.2, filler alloy 4043 or 5356.
   5. Coat all aluminum materials in contact with dissimilar materials with coatings as specified in Section 09 91 00.

C. Washers: Same material and alloy as found in accompanying bolts and nuts.
   1. For washers at dissimilar metals, provide isolating washers and sleeves as manufactured by PSI, or equal.

D. Embedded Anchor Bolts:
   1. Stainless steel 316L.

E. Mechanical Anchor Bolts and Adhesive Anchor Bolts:
   1. Stainless steel 316L.

F. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

G. Deformed Bar Anchors: ASTM A1064 with a minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.

H. Iron and Steel Hardware: stainless steel 316L.

2.3 MANUFACTURED UNITS

A. Ladders:
   1. General:
      a. Fully welded type.
         1) All welds to be full penetration welds, unless otherwise specified.
      b. All ladders of a particular material shall have consistent construction and material shapes and sizes unless noted otherwise on the Drawings.

c. Design ladder in accordance with OSHA Standards, ANSI A14.3, ASCE 7 and applicable Building Codes.
d. Ladders shall be designed to support a minimum concentrated live load of 300 LBS at any point to produce the maximum stress in the member being designed.
    1) Apply additional 300 LB loads for each section of ladder exceeding 10 FT.
e. Maximum allowable stresses per AA ADM 1.
f. Maximum lateral deflection: Side rail span/240 when lateral load of 100 LBS is applied at any location.

2. Material:
    a. Aluminum.
    b. Finish:
        1) Mill.
            a) Anodized, AA DAF 45: AA-M10C22A41 clear.
3. Rails:
    a. Round pipe or rectangular tubing:
        1) Round pipe:
            a) 1-1/2 IN nominal diameter.
            b) Schedule 80.
    b. Spacing:
        1) Minimum clear distance between rails to be 18 IN.
        2) Step-through ladder extensions: 24 IN, centerline to centerline.
    c. Provide cap at exposed top and bottom of side rails.
        1) Provide weep holes as necessary to prevent the accumulation of moisture within hollow members.
    d. Extend side rails of step-through ladders a minimum of 42 IN above the landing.
4. Rungs:
    a. Minimum 1 IN DIA or 1 IN square solid bar.
        1) Integral non-slip finish on all sides.
            a) Non-slip finish: Coarse knurling or extruded serrations.
            b) Shop or field-applied grit tape and cap type non-slip finishes are not acceptable.
    b. Rungs shall penetrate inside wall of side rails.
        1) Do not extend rungs beyond the outside face of the side rail.
        2) Provide fillet weld all around rung at inside face of side rail and plug weld at outside face of side rail.
    c. Rung spacing:
        1) Uniform, 12 IN.
        2) Top rung shall be level with landing or platform.
            a) Where top of ladder terminates at grating cover, floor access door, roof hatch or similar condition; locate top rung as close as practicable to, but not more than 6 IN below, adjacent walking surface.
        3) Spacing of bottom rung from grade or platform may vary but shall not exceed 14 IN.
5. Brackets:
    a. Angle or bent plate brackets welded to side rails:
        1) 3/8 IN by 2-1/2 IN by length required.
        2) Provide punched holes for 3/4 IN bolts or anchors.
        3) Minimum distance from centerline of rung to wall or any obstruction: 7 IN.
        4) Maximum spacing: 4 FT OC.
        5) Maximum spacing on caged ladders: 4 FT.
    b. For floor supported ladders, provide 3/8 by 2-1/2 by 4 IN rectangular bracket or 3/8 by 6 by 6 IN square plate welded to rails with punched holes for 3/4 IN bolts.
        1) Provide wall brackets on floor supported units if vertical run is over 4 FT.
6. Provide ladder cage where shown on the Drawings or required by OSHA.
    a. Cage construction shall meet all requirements of OSHA Standards and this Specification Section:

1) Hoops: Minimum 1/4 by 2 IN bar at 48 IN OC spacing.
2) Vertical bars: Minimum 1/4 by 1-1/2 IN bar.
3) Weld all connections.
4) Construct cage of same materials as the ladder on which it is mounted.
5) Mount cage on ladder by welding.
6) Mount cage on ladder by welding or bolting with stainless steel bolts, nuts and washers.
a) On bolted attachments, the bolt, nut or washer shall not affect a person's ability to grasp the ladder rail.

7. Ladder safety extension post:
a. Telescoping tubular aluminum section that automatically locks into place when fully extended.
b. Non-ferrous corrosion-resistant spring and hardware.
c. Factory assembled with all hardware necessary for mounting to ladder.
d. Bilco "LadderUp" safety post.
8. Ladder fall protection system:
a. Extruded aluminum safety rail.
1) Safety rail shall extend from within 3 FT of base of ladder to top of ladder side rails.
b. Extruded aluminum trolley with brake.
1) Ice guard.
c. Full body harness with adjustable leg straps, backpad, and front dee ring.
d. Miller Equipment "SURETRACK."
e. Provide all components required for a complete OSHA approved operating system.

B. Landings, Platforms, Stoops, etc.:
1. Construct landing, railing and all supports of same material as the ladder.
2. Design live load for landing platform and supporting structure:
a. 100 psf, uniform load.
b. 300 LBS concentrated load on 4 IN square area.
c. All components to be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
d. Maximum deflection: 1/300 of span under a superimposed live load of 100 psf.
3. Grating:
a. Per this Specification Section.
4. Structural support: Channel or tubular sections with bracing, plates, angles, etc., to support guardrail and grating and to support landing from the side of the building wall.
a. Weld or bolt all connections using stainless steel bolts, nuts and washers.
5. Guardrails:
a. Match ladder side rails.
1) Space intermediate rails equally between top rail and top of kickplate.
b. Provide 4 IN high x 3/8 IN thick toeboard each side of landing.
6. Gates:
a. Constructed of same material and sizes as the railing system.
b. Hinges:
1) Stainless steel.
2) Heavy-duty, self-closing.
c. Gate stop:
1) Aluminum.
7. Deflector plate:
a. For aluminum ladders: Minimum .0625 IN aluminum plate, ASTM B209.
b. For stainless steel ladders: Minimum .0625 IN stainless steel plate, ASTM A666.
c. For steel ladders: Minimum .0625 IN steel plate, ASTM A6.
d. Profile as shown on Drawings.
e. Fabricate to shapes and sizes required to meet OSHA Standards.

8. Security door:
    a. Sheet aluminum alloy 5005.
        1) Minimum 0.125 IN thick with mill finish.
    b. Continuous aluminum or stainless steel piano hinge.
        1) Handing as shown on Drawings.
    c. Minimum two (2) heavy-duty locking hasps.
    d. Full flush door panel with perpendicular side returns to within 2 IN of face of wall.
    e. Size: Width as required by {7} FT high.
    f. Provide complete with all fasteners.
    g. Padlocks to be provided by Owner.
    h. O'Keefe's Inc. Model "SD."

C. Manhole Steps:
1. ASTM C478.
2. Minimum clear step width: 16 IN.
3. Minimum cross section: 1 IN.
4. Extruded aluminum:
    a. Slip resistant design.
5. Neenah Model R-1982-W.

D. Bollards:
1. 6 IN DIA Schedule 40 extra strength steel pipe, ASTM A53.

E. Abrasive Stair Nosings:
1. One-piece, 3 IN side with integral anchor.
2. Cast aluminum.
3. Diamond abrasive pattern on top surface.
4. Two (2) component consisting of an embedded subchannel, installed with the concrete pour, and an abrasive tread plate to be installed later.
5. 6063-T5 extruded aluminum, mill finished and heat treated.
6. Complete with concrete anchors and tread plate securing screws.
7. Tread plate:
    a. Extruded aluminum.
    b. Solid epoxy abrasive filler.
        1) Color: To be selected by Engineer.
    c. Integral photoluminescent strip.
        1) 1 IN wide by full length.
        2) Tape is not acceptable.
8. Balco "DXH-330."
9. Length:
    a. Concrete stairs:
        1) 4 IN less than overall stair width.
        2) Where tread mounted railing post occurs, hold nosing back 4 IN clear from railing centerline.
    b. Concrete landings at metal stairs: 4 IN less than clear width between stringers.

F. Metal Stairs:
1. Fabricated as indicated.
2. Treads: Grating as specified.
    a. Provide integral corrugated non-slip nosing.
3. Risers:
    a. Grating treads: Solid plate attached to trailing edge of tread as shown on Drawings.
4. Landings:
    a. Grating as specified.
    b. Provide integral corrugated non-slip nosing at edge acting as stair tread/nosing.
    c. Nosing at concrete landing:
        1) Abrasive stair nosing.

5. Design live load for landing platform and supporting structure:
    a. 100 psf, uniform load.
    b. 300 LBS concentrated load on 4 IN square area.
    c. All components to be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
    d. Maximum deflection: 1/300 of span under a superimposed live load of 100 psf.
6. Design, fabricate, and install in compliance with NAAMM and applicable codes.
    a. NAAMM AMP 510:
        1) Exterior at site structures and equipment: Industrial Class.
        2) Interior or exterior at buildings: Service Class.
7. Handrails and guardrails: Refer to Specification Section 05 52 02.
8. Material:
    a. Aluminum.

G. Aluminum Grating and Plank Grating:
1. NAAMM MBG 531.
2. Minimum depth: 1-1/2 IN.
3. Minimum rectangular bearing bar size:
    a. 3/16 IN thick.
    b. Maximum 1-3/16 IN OC spacing.
4. Minimum I-bar flange width: 1/4 IN.
5. Design live load:
    a. 100 psf, uniform load.
    b. 300 LBS concentrated load on 4 IN square area.
    c. All components to be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
    d. Maximum deflection: 1/300 of span under a superimposed live load of 50 psf.
6. Cross bars:
    a. Welded, swaged or pressure locked to bearing bars.
    b. Maximum 4 IN OC spacing.
7. Top edges of bars: Grooved or serrated.
8. Where plank grating is indicated in Contract Drawings provide unpunched aluminum plank grating with skid-resistant surface and male-female interlocking side channels which snap together into modular panels Line Item 9. All grating shall be anchored into the supporting structure with corrosion resistant hold-down clips provided by grating manufacturer and installed at regular intervals recommended by the manufacturer.

2.4 FABRICATION

A. Verify field conditions and dimensions prior to fabrication.

B. Form materials to shapes indicated with straight lines, true angles, and smooth curves.
1. Grind smooth all rough welds and sharp edges.
    a. Round all corners to approximately 1/32 - 1/16 IN nominal radius.

C. Provide drilled or punched holes with smooth edges.
1. Punch or drill for field connections and for attachment of work by other trades.

D. Weld Shop Connections:
1. Welds to be continuous fillet type unless indicated otherwise.
2. Full penetration butt weld at bends in stair stringers and ladder side rails.
3. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming to AWS A5.1/A5.1M.
4. Weld aluminum in accordance with AWS D1.2.
5. Weld stainless steel in accordance with AWS D1.6.
    a. Treat all welded areas in accordance with ASTM A380.
6. All headed studs to be welded using automatically timed stud welding equipment.
7. Grind smooth welds that will be exposed.

E. Conceal fastenings where practicable.

F. Fabricate work in shop in as large assemblies as is practicable.

G. Tolerances:
   1. Rolling:
      a. ASTM A6.
      b. When material received from the mill does not satisfy ASTM A6 tolerances for camber, profile, flatness, or sweep, the Contractor is permitted to perform corrective work by the use of controlled heating and mechanical straightening, subject to the limitations of the AISC Specification.
   2. Fabrication tolerance:
      a. Member length:
         1) Both ends finished for contact bearing: 1/32 IN.
         2) Framed members:
            a) 30 FT or less: 1/16 IN.
            b) Over 30 FT: 1/8 IN.
      b. Member straightness:
         1) Compression members: 1/1000 of axial length between points laterally supported.
         2) Non-compression members: ASTM A6 tolerance for wide flange shapes.
      c. Specified member camber (except compression members):
         1) 50 FT or less: Minus 0/plus 1/2 IN.
         2) Over 50 FT: Minus 0/plus 1/2 IN (plus 1/8 IN per 10 FT over 50 FT).
         3) Members received from mill with 75 percent of specified camber require no further cambering.
         4) Beams/trusses without specified camber shall be fabricated so after erection, camber is upward.
         5) Camber shall be measured in fabrication shop in unstressed condition.
      d. At bolted splices, depth deviation shall be taken up by filler plates.
         1) At welded joints, adjust weld profile to conform to variation in depth.
         2) Slope weld surface per AWS requirements.
      e. Finished members shall be free from twists, bends and open joints.
         1) Sharp kinks, bends and deviation from above tolerances are cause for rejection of material.

H. Fabricate grating, stairs, and accessories using aluminum unless shown otherwise on Drawings.
   1. Finish:
      a. Mill, unless noted otherwise.
      b. Coat surfaces in contact with dissimilar materials.
         1) See Specification Section 09 91 00.

I. Fabricate grating in accordance with NAAMM MBG 531.
   1. Maximum tolerance for difference in depth between grating depth and seat or support angle depth: 1/8 IN.
   2. Distance between edge of grating and face of embedded seat angle or face of wall or other structural member: 1/4 IN.
      a. Tolerance: NAAMM MBG 531.
   3. Removable sections: Not wider than 3 FT and not heavier than 100 LBS.
   4. Ends and perimeter edges: Banded, with alternate bearing bars welded to band.
      a. Provide full depth banding unless noted otherwise.
      b. Banding at trenches and sumps to be 1/4 IN less than grating depth to allow for drainage.
   5. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 IN high toe plate.
   6. Provide joints at openings between individual grating sections.
   7. Fabricate grating so that bearing bars and cross bars in adjacent sections are aligned.

J. Fabricate miscellaneous metals in accordance with NAAMM AMP 555.
   1. Workmanship: Class 2 unless noted otherwise.

2.5 SOURCE QUALITY CONTROL

A. Surface Preparation:
   1. Refer to Specification Section 09 91 00 for surface preparation requirements.
   2. All miscellaneous metal fabrication item surfaces shall be inspected and approved by coatings inspector prior to application of shop-applied paint coating.
      a. Inspection shall be performed to determine depth of blast profile and cleanliness of surface.
      b. Fabricator shall reblast and or re-clean surfaces as required until acceptable.

B. Shop Applied Paint Coating Application:
   1. Refer to Specification Section 09 91 00 for painting requirements.
   2. After surface has been accepted in writing by coatings inspector, fabricator may proceed with application of paint coatings.
   3. Application of paint coatings shall be observed and certified by coatings inspector.

C. Meet structural requirements of Specification Section 01 45 33 for inspection and testing items of structural nature.

D. Shop Inspection and Testing:
   1. Owner will employ and pay for the services of a qualified independent testing agency to inspect and test all structural steel work for compliance with Contract Documents.
   2. Contractor responsible for testing to qualify shop and field welders and as needed for Contractor's own quality control to ensure compliance with Contract Documents.
   3. Independent testing agency shall have a minimum of five (5) years performing similar work and shall be subject to Owner's approval.

E. Responsibilities of Testing Agency:
   1. Inspect shop and field welding in accordance with AWS Code including the following non-destructive testing:
      a. Visually inspect all welds.
      b. In addition to visual inspection, test 50 percent of full penetration welds and 20 percent of fillet welds with liquid dye penetrant or mag particle.
      c. Test 20 percent of liquid dye penetrant tested full penetration welds with ultrasonic or radiographic testing.
   2. Inspect high-strength bolting in accordance with the RCSC Specification for Structural Joints Using High-Strength Bolts, Section 9.
      a. Verify direct tension indicator gaps, if applicable.
   3. Inspect structural steel which has been erected.
   4. Inspect stud welding in accordance with AWS Code.
   5. Prepare and submit inspection and test reports to Engineer.
      a. Assist Engineer to determine corrective measures necessary for defective work.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction in time to allow their installation.
   1. If such items are not provided in time for installation, cut in and install.

B. Prior to installation, inspect and verify condition of substrate.

C. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.
   1. Field welding aluminum is not permitted unless approved in writing by Engineer.

3.2 INSTALLATION

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

B. Contractor is solely responsible for safety.
   1. Construction means and methods and sequencing of work is the prerogative of the Contractor.
   2. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until slabs, decks, and diagonal bracing or rigid connections are installed.
   3. Partially complete structural members shall not be loaded without an investigation by the Contractor.
   4. Until all elements of the permanent structure and lateral bracing system are complete, temporary bracing for the partially complete structure will be required.

C. Adequate temporary bracing to provide safety, stability and to resist all loads to which the partially complete structure may be subjected, including construction activities and operation of equipment is the responsibility of the Contractor.
   1. Plumb, align, and set structural steel members to specified tolerances.
   2. Use temporary guys, braces, shoring, connections, etc., necessary to maintain the structural framing plumb and in proper alignment until permanent connections are made, the succeeding work is in place, and temporary work is no longer necessary.
   3. Use temporary guys, bracing, shoring, and other work to prevent injury or damage to adjacent work or construction from stresses due to erection procedures and operation of erection equipment, construction loads, and wind.
   4. Contractor shall be responsible for the design of the temporary bracing system and must consider the sequence and schedule of placement of such elements and effects of loads imposed on the structural steel members by partially or completely installed work, including work of all other trades.
      a. If not obvious from experience or from the Drawings, the Contractor shall confer with the Engineer to identify those structural steel elements that must be complete before the temporary bracing system is removed.
   5. Remove and dispose of all temporary work and facilities off-site.

D. Examine work-in-place on which specified work is in any way dependent to ensure that conditions are satisfactory for the installation of the work.
   1. Report defects in work-in-place which may influence satisfactory completion of the work.
   2. Absence of such notification will be construed as acceptance of work-in-place.

E. Field Measurement:
   1. Take field measurements as necessary to verify or supplement dimensions indicated on the Drawings.
   2. Contractor responsible for the accurate fit of the work.

F. Check the elevations of all finished footings or foundations and the location and alignment of all anchor bolts before starting erection.
   1. Use surveyor's level.
   2. Notify Engineer of any errors or deviations found by such checking.

G. Framing member location tolerances after erection shall not exceed the frame tolerances listed in the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.

H. Erect plumb and level; introduce temporary bracing required to support erection loads.

I. Use light drifting necessary to draw holes together.
   1. Drifting to match unfair holes is not allowed.

J. Welding:
   1. Conform to AWS D1.1 and requirements of the FABRICATION Article in PART 2 of this Specification Section.

2. When joining two (2) sections of steel of different ASTM designations, welding techniques shall be in accordance with a qualified AWS D1.1 procedure.

K. Shore existing members when unbolting of common connections is required.
   1. Use new bolts for rebolting connections.

L. Clean stored material of all foreign matter accumulated prior to the completion of erection.

M. Bolt Field Connections: Where practicable, conceal fastenings.

N. Field Welding:
   1. Follow AWS procedures.
   2. Grind welds smooth where field welding is required.

O. Field cutting grating or checkered plate to correct fabrication errors is not acceptable.
   1. Replace entire section.

P. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing system elements, etc.

Q. Unless noted or specified otherwise:
   1. Connect steel members to steel members with 3/4 IN DIA ASTM A325 high strength bolts.
   2. Connect aluminum to aluminum with 3/4 IN DIA stainless bolts.
   3. Connect aluminum to structural steel using 3/4 IN DIA stainless steel bolts.
      a. Provide dissimilar metals protection.
   4. Connect aluminum and steel members to concrete and masonry using stainless steel mechanical anchor bolts or adhesive anchor bolts unless shown otherwise.
      a. Provide dissimilar materials protection.
   5. Provide washers for all bolted connections.
   6. Where exposed, bolts shall extend a maximum of 3/4 IN and a minimum of 1/2 IN above the top of installed nut.
      a. If bolts are cut off to required maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.

R. Install and tighten ASTM A325 high-strength bolts in accordance with the AISC 325, Allowable Stress Design (ASD).
   1. Provide hardened washers for all ASTM A325 bolts.
      a. Provide the hardened washer under the element (nut or bolt head) turned in tightening.

S. After bolts are tightened, upset threads of ASTM A307 bolts or anchor bolts to prevent nuts from backing off.

T. Secure metal to wood with lag screws of adequate size with appropriate washers.

U. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing.
   1. Provide full penetration welded splices where continuity is required.

V. Provide each fabricated item complete with attachment devices as indicated or required to install.

W. Anchor such that work will not be distorted nor fasteners overstressed from expansion and contraction.

X. Set beam and column base plates accurately on nonshrink grout as indicated on Drawings.
   1. See Division 03 Specification Sections for non-shrink grout and anchorage.
   2. Set and anchor each base plate to proper line and elevation.
      a. Use metal wedges, shims, or setting nuts for leveling and plumbing columns and beams.
         1) Wedges, shims and setting nuts to be of same metal as base plate they support.
         2) Tighten nuts on anchor bolts.
      b. Fill space between bearing surface and bottom of base plate with nonshrink grout.

1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
c. Do not remove wedges or shims.
1) Where they protrude, cut off flush with edge of base plate.
d. Fill sleeves around anchor bolts solid with non-shrink grout.

Y. Tie anchor bolts in position to embedded reinforcing steel using wire.
1. Tack welding prohibited.
a. Coat projecting bolt threads and nuts with heavy coat of clean grease.
2. Anchor bolt location tolerance:
a. Per Section 03 15 19.

Z. Install bollards in concrete as detailed.
1. 48 IN projection above ground.
2. 48 IN embedment in concrete, unless detailed otherwise on Drawings.
3. Fill pipe with concrete and round off at top.

AA. Accurately locate and place frames for openings before casting into floor slab so top of plate is flush with surface of finished floor.
1. Keep screw holes clean and ready to receive screws.

BB. Attach grating to end and intermediate supports with grating saddle clips and bolts.
1. Maximum spacing: 2 FT OC with minimum of two (2) per side.
2. Attach individual units of aluminum grating together with clips at 2 FT OC maximum with a minimum of two (2) clips per side.

CC. Coat aluminum surfaces in contact with dissimilar materials in accordance with Specification Section 09 91 00.

DD. Repair damaged galvanized surfaces in accordance with ASTM A780.
1. Prepare damaged surfaces by abrasive blasting or power sanding.
2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.

EE. Anchor ladder to concrete structure with minimum 3/4 IN stainless steel anchor bolts with minimum 6 IN embedment.

FF. Install manhole steps in cast-in-place concrete where indicated on the Drawings.
1. Provide in compliance with ASTM C478 and OSHA requirements for fixed ladders.
2. Tie steps to reinforcing or formwork.
a. Provide equal spacing from surface to first rung and equal spacing on remaining rungs.
1) Maximum spacing: 12 IN.
b. Minimum clear distance from face of wall to center of step: 7 IN.
c. Minimum embedment: 6 IN.
3. Provide dissimilar materials protection.
a. See Specification Section 09 91 00.
4. Install deflector plate at bottom of roof hatch opening as indicated on Drawings.
a. Install in accordance with applicable OSHA Standards.
5. Install alternating tread stair in accordance with manufacturer's recommendations using stainless steel fasteners.

GG. Install ladder safety extension post in accordance with manufacturer's instructions.
1. Mount device opposite the climbing side.
2. Provide ladder safety extension device for all ladders unless noted otherwise.

HH. Install ladder security door where indicated on the Drawings.
1. Install in accordance with manufacturer's instructions.

II. Mount ladder fall protection system with rail offset from ladder side rail approximately 3 IN.
1. Provide bracket at top of fall protection rail attached to ladder side rail to help stabilize the fall protection rail.

JJ. Install factory pre-fabricated stairs in location indicated in the Contract Documents and approved submittals.

3.3 FIELD QUALITY CONTROL

A. Tolerances (unless otherwise noted on the Drawings):
   1. Frame placement, after assembly and before welding or tightening.
      a. Deviation from plumb, level and alignment: 1 in 500, maximum.
      b. Displacement of centerlines of columns: 1/2 IN maximum, each side of centerline location shown on Drawings.
      c. Displacement of centerlines of columns: 1/2 IN maximum, each side of centerline location shown on Drawings.

B. Meet structural requirements of Specification Section 01 45 33 for inspection and testing items of structural nature.

C. OWNER Pays for Field Inspection and Testing:
   1. Owner will employ and pay for services of an independent testing agency to inspect and test structural steel shop and field work for compliance with this Specification Section.
   2. Contractor provides sufficient notification and access so inspection and testing can be accomplished.
   3. Contractor pays for retesting of failed tests and for additional testing required when defects are discovered.

3.4 CLEANING

A. After fabrication, erection, installation or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter.

B. All stainless steel products in addition to Paragraph A. above:
   1. Remove all heat tint, rusting, discoloration by passivation, ASTM A380, or other acceptable means as listed in NiDI 11 007 as approved by the Engineer.

C. Provide surface acceptable to receive field applied paint coatings specified in Specification Section 09 91 00.

END OF SECTION

SECTION 05 52 02
ALUMINUM RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum handrail, stair rail and guardrail.
   2. Aluminum guardrail gates.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA):
      a. ADM 1, Aluminum Design Manual.
      b. DAF 45, Designation System for Aluminum Finishes.
   2. American Society of Mechanical Engineers (ASME):
      a. Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
   3. ASTM International (ASTM):
      a. B108, Standard Specification for Aluminum-Alloy Permanent Mold Castings.
      b. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
      c. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
      d. B247, Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
      e. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
      f. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
   4. American Welding Society (AWS):
      a. C5.5, Recommended Practices for Gas Tungsten Arc Welding.
      b. D1.2, Structural Welding Code - Aluminum.
   5. National Association of Architectural Metal Manufacturers (NAAMM):
      a. AMP 521, Pipe Railing Systems Manual.
   6. U.S. Department of Justice, Architectural and Transportation Barriers Compliance Board (Access Board):
      a. Americans with Disabilities Act (ADA):
         1) Accessibility Guidelines for Buildings and Facilities (ADAAG).
   7. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
   8. Building code:
      a. International Code Council (ICC):
         1) International Building Code and associated standards, 2015 Edition including all California amendments, referred to herein as 2016 California Building Code (CBC).

B. Qualifications:
   1. Qualify welding procedures and welding operators in accordance with AWS and ASME Section IX.

1.3 DEFINITIONS

A. Guardrail: A system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.

B. Handrail: A railing provided for grasping with the hand for support.

C. Railing: A generic term referring to guardrail, handrail and/or stair rails.

D. Stair Rail: A guardrail, installed at the open side of stairways with either a handrail mounted to the inside face of the guardrail, or where allowed by applicable codes, with the top rail mounted at handrail height and serving the function of a handrail.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Fabrication and/or layout drawings:
      a. Drawings showing profile, location, sections and fabrication details including all welding information of each railing.
      b. Type and details of anchorage.
      c. Location and type of expansion joints.
      d. Materials of construction, shop coatings and all third-party accessories.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation details.
   4. Certification that railings have been designed and fabricated to meet the loading requirements specified.
   5. Calculations for all proposed deviations from the Specification.
      a. Calculations shall be performed, sealed, signed and dated by a registered professional Civil or Structural engineer licensed in the State of California.
      b. Calculations shall be specific to this Project and shall include all assumptions, references and design interpretations used to achieve the results obtained by the Engineer.
      c. Reduction in load criteria is not acceptable as reason for deviation from sizes indicated in the Specification.

B. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Certification of welders and welding procedures indicating compliance with AWS requirements.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver and handle railings to preclude damage.

B. Store railings on skids, keep free of dirt and other foreign matter which will damage railings or finish and protect against corrosion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Welded railing systems:
      a. Any manufacturer meeting this Specification Section.

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

2.2 MATERIALS

A. Alloy 6061-T6 marine grade, 32,000 psi tensile yield strength minimum.
   1. ASTM B209 for sheets and plates.

2. ASTM B221 and ASTM B308 for shapes - beams, channels, tubes, angles, tees, and zees.
3. ASTM B247 for forgings.

B. Cast Fittings: Aluminum, ASTM B108.

C. Shims: Aluminum of same alloy as component being shimmed.

D. Fasteners: Stainless steel, 316L.

E. Expansion and Adhesive Anchors: Stainless steel, 316L.

F. Electrodes for Welding:
1. Aluminum: AWS D1.2.
2. Filler alloy 5356 or 4043.

2.3 FABRICATION

A. General:
1. Verify field conditions and dimensions prior to fabrication.
2. For fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
   a. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.
3. Form exposed work with smooth, short radius bends, accurate angles and straight edges.
   a. Ease exposed edges to a radius of approximately 1/32 IN.
   b. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
   c. Drill or punch holes with smooth edges.
4. Form exposed connections with flush, smooth, hairline joints, using stainless steel or aluminum splice locks to splice sections together or by welding.
   a. Ease the edges of top rail splices and expansion joints and remove all burrs left from cutting.
5. Provide for anchorage of type indicated on Drawings or as required by field conditions.
   a. Drill or punch holes with smooth edges.
6. Design railings and anchorage system in accordance with NAAMM AMP 521 to resist loading as required by Building Code.
   a. Maximum allowable stresses per AA ADM 1.
7. Design railings in accordance with accessibility requirements per the Building Code and ADAAG.

B. Custom fabricate railings to dimensions and profiles indicated.
1. Guardrails:
   a. Schedule 40 pipe.
   b. Top rails: 2 IN nominal diameter.
   c. Intermediate rails: 1-1/2 IN nominal diameter.
   d. Vertical posts:
      1) 2 IN nominal diameter.
      2) Vertical posts that are to be side-bracket mounted to a vertical concrete surface or metal structure shall use Alloy 6063-T6.
2. Handrail mounted to wall or to guardrail vertical posts: 1-1/4 IN nominal diameter Schedule 40 pipe.
3. Where details are not indicated, space intermediate rails to requirements of the Building Code or OSHA Standards, whichever requires the more restrictive design.
4. Space vertical posts as required by loading requirements but not more than 4 FT on center.
   a. Avoid locating vertical posts at changes in direction of railing.
   b. Hold vertical post back from corner and provide radiused corners.
5. Space handrail brackets as required by loading requirements but not more than 4 FT on center.

6. Base plate for vertical guardrail posts mounted to top of concrete surface:
    a. 3/8 x 6 x 6 IN square plate.
    b. Predrilled to accept four (4) anchors.
    c. Provide a 2 IN DIA x 8 IN long solid aluminum rod welded to the base plate.
    d. Fit the vertical post over the solid rod and weld the post to the base plate.
7. Base plate for vertical guardrail post mounted to flange of metal structure:
    a. 3/8 x 3 x 8 IN plate.
    b. Predrilled to accept two (2) fasteners.
    c. Provide a 2 IN DIA x 8 IN long solid aluminum rod welded to the base plate.
    d. Fit the vertical post over the solid rod and weld the post to the base plate.
8. Mounting bracket for vertical guardrail post mounted to vertical concrete surface or web of metal structural member:
    a. Pair of 3/8 IN angles or bent plates.
    b. Predrilled to accept two (2) fasteners each.
    c. Weld angles or bent plates to vertical posts.
    d. Provide toeboards on walkway side of all elevated walkways, platforms and stair landings, and where indicated on the Drawings or required by OSHA Standards.
        1) 4 IN high extruded toeboard with stiffener ribs and angled toe.
            a) Similar to Wagner, Model "IR94102."
    e. Guardrail gates:
        1) Constructed of same material and sizes as the guardrail system.
        2) Width of gate as shown on Drawings.
        3) Hinges:
            a) Cast aluminum.
            b) Self-closing.
                (1) Stainless steel torsion spring.
            c) Similar to Wagner, Model "IR100."
        4) Gate latch and stop:
            a) Cast aluminum.
            b) Spring-loaded pin latch.
                (1) Stainless steel spring.
            c) Similar to Wagner, Model "IR101."

C. Railing Fabrication:
1. All railings are to be welded systems.
2. Use wire welding for all joints.
3. All welding to be continuous in accordance with AWS C5.5 and AWS D1.2.
    a. All welded railing joints shall have full penetration welds unless noted otherwise.
4. All exposed welds to be ground smooth and flush to match and blend with adjoining surfaces.
    a. NAAMM AMP 521, Type 2.
5. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted.
6. Finishing joints with filler is not acceptable.
7. Provide flush weld fittings using locking weld connectors or coped drive-on connectors.
8. Fit exposed ends of guardrails and handrails with solid terminations.
    a. Return ends of handrail to wall, but do not attach to wall.
    b. Where guardrail terminates at a wall, provide a vertical post or end-loop 4 IN off the wall to center of vertical member.
9. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly of units at project site.
10. Install weeps to drain water from hollow sections of railing at exterior and high humidity conditions.
    a. Drill 1/4 IN weep hole in railings closed at bottom:
        1) 1 IN above walkway surface at bottom of posts set in concrete.
        2) 1 IN above solid aluminum rod at posts having base plate.
        3) At low point of intermediate rails.

b. Do not drill weep holes:
    1) In bottom of base plate.

11. Expansion joints:
    a. Joints to be designed to allow expansion and contraction of railing and still meet design loads required.
        1) Top rail splices and expansion joints shall be located within 8 IN of post or other support.
        2) Where railings span structure expansion joints; provide a railing expansion joint in the span crossing the structure expansion joint.
    b. Provide expansion joints in any continuous run exceeding 20 FT in length.
        1) Space expansion joints at not more than 40 FT on center.
    c. Provide minimum 0.10 IN of expansion joint for each 20 FT length of top rail for each 25 DegF differential between installation temperature and maximum design temperature.
        1) Maximum expansion joint width at time of installation shall not exceed 3/8 IN.
            a) Provide additional expansion joints as required to limit expansion joint width.
    d. Provide slip-joint with internal sleeve.
        1) Extend slip joint min 2 IN beyond joint at maximum design width.
        2) Fasten internal sleeve securely to one side
            a) Provide allen-head set screw located in bottom of rail.
            b) Rivets or exposed screw heads are not acceptable.

D. Finish: Mill.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation, inspect and verify condition of substrate.

B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.
    1. Field welding aluminum is not permitted unless approved in writing by Engineer.

3.2 INSTALLATION

A. Install handrails and guardrails to meet loading requirements of the Building Code.

B. Install products in accordance with manufacturer's instructions.

C. Set work accurately in location, alignment and elevation; plumb, level and true.
    1. Measure from established lines and items which are to be built into concrete, masonry or similar construction.

D. Align railings prior to securing in place to assure proper matching at butting and expansion joints and correct alignment throughout their length.
    1. Provide shims as required.

E. Install proper sized expansion joints based on temperature at time of installation and differential coefficient of expansion of materials in all railings as recommended by manufacturer.
    1. Lubricate expansion joint splice bar for smooth movement of railing sections.

F. Attach handrails to walls or guardrail with brackets designed for condition:
    1. Provide brackets which provide a minimum 1-1/2 IN clearance between handrail and nearest obstruction.
        a. Handrails shall not project more than 4-1/2 IN into required stairway width.
    2. Anchor handrail brackets to concrete or masonry walls with 1/2 IN stainless steel adhesive anchors with stainless steel hex head bolts.

G. Anchor railings to concrete with minimum 1/2 IN stainless steel adhesive anchors with stainless steel bolts, nuts and washers unless noted otherwise in the Contract Documents.

1. Where exposed, bolts shall extend minimum 1/2 IN and maximum 3/4 IN above the top nut.
    a. If bolts are cut off to required height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nut.
    b. Bevel the top of the bolt after cutting to provide a smooth surface.

H. Anchor railings to metal structure with minimum 3/4 IN stainless steel bolts, nuts and washers.

I. Install toeboards to fit tight to the walking surface.
    1. Attach to railing vertical post with manufacturer's standard mounting clamp:
        a. Adjustable.
        b. Designed to engage in extruded slot on back of toeboard.
    2. Provide splice bars, corner splices and brackets:
        a. Manufacturer's standard items as required for a complete installation.
    3. Notch toeboards at base plates or other obstructions.
    4. Bottom of toeboard shall not exceed 1/4 IN above walking surface.

J. Coat aluminum in contact with dissimilar metal or concrete in accordance with Specification Section 09 91 00.

K. Provide railings as required for stair construction identified in Specification Section 05 50 00.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rough carpentry.
   2. Roof trusses.
      a. Includes design.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. APA - The Engineered Wood Association (APA):
      a. PRP-108, Performance Standards and Qualification Policy for Structural Use Panels.
      b. U450E, Storage and Handling of APA Trademarked Panels.
      c. Y510T, Plywood Design Specification.
   2. ASTM International (ASTM):
      a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      b. D2898, Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
      c. D4442, Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
      d. D4444, Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters.
      e. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. American Wood Protection Association (AWPA):
      a. M2, Standard for Inspection of Wood Products Treated with Preservatives.
      b. M3, Standard Quality Control Procedures for Wood Preserving Plants.
      c. M4, Standard for the Care of Preservative-Treated Wood Products.
      d. P5, Standard for Waterborne Preservatives.
      e. U1, Use Category System: User Specification for Treated Wood.
   4. American National Standards Institute/Single Ply Roofing Industry (ANSI/SPRI):
      a. ES-1, Wind Design Standard for Edge Systems Used with Low Slope Roof Systems.
   5. Environmental Protection Agency (EPA).
   6. FM Global:
      a. 1-49, Property Loss Prevention Data Sheets - Perimeter Flashing.
   7. National Institute of Standards and Technology (NIST):
      a. PS-1, Construction and Industrial Plywood.
      b. PS-20, American Softwood Lumber Standard.
   8. Truss Plate Institute Inc. (TPI):
      a. 1 National Design Standard for Metal Plate Connected Wood Truss Construction.
      b. HIB, Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses.
   9. Underwriters Laboratories, Inc. (UL):
      a. 723, Standard for Test for Surface Burning Characteristics of Building Materials.
   10. Building code:
      a. California Building Code 2013.

B. Qualifications:
   1. Wood Treatment Plant: AWPA M3.
   2. Treated Wood Inspection: AWPA M2.

C. Miscellaneous:
1. Factory marking:
a. Lumber:
1) Identify type, grade, moisture content, inspection service, producing mill, and other qualities specified.
2) Marking may be omitted, as allowed by Building Code, if certificate of inspection is provided for each shipment.

1.3 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Fabrication drawings of all fabricated items.
3. Product technical data including:
a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's installation instructions for all products specified.
4. Certifications:
a. Chemicals used in treatment process are registered with and approved by EPA.
b. Moisture content of material prior to treatment: 25 percent maximum.
c. Material has been kiln-dried after treatment (KDAT) to the moisture content specified.
5. Documentation of treatment of treated material in accordance with standards referenced.

B. Informational Submittals:
1. Wood trusses:
a. Provide the following:
1) Design criteria, span, depth, slope and spacing of all trusses.
2) Minimum bearing width required by lumber in truss.
3) Design dead, live and wind loads and any concentrated loads and their point of application.
4) Species, grade, size and dimension of all lumber.
5) Connection details and plating requirements.
6) Bracing details and location.
7) Letter of certification signed and stamped by civil or structural engineer registered in State of California stating that wood trusses have been designed to meet the requirements of the Drawings, Specifications and the Building Code.
8) Test results of connector plate lateral load evaluation to determine normal load values for design based on ultimate load and proportional limit value at 0.015 IN.
9) Adjustments to metal connector plate and lumber design values.

1.4 DELIVERY AND STORAGE

A. Delivery, storage and handling of untreated wood products:
1. Lumber: As recommended by the grading agency indicated on the grade stamp.
2. Plywood: APA U450E.

B. Delivery, storage, handling and disposal of treated wood products: AWPA M4.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Wood connectors:
a. Simpson Strong-Tie Company, Inc.
b. Southeastern Metals Manufacturing Company, Inc.

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

2.2 MATERIALS

A. General:
   1. Lumber (for framing, blocking, nailers, furring, grounds and similar members):
      a. NIST PS-20.
      b. Species:
         1) Treated material: As indicated in the appropriate AWPA standard.
            a) Provide species of FRTM as necessary to achieve UL rating listed.
         2) Untreated material:
            a) For nominal sizes up to and including 2 x 4: Douglas Fir.
            b) For nominal sizes up to 2 IN thick and wider than 4 IN: Douglas Fir.
      c. Grade:
         1) For nominal sizes up to and including 2 x 4: Standard and better.
         2) For nominal sizes up to 2 IN thick and wider than 4 IN: #2 and better.
   2. Non-structural plywood:
      a. NIST PS-1.
      b. C-C plugged:
         1) Exposure: EXT.
         2) Thickness: As indicated on Drawings.
         3) Touch sanded.

B. Preservative Treated Material:
   1. Moisture content:
      a. Prior to treatment: 25 percent.
      b. Kiln-dry after treatment (KDAT), ASTM D4442 and ASTM D4444:
         1) Lumber: 19 percent maximum.
         2) Plywood: 18 percent maximum.
   2. Preservative:
      a. Waterborne: AWPA P5.
      b. As indicated in the appropriate AWPA standard.
   3. Pressure-treat material in accordance with AWPA U1.
   4. Wherever practicable, material to be treated shall be manufactured in its final form prior to treatment.

C. Fasteners and Anchors:
   1. Nails, screws, truss nail plates, and wood connectors:
      a. Type 316 stainless steel.
   2. Adhesive anchors, expansion anchors, self-tapping concrete anchors, bolts, nuts, and washers: See Specification Section 05 50 00.

D. Roof Trusses:
   1. Lumber:
      a. Species: Douglas fir.
      b. Grade: #2 and better.
   2. Design trusses, connections, bracing, bridging and end bearings to resist loads shown on Drawings.
   3. Design and fabricate wood trusses to meet requirements of:
      a. AF&PA NDS.
      b. TPI 1.
      c. Building Code.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify measurements, dimensions, and shop drawing details before proceeding.

B. Coordinate location of studs, nailers, blocking, grounds and similar supports for attached work.

C. Eliminate sharp projections which would puncture roofing, flashing or underlayment material.

3.2 ERECTION AND INSTALLATION

A. General:
   1. Provide preservative treated material for all wood used:
      a. Outside building.
      b. Below grade.
   2. Provide fire-retardant treated material for all wood used:
      a. Inside building.
      b. Exterior building walls.
      c. Roof construction.
      d. Parapet walls.
      e. Roofing nailers.

B. Attach work securely by anchoring and fastening as indicated or required to support applied loading.
   1. Anchor wood to concrete using adhesive or expansion anchors as specified in Specification Section 05 50 00.
   2. Anchor wood to metal using bolts and nuts as specified in Specification Section 05 50 00.
   3. Provide flat washers under all bolt heads and nuts.
   4. Fasten plywood in accordance with APA recommendations.
   5. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
   6. Install fasteners without splitting of wood; predrill as required.
   7. Do not drive threaded friction type fasteners.
   8. Tighten bolts and lag screws at installation and retighten as required.

C. Set work to required levels and lines, plumb, true.
   1. Shim as required.
   2. Cut and fit accurately.

D. Provide wood grounds, nailers, or blocking where required for attachment of other work and surface applied items.

E. When wood has been exposed to moisture allow to completely dry out prior to covering with additional wood or another material.

F. Correct or replace wood which shows bowing, warping or twisting to provide a straight, plumb and level substrate for applications of other materials.

G. Wood Trusses:
   1. Use care when handling so as not to subject trusses to excessive lateral bending.
   2. Erect trusses in accordance with recommendations of TPI HIB so as to be level, plumb and in correct location.
   3. Cutting and altering trusses is not permitted.
   4. Brace trusses sufficiently during construction to prevent toppling or dominoing prior to placing any load on trusses.
   5. Connect trusses to remainder of structure using wood connectors in accordance with details on drawings and manufacturers' recommendations.
   6. Provide bracing where required by truss designer.

END OF SECTION

SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building insulation.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 09 29 00 - Gypsum Board.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C272/C272M, Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
      b. C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
      c. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
      d. C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
      e. C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
      f. D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
      g. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
   2. Underwriters Laboratories, Inc. (UL):
      a. Building Materials Directory.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Manufacturer's recommendations on sealants, tapes and mastics.

B. Informational Submittals:
   1. Certification from insulation manufacturer stating that insulation proposed is acceptable for intended use per the Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Rigid extruded polystyrene board insulation:
      a. Dow.
      b. DiversiFoam Products.
      c. Owens Corning.
   2. Blanket or batt thermal insulation:
      a. Owens Corning.
      b. USG Corporation.
      c. CertainTeed.

3. Vapor retarder:
    a. Raven Industries, Inc.
    b. Reef Industries, Inc.
    c. Fortifiber Building Systems Group, Inc by Henry Company.
    d. Alumiseal.

2.2 INSULATION & VAPOR RETARDER

A. General:
1. Foam plastic insulation used in buildings and structures shall comply with the requirements of the building code.
    a. Surface burning characteristics: ASTM E84.
    b. Flame spread index: Maximum 75.
    c. Smoke developed: Maximum 450.

B. Rigid Polystyrene Board Insulation:
1. Extruded: ASTM C578, Type IV.
    a. Water vapor transmission: ASTM E96/E96M, 1.1 perm-IN maximum.
    b. Water absorption: ASTM C272/C272M, 0.3% maximum.
    c. Thermal resistance: ASTM C518 at 75 DEGF mean temperature, 5.0/IN.
2. Provide insulation designed for intended use.
    a. Perimeter insulation and protection board.
        1) Similar to Dow "Styrofoam PERIMATE."
        2) Compressive strength: ASTM D1621, 30 PSI.
        3) Thickness:
            a) Perimeter insulation: 2 IN.
            b) Protection board: 1 IN.
        4) Edges:
            a) Long edge: Shiplap.
            b) Short edge: Square.
    b. Cavity insulation:
        1) Similar to Dow "CAVITYMATE."
        2) Compressive strength: ASTM D1621, 15 PSI.
        3) Thickness: 2 IN.
        4) Edges: Square.

C. Sealant and Mastic (for setting polystyrene and/or polyisocyanurate insulation board): Manufacturer's recommended standard.

D. Blanket or Batt Thermal Insulation:
1. Glass or other inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets.
2. Unfaced:
    a. ASTM C665, Type 1.
3. Minimum thickness as noted on Drawings.

E. Vapor Retarder:
1. Fire rated, reinforced, 3 ply, Class 1 material.
2. Perm rating: Not exceeding 0.035 grains/HR-FT^2-IN-Hg when determined in accordance with ASTM E96/E96M.
3. Griffolyn "TX-1200FR."

F. Vapor Retarder Tape: As recommended by vapor retarder manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. General:
   1. Insulate full thickness over surfaces to be insulated.
   2. Fit tightly around obstructions, fill voids.
   3. Cover all penetrations (electrical junction boxes, switch boxes, piping, conduits, etc.) with insulation, taking care not to compromise the workings of the device.
   4. Fit butted joints of batt or blanket insulations tightly together.
   5. Apply single or double layer to achieve total thickness.
      a. If double layer is provided, stagger all joints minimum 12 IN.
   6. Do not use broken or torn pieces of insulation.
   7. Install so that completed installation is vapor tight.
      a. Seal all joints.
      b. Seal to abutting materials to maintain vapor retarder integrity.
      c. Provide manufacturer's recommended vapor retarder tape for use with faced batt insulation or separate vapor retarder.
         1) If vapor retarder tape fails to adhere to any surface, apply sprayed-on adhesive as recommended by tape manufacturer to promote adhesion.
      d. Provide manufacturer's recommended solvent-free sealant compatible with insulation board for rigid board insulation.
         1) Tape is not acceptable for use with rigid board insulation.

C. Blanket or Batt Insulation using Separate Vapor Retarder Sheet in Exterior Stud Wall Systems:
   1. Verify that all piping, conduit, electrical box and other in-wall work is complete prior to installing insulation and vapor retarder.
   2. Install insulation friction fit between studs.
   3. Tightly butt ends.
   4. Install vapor retarder to warm side of building exterior wall.
      a. Completely seal each wall area to surrounding construction.
   5. Install vapor retarder vertically.
      a. Use widest practical sheet.
      b. Install in continuous sheets, floor to structure above, without horizontal joints.
      c. Fold flaps of vapor retarder over studs.
      d. Tape flaps together continuously.
      e. Tape bottom and top edges to structure continuously.
      f. After installation of any additional conduit, boxes, piping or other items within wall system, repair all tears or penetrations of vapor retarder with vapor retarder tape prior to installation of gypsum board.

D. Rigid Board Insulation in Cavity Walls:
   1. Do not proceed with installation until subsequent work which conceals insulation is ready to be performed.
   2. Set each piece of insulation flush with the abutting piece to eliminate ledges in the face of the insulation.
   3. Install mastic on face of concrete or masonry back-up in accordance with mastic and insulation manufacturer's recommendation.
   4. Press courses of insulation between wall ties (horizontal reinforcing) with edges butted tightly both ways.
   5. Set units firmly into mastic.
   6. Seal all horizontal and vertical joints with sealant recommended by insulation manufacturer.
   7. Do not use damaged insulation.

3.2 FIELD QUALITY CONTROL

A. Repair or replace damaged insulation and/or vapor retarder as directed by Engineer.

B. Provide minimum cover of 5/8 IN gypsum board over foam insulation exposed to the building interior.

END OF SECTION

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SECTION 07 42 13
PREFORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preformed metal wall panels.

B. Related Sections include but are not necessarily limited to:
   1. Section 07 21 00 - Building Insulation.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Civil Engineers (ASCE):
      a. 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
   2. ASTM International (ASTM):
      a. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      b. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
      c. E283, Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
      d. E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
   3. Underwriters Laboratories, Inc. (UL):
      a. Building Materials Directory.
      b. Fire Resistance Directory.

B. Qualifications:
   1. Installer shall be licensed or approved in writing by manufacturer.
   2. Installer shall have minimum of 10 years of experience in the installation of metal wall panel systems similar to system specified.
   3. Installer shall have successfully completed two projects of similar size, scope and complexity within past three years.

C. Mock-ups:
   1. Prior to start of permanent wall construction, construct mock-ups of wall system.
      a. Mock-ups shall be minimum of 5 FT x 5 FT.
   2. Mock-ups to include all types of wall panel profiles, insulation, liner panel, vapor retarder, trim, sealant, closures, angles, brackets, etc., as needed for a complete water and air tight installation.
   3. Step-construction to allow observation of all components.
   4. Panels shall be same panels as specified or approved for Project.
      a. Exact color is not necessary; however, Contractor is to label each exposed component to identify final installed color of component.
   5. Construct additional mock-ups or rework existing mock-ups until acceptable to Engineer.
   6. Maintain mock-ups at Project Site until Engineer approves removal of mock-ups.
   7. Approved mock-ups to constitute minimum acceptable standard of quality for actual construction.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.

2. Installer and applicator are synonymous.

1.4 SYSTEM DESCRIPTION

A. Metal wall panel system consisting of exterior corrugated panel; to match color and profile of panels on the existing Water Treatment building.

1.5 SUBMITTALS

A. Shop Drawings:
   1. Fabrication and/or layout drawings: Drawings, prepared by manufacturer, showing anchorage, flashing, jointing and any special detailing different from or not indicated on the Drawings.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's complete installation and erection instructions and details showing all accessories required.

B. Samples:
   1. For initial color selection, provide 2 x 3 IN panel samples for each color offered by manufacturer for Engineer's color selection.

C. Informational Submittals:
   1. Installer qualifications and listing of projects completed in past three years.
   2. Letter of acceptance of Installer from manufacturer.
   3. Instructions on proper cleaning methods and materials for Owner reference.
   4. Warranty.
   5. Product data on insulation for field-insulated panels.
   6. Test data:
      a. Certification that all tests identified under Article 2.4 have been performed on panel being provided and that panel has passed minimum requirements of those tests.

1.6 WARRANTY

A. Provide listed manufacturer's standard 20 year warranty on panel finish against fading, chipping, cracking and peeling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Assembled exposed fastener metal wall panels:
      a. Ceco Building Systems.
      b. MBCI by NCI Building Systems.
   2. PVDF coating:
      a. PPG IdeaScapes - DURANAR.
      b. Valspar - Fluropon.
      c. Arkema - Kynar 500.
      d. Solvay - Hylar 5000.

2.2 MATERIALS

A. Wall Panels:
   1. General:
      a. Galvanized Steel, ASTM A653/A653M.

B. Perimeter Trim Pieces and Flashing: Same material as wall panels.

C. Fasteners: 300 Series stainless steel.

D. Intermediate support items:
   1. Steel, galvanized per ASTM A653/A653M with G90 (1.25 OZ) coating.
   2. Minimum 18 GA.
   3. Panel manufacturer shall design subgirt for loading conditions specified.

E. Sealant: Manufacturer's standard.

2.3 FABRICATION

A. General:
   1. Fabricate to shapes indicated on Drawings.
      a. Provide custom fabricated trim pieces as required.
   2. Completely fabricate in shop and label all items for field assembly or, if approved in writing by Engineer, fabricate on-site using same equipment used in the fabrication shop.
   3. System shall be designed for wind loading in accordance with ASCE 7 and the building code.
   4. Length of exterior panels shall be sufficient to cover minimum 40 FT without horizontal joints.
   5. Fasteners: Painted to match wall panel.

B. Panels:
   1. Exterior Panel (Exposed fastener):
      a. Profile: Match with existing Water Treatment building.
      b. Gage: Match with existing Water Treatment building .
      c. Width: Match with existing Water Treatment building .
      d. Provide watertight gaskets/washers.
      e. Finish: PVDF having minimum 70% resin content.
      f. Finish:
         1) Three-coat system having minimum 0.8 MIL primer coat on both sides of panel with a 0.8 MIL 70% Kynar 500 or Hylar 5000 resin color coat and a 0.8 MIL 70% Kynar 500 to Jylar 5000 clear top coat on the exterior.
         2) Centria "DURAGARD PLUS."
         3) Color: Match with existing Water Treatment building.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests:
   1. Air infiltration:
      a. When tested per ASTM E283 at a positive pressure differential of 1.57 PSF, air infiltration shall not exceed 0.06 CFM per square foot of wall area.
      b. Does not apply to liner panels.
   2. Water infiltration:
      a. When tested per ASTM E331 at a pressure differential of 6.24 PSF or 20% of the design wind pressure, whichever is greater, there shall be no uncontrolled leakage through the panel joints.
      b. Does not apply to liner panels.
   3. Fire tests:
      a. Panels shall be qualified by laboratory scale and/or full scale fire tests for acceptance by the building code and insurance authorities for use when non-load-bearing non-combustible wall construction is permitted, based on fire performance.
      b. Evidence of fire performance shall be submitted and include the following:
         1) UL classification for "Surface Burning Characteristics" per ASTM E84.

2.5 MAINTENANCE MATERIALS

A. Extra Materials:
   1. Provide Owner with following extra materials:
      a. Eight 8 OZ of touch-up paint for each color and each different finish specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine alignment of structural steel and/or panel support system prior to installation and do not proceed until all defects are corrected.

3.2 ERECTION AND INSTALLATION

A. Provide all closures, trim, angles, plates, sealant, gaskets, fasteners, washers, etc., as required for complete water and air infiltration.

B. Install products in accordance with manufacturer's instructions.

C. Remove all strippable coating and provide a dry wipe-down cleaning of the panels as they are erected.

D. Provide prefinished fasteners to match finish of panels where fasteners must be exposed.

E. Touch up all damaged surfaces with paint supplied by panel manufacturer.

F. Seal all joints using sealant recommended by panel manufacturer for water- and air-tight installation.

G. Wall panel manufacturers shall be responsible for designing and installing necessary expansion joints in wall panel system.

END OF SECTION

SECTION 07 61 13
STANDING SEAM METAL ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Standing Seam Metal Roofing in accordance with provisions of Contract Documents and as indicated below:
   1. Replacement roofing for the existing Water Treatment building.
   2. New roofing for the enlarged Control building.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Company engaged in copper or other unpainted metal roofing work with three years' experience in similar size and type of installations.
   2. Architectural roofing fabricated in a permanent stationary indoor facility.

B. Installer Qualifications:
   1. Minimum of two (2) years' experience in installation of concealed clip architectural standing seam metal roofing and show evidence of successful completion of at least 3 projects of similar size, scope, and complexity.
   2. An entity that employs installers and supervisors who are trained or approved by manufacturer.

C. ASTM International (ASTM):
   1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers.
   3. ASTM D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
   4. ASTM E1646 Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
   5. ASTM E1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
   1. Architectural Sheet Metal Manual

E. American Welding Society (AWS):
   1. AWS Sheet Steel in Structures, Specification for Welding AWS D1.3.

F. National Roofing Contractors Association (NRCA):
   1. Roofing Manual, Metal Panel and SPF Roof Systems.

G. Underwriters Laboratories (UL):
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 580 - Test for Wind-Uplift Resistance of Roof Assemblies.
   3. UL-2218 - Impact Resistance Test

1.3 SUBMITTALS

A. Product Data:
   1. For each type of material and accessory.

B. Shop Drawings:
   1. Complete layout indicating types of roofing, anchorage, sections of flashing and trim conditions, cut openings and accessories.
   2. Drawings shall distinguish between factory and field fabrication.

C. Samples:
   1. Color samples of finishes.

D. Project Information:
   1. Certification of conformance with wind uplift standard listed.

E. Contract Closeout Information:
   1. Warranty.

1.4 WARRANTY

A. General Warranty:
   1. Provide two year warranty for water tightness of roof and associated flashing signed by roofing installer.
   2. Provide 20 year warranty for water tightness of roof and associated flashing signed by roofing materials manufacturer.
   3. Warrant water tightness of roof and associated flashing.

B. PVDF Finish:
   1. Provide 20 year warranty against fading, chalking, cracking or failure resulting in corrosion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Standing Seam Metal Roofing:
   1. Base:
      a. Petersen Aluminum
   2. Optional:
      a. Berridge Manufacturing
      b. Centria
      c. Fabral
      d. Firestone Una-Clad
      e. Morin
      f. Ryerson Metals

B. Underlayment:
   1. Base:
      a. Same as Metal Roof Manufacturer
   2. Optional:
      a. Approved by Metal Roof Manufacturer

C. Reglets, Downspouts and Gutters:
   1. Specified in Section 07 62 00.

D. Galvanizing repair paint:
   1. Base:
      a. Tnemec
   2. Optional:
      a. ZRC Worldwide

E. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

A. Static Air Infiltration:
   1. Maximum infiltration: 0.007 CUFTM/SQ FT at a pressure differential of 6.24 PSF when tested in accordance with ASTM E1680.

B. Static Water Infiltration:
   1. No uncontrollable water leakage at a pressure differential of 6.24 PSF when tested in accordance with ASTM E1646.

C. Wind Uplift Approval:
   1. UL-90 rating when tested per UL 580.

2.3 MATERIALS

A. Factory formed, pre-finished, standing seam metal roofing system with concealed fasteners over solid substrate.

B. Fabricate trim and flashings from same material as roof system material.

C. Painted Steel Panels:
   1. Sheet Steel: ASTM A653, Grade-A.
   2. Galvanized Coating: ASTM A653, zinc coating.
   3. Base Product: Snap Clad Standing Seam by Peterson Aluminum.
      a. Standing Seam Panels.
   4. Minimum Sheet Thickness:
      a. Steel: 24 GA.
      b. Reglets, Downspouts and Gutters: Specified in Section 07 62 00.
   5. Spacing of Standing Seams:
      a. 12 IN.
   6. Height of Standing Seam: 1-3/4 IN.
   7. Finish:
      a. Exposed:
         1) Minimum 70% PVDF.
         2) Minimum DFT: 1.0 mils.
         3) Color:
            a) To be selected by Architect from manufacturer's standard line.
      b. Concealed:
         1) PVDF Wash coat.
         2) Minimum DFT: 0.3 mils.
   8. Protective film: Strippable vinyl film applied during panel fabrication and finishing; removed after installation.
   9. Metal roofing clips and fasteners:
      a. ASTM A653, galvanized sheet steel.
      b. Minimum 26 GA before coating.
      c. Configurations and sizes required by Manufacturer.

D. Underlayment:
   1. Cold-applied, self-adhering rubberized asphalt membrane with cross laminated polyethylene film.
      a. Minimum sheet thickness: 40 MIL.
      b. Vapor Permeance: less than 0.05 perms.
      c. Tensile Strength: 250 PSI.
      d. Rated for use from -20 DEGF to 250 DEGF.
      e. Primer as required for substrate.
   2. Base Product:
      a. Grace Ice and Water Shield manufactured by Grace Construction Products.
   3. Optional:
      a. Other products approved by Roof Manufacturer for warranty.

E. Fasteners:
   1. Nails:
      a. Large head galvanized roofing nails.
   2. Screws:
      a. Stitch Teks, 12-14 x 3/4 hex washer head with pilot point.
      b. Color to match roofing.

F. Roof Sheathing:
   1. APA-Rated Sheathing.
   2. Exposure durability classification: Exterior.
   3. Span rating: As required to suit stud spacing indicated.
   4. Fire rated assemblies:
   5. Non-fire rated assemblies:
      a. Minimum 5/8 IN thick preservative treated, exterior grade wood and plywood.

G. Insulation:
   1. Specified in Section 07 21 00.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect entire area to be roofed for acceptability.

B. Correct unsatisfactory conditions.

C. Commencement of roofing activities constitutes acceptance of conditions affecting installation and responsibility for roofing system performance.

3.2 INSTALLATION

A. Do not start placement of roofing until supporting members are installed complete.

B. Install metal roofing panels to profiles, patterns and drainage indicated and required for leak-proof installation.

C. Provide for structural and thermal movement.

D. Prevent galvanic action of dissimilar metals.

E. Conceal fasteners where possible in exposed work.

F. Form joints to conceal sealant.

G. Deck Reinforcement:
   1. Reinforce openings between 6 and 12 IN with 20 GA steel sheet 12 IN greater in each dimension than opening.
   2. Place sheet around opening and weld to top surface of deck at each corner and each side midway between each corner.

H. Underlayment:
   1. Install membrane directly on clean, dry, continuous structural deck in accordance with manufacturers recommendations.
   2. Prime concrete surfaces at recommended application rate.
      a. Priming is not required for other suitable surfaces provided that they are clean and dry.
   3. Place first coarse starting at the eave.
   4. Overlap subsequent layers.
   5. Install additional layers of underlayment at ridges, valleys, penetrations, equipment curbs, adjoining walls and similar conditions.

I. Standing Seam Metal Roofing:
   1. Install cleats as required.

2. Place each panel on supporting structural frame, adjust to final position, and accurately align with ends bearing on supporting members.
    a. Install panels in one continuous length.
    b. Do not stretch or contract side lap interlocks.
    c. Place panels flat and square and secure to framing without warp or excessive deflection.
3. Remove and replace panels which are structurally weak, unsound or have burn holes scratches or other damage caused by shipping or installation.
4. Form trim with flush, telescoped, or nested 2 IN end and side laps.
5. Cut and fit panels and accessories around other work projecting through or adjacent to roofing.
    a. Make cutting and fitting neat, square and trim.
    b. Neatly and accurately reinforce openings exceeding 6 IN in diameter or on a side.
6. Install metal closure strips as required.
    a. Provide where rib openings in top surface of roof decking occur adjacent to edge and openings.
    b. Form tight-fitting closures at open ends and sides.
    c. Securely fasten closure strips into position.

3.3 CLEANING AND PROTECTION

A. Cleaning:
    1. Remove temporary coverings and protection of adjacent work areas.
    2. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

B. Touch Up:
    1. Retouch scarred areas, welds and rust spots.
    2. Touch-up damaged galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
    3. Touch-up PVDF surfaces with material used in shop, as recommended by metal roofing material manufacturer.

C. Protect installed product from damage during construction.

END OF SECTION

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SECTION 07 62 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Architectural flashing and sheet metal work.
   2. Prefinished scuppers, conductor heads and downspouts.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Architectural Manufacturers Association (AAMA):
      a. 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   2. American National Standards Institute/Single Ply Roofing Industry (ANSI/SPRI):
      a. ES-1, Wind Design Standard for Edge Systems Used with Low Slope Roof Systems.
   3. ASTM International (ASTM):
      a. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
      b. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
      c. B32, Standard Specification for Solder Metal.
      d. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   4. FM Global (FM).
   5. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
      a. Architectural Sheet Metal Manual.

B. Qualifications:
   1. Sheet metal fabricator shall have minimum 10 years experience in fabrication of sheet metal items similar to items specified.
   2. Sheet metal installer shall have minimum five years experience installing sheet metal items specified.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

B. PVDF: Polyvinylidene fluoride.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   2. Fabrication and/or layout drawings.
      a. Scaled drawing showing expansion joint locations, special conditions, profile, fastening and jointing details.
         1) Minimum plan scale: 1/8 IN = 1 FT.
         2) Minimum detail scale: 1-1/2 IN = 1 FT.
   3. Fabricator qualifications.
   4. Installer qualifications.

B. Samples:
   1. Finish and color samples for each product specified for Engineer preliminary color selection.
   2. For final color selection, provide [two], 2 IN x 3 IN colored metal samples for each color selected during the preliminary color selection.

C. Informational Submittals:
   1. Warranty: Manufacturer's sample warranty language.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pre-finished sheet metal:
      a. Carlisle SynTec Systems.
      b. Firestone Building Products Company.
      c. Petersen Aluminum Corporation.
   2. Factory-formed fascia system.
      a. Hickman Edge Systems.
      b. Metal Era.
   3. Factory-formed coping system.
      a. Hickman Edge Systems.
      b. Metal Era.
   4. Butyl sealant:
      a. Pecora Corporation.
      b. Sika.
      c. Tremco Commercial Sealants & Waterproofing.

2.2 MATERIALS

A. Sheet Metal:
   1. Aluminum: ASTM B209.
   2. Galvanized Steel: ASTM A653/A653M.
   3. Stainless Steel: ASTM A666.
      a. Type 304.

B. Fasteners: Non-ferrous compatible with sheet metal.

C. Sealants:
   1. Non-curing Butyl Sealant:
      a. Pecora "BA-98".
      b. Sika "SikaLastomer 511".
      c. Tremco "TremPro JS-773".
   2. Building sealants:
      a. See Specification Section 07 92 00.

D. Fasteners: Non-ferrous compatible with sheet metal.

E. Retainer Clips and Continuous Cleats: Galvanized steel or stainless steel.

F. Solder: ASTM B32.

G. Dissimilar Metal Protection: Comply with Specification Section 09 96 00.

H. Reglets: See Specification Section 04 05 23.

2.3 MANUFACTURED ITEMS

A. Factory Formed Fascia Systems:

1. Formed fascia cover snap locked to extruded aluminum anchor bar.
2. ANSI/SPRI ES-1 tested.
3. FM Approved.
4. Fascia cover:
    a. Aluminum.
        1) Thickness: 0.040 IN.
5. Factory fabricated accessories, including but not limited to:
    a. Corners, end caps, end terminations.
    b. Scuppers and spill-outs.
    c. All accessories to be factory mitered and welded.
6. Profile:
    a. Metal-Era "Anchor-Tite Standard Fascia".

B. Factory Formed Coping System:
1. Formed coping piece which locks to anchor plate fastened to top of wall.
2. ANSI/SPRI ES-1 tested.
3. FM approved.
4. Coping cover:
    a. Aluminum.
        1) Thickness: 0.040 IN.
5. Anchor plate: Stainless steel, minimum 20 GA.
6. Splice plates: Aluminum, minimum 0.032 IN.
    a. Continuous, minimum 6 IN long.
    b. Front and back legs with extruded butyl seal.
    c. Finish: Match coping.
7. Factory fabricated accessories, including but not limited to:
    a. Corners, end caps, end terminations.
    b. All accessories to be factory mitered and welded.
8. Profile:
    a. Metal-Era "Perma-Tite Tapered."
    b. Front leg: 6 IN.
    c. Back leg: 5 IN.

C. Finish:
1. PVDF coating with minimum 70% resin content.
    a. Meet requirements of AAMA 2605.
        1) Color: Coordinate with Owner.

2.4 FABRICATED ITEMS

A. General:
1. Shop fabricate items to maximum extent possible.
    a. Fabricate true and sharp to profiles and sizes indicated on Drawings.
        1) Shop fabricate and weld or solder all corners.
2. Pre-finished aluminum:
    a. Thickness: Minimum 0.040 IN.
    b. Texture: Smooth.
    c. Coated on exposed face with PVDF coating having a minimum 70% resin content and a minimum 1.0 MIL dry film thickness.
        1) Meet requirements of AAMA 2605.
        2) Color: Match coping and fascia.

B. Overflow Scuppers:
1. Roofing manufacturer’s recommended through-wall scupper design.
    a. Refer to Specification Section 07 61 13.
    b. Size and location(s) as shown on Drawings.

C. Scupper and Conductor Head:
1. Roofing manufacturer’s recommended through-wall scupper design.

a. Size and location(s) as shown on Drawings.
2. Conductor head profile per SMACNA Figure 1-25F.
a. Provide 1 IN x 4 IN overflow opening with drip edge on front face of conductor.
3. 4 IN long outlet tube.
a. Size and shape to match downspout.
4. Debris screen:
a. Installed in top of conductor head.
b. 1/4 x 1/4 IN aluminum mesh screen.
c. Screen shall be removable without damage to screen or conductor head.

D. Retainer Clips and Continuous Cleats:
1. 0.050 IN stainless steel.

E. Downspouts:
1. Rectangular open-face style .
a. Horizontal cross brace at 5 FT maximum spacing.
2. Fabricated in longest practical lengths.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction to Contractor in time to allow their installation.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions, SMACNA, and as indicated on Drawings.

B. Weld aluminum to achieve weathertight joints and required details.
1. Do not weld slip joints.
2. Touch-up damaged prefinished items.

C. Set top edges of membrane flashing and sheet metal flashing into reglets wherever practicable.
1. Surface applied terminations will be allowed only where specifically detailed or otherwise approved in writing by the Engineer.
2. Provide counterflashing at all reglets.
3. Seal reglets and counterflashings in accordance with Specification Section 07 92 00.

D. Fasten materials at intervals recommended by SMACNA.

E. Install slip joints to allow for thermal movement as recommended by SMACNA and manufacturer.
1. Maximum spacing: 10 FT OC.
2. Provide slip joint 24 IN from corners.
3. Provide slip joint at each vertical expansion joint location in wall.
a. Provide break in continuous cleat at each vertical expansion joint.
b. The above expansion joints do not include brick veneer expansion joints.

F. Seal slip joints with two beads of non-curing butyl sealant on each side of slip joint overlap.

G. Form flashings to provide spring action with exposed edges hemmed or folded to create tight junctures.

H. Provide dissimilar metals and materials protection where dissimilar metals come in contact or where sheet metal contacts mortar, concrete masonry or concrete.

I. Provide all miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weathertight installation.
1. Provide all components necessary to create weather-tight junctures between roofing and sheet metal work.

J. Provide sheet metal liner at exposed-to-view openings through roof deck, including but not limited to:
   1. Roof hatches: See Specification Section 07 72 33.

K. Installation of Scupper and Conductor Head:
   1. Flash the opening in the parapet wall and install the scupper and conductor head as indicated in SMACNA Figure 1-27A.
   2. Seal all joints to provide complete weathertight installation.
   3. Flash roofing material onto scupper per roofing manufacturer's recommendations.

L. Installation of Downspouts:
   1. Install downspouts in locations shown on the Drawings.
   2. Provide downspout anchor straps per SMACNA Figure 1-35 as appropriate for downspout style.
   3. Provide gutter to downspout connection per SMACNA Figure 1-33B, Detail 1.
   4. Seal all joints in downspout for a complete watertight system.
   5. Angle bottom of downspout out away from building to direct discharge onto concrete splashblock.
   6. Anchor hanger straps to building wall with stainless steel screws and anchor sleeves appropriate for wall construction.
      a. Provide minimum of two anchors per strap.
   7. Maximum spacing of hanger straps shall be 10 FT with minimum of two hanger straps per vertical piece of downspout.
   8. Spacing and location of hanger straps shall be consistent from downspout to downspout.

END OF SECTION

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sealing all joints which will permit penetration of dust, air or moisture.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 302.1R, Guide for Concrete Floor and Slab Construction.
   2. ASTM International (ASTM):
      a. C834, Standard Specification for Latex Sealants.
      b. C920, Standard Specification for Elastomeric Joint Sealants.
      c. C1521, Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
   3. Underwriters Laboratories, Inc. (UL).

B. Qualifications: Sealant applicator shall have minimum five (5) years experience using products specified on projects with similar scope.

C. Mock-Ups:
   1. Before sealant work is started, a mock-up of each type of joint shall be sealed where directed by the Engineer.
      a. The approved mock-ups shall show the workmanship, bond, and color of sealant materials as specified or selected for the work and shall be the minimum standard of quality on the entire project.
      b. Each sample shall cure for a minimum of seven (7) days at which time the sealant manufacturer's authorized factory representative shall perform adhesion tests on each sample joint.
         1) Perform adhesion tests per ASTM C1521.
         2) If mock-up is not acceptable or if adhesion test fails, provide additional mock-up and adhesion testing as required until acceptable to Engineer.

1.3 DEFINITIONS

A. Defect(ive): Failure of watertightness or airtightness.

B. Finish sealant: Sealant material per this specification applied over face of compressible sealant or expanding foam sealant specified, to provide a finished, colored sealant joint.

C. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

D. "Interior wet areas": Water Treatment Building and similar areas.

E. "Seal," "sealing" and "sealant": Joint sealant work.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's installation instructions.
c. Manufacturer's recommendations for joint cleaner, primer, backer rod, tooling and bond breaker.

3. Certification from sealant manufacturer stating product being used is recommended for and is best suited for joint in which it is being applied.
4. Certification of applicator qualification.

B. Test Results:
1. Provide adhesion test results for each sealant sample including adhesion results compared to adhesion requirements.
2. Manufacturer's authorized factory representative recommended remedial measures for all failing tests.

C. Samples:
1. Cured sample of each color for Engineer's color selection.
2. Color chart not acceptable.

D. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original unopened containers with labels intact: Labels shall indicate contents and expiration date on material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Compressible sealant:
a. Polytite Manufacturing Corporation.
b. Emseal.
c. Norton.
d. Sandell.
2. Polyether sealants:
a. BASF.
b. ChemLink, Inc.
c. Tremco.
3. Polysulfide rubber sealant:
a. Pecora.
b. BASF.
c. PolySpec.
4. Polyurea joint filler:
a. Dayton Superior Specialty Chemical Corporation.
b. Euclid Chemical Co.
c. L&M Construction Chemicals, Inc.
d. BASF.
5. Polyurethane sealants:
a. Pecora.
b. Sika Chemical Corp.
c. BASF.
d. Tremco.
6. Backer rod, compressible filler, primer, joint cleaners, bond breaker: As recommended by sealant manufacturer.

2.2 MATERIALS

A. Sealants - General:
   1. Provide colors matching materials being sealed.
   2. Where compound is not exposed to view in finished work, provide manufacturer's color which has best performance.
   3. Nonsagging sealant for vertical and overhead horizontal joints.
   4. Sealants for horizontal joints: Self-leveling pedestrian/traffic grade.
   5. Joint cleaner, primer, bond breaker: As recommended by sealant manufacturer.
   6. Sealant backer rod and/or compressible filler:
      a. Closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, nonabsorbent, non-bituminous material recommended by sealant manufacturer to:
         1) Control joint depth.
         2) Break bond of sealant at bottom of joint.
         3) Provide proper shape of sealant bead.
         4) Serve as expansion joint filler.

B. Compressible Sealant:
   1. Foamed polyurethane strip saturated with polymerized polybutylene waterproofing coated on front face with nonreactive release agent that will act as bond breaker for applied sealant.
      a. Polytite Manufacturing Corp. "Polytite-B."
   2. Fire rated where required.
   3. Adhesive: As recommended by sealant manufacturer.

C. Polyether Sealant:
   1. Silyl-terminated polyether polymer.
   2. ASTM C920, Type S, Grade NS, Class 50, Use NT, M, A, and O.
      a. BASF MasterSeal 150.
      b. ChemLink DuraLink.
      c. Tremco Dymonic FC

D. Polysulfide Rubber Sealant:
   1. One (1) or two (2) component.
   2. Meet ASTM C920.
      a. Pecora Synthacalk GC2+.
      b. PolySpec THIOKOL 2235.

E. Polyurea Joint Filler:
   1. Two (2) component, semi-rigid material for filling formed or saw-cut control joints in interior concrete slabs.
      a. Dayton Superior Specialty Chemical Corp. "Joint Fill, Joint Seal, Joint Saver II" as required for condition and recommended by manufacturer.
      b. Euclid Chemical Co. "EUCO QWIK" joint.
      c. L&M Construction Chemicals, Inc. "Joint Tite 750".
      d. BASF MasterSeal “CR100” control joint filler.
   2. Comply with ACI 302.1R performance recommendations regarding control and construction joints.
   3. Color: Gray.

F. Polyurethane Sealant:
   1. One (1) or two (2) components.
   2. Paintable.
   3. Meet ASTM C920 Type S or Type M, Grade NS or P, Class 25, Use NT, T, M, A and O.
      a. Pecora Dynatrol-IXL, Dynatrol II, Urexpan NR-200, NR-201.
      b. Sika Chemical Corporation Sikaflex-1a, Sikaflex-2C NS/SL.
      c. BASF MasterSeal NP-1, NP-II, SL-1 SL-2.
      d. Tremco Dymonic or Dymeric, Vulkem 116,227,45,245.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before use of any sealant, investigate its compatibility with joint surfaces, fillers and other materials in joint system.

B. Use only compatible materials.

C. Where required by manufacturer, prime joint surfaces.
   1. Limit application to surfaces to receive sealant.
   2. Mask off adjacent surfaces.

D. Provide joint depth for joints receiving polyurea joint filler in accordance with manufacturer's recommendations.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions and UL requirements.

B. Clean all joints.

C. Make all joints water and airtight.

D. At changes in direction of joints, joint intersections and where sealant joints interface with other construction, install continuous sealant as necessary to ensure a weather-tight seal.

E. Make depth of sealing compounds, except expanding foam and polyurea sealant, not more than one-half width of joint, but in no case less than 1/4 IN nor more than 1/2 IN unless recommended otherwise by the manufacturer.

F. Provide correctly sized backer rod, compressible filler or compressible sealant in all joints to depth recommended by manufacturer:
   1. Take care to not puncture backer rod and compressible filler.
   2. Provide joint backer rod as recommended by the manufacturer for polyurea joint filler.

G. Apply bond breaker where required.

H. Tool sealants using sufficient pressure to fill all voids.

I. Upon completion, leave sealant with smooth, even, neat finish.

J. Where piping, conduit, ductwork, etc., penetrate wall, seal each side of wall opening.

K. Install compressible sealant to position at indicated depth.
   1. Size so that width of material is twice joint width.
   2. Take care to avoid contamination of sides of joint.
   3. Protect side walls of joint (to depth of finish sealant).
   4. Install with adhesive faces in contact with joint sides.
   5. Install finish sealant where indicated.

L. Install expanding foam sealant to minimum 4 IN depth or thickness of wall being penetrated if less than 4 IN or as indicated on Drawings.
   1. Provide adequate fire rated backing material as required.
   2. Hold material back from exposed face of wall as necessary to allow for installation of backer rod and finish sealant.
      a. Allow expanding foam sealant to completely cure prior to installing backer rod and finish sealant.
   3. Trim off excess material flush with surface of the wall if not providing finished sealant.

3.3 SEALANT WORK

A. General:
   1. Work includes but is not limited to: Sealing all joints which will permit penetration of dust, air, or moisture.
   2. Refer to SCHEDULE for materials to be used.

B. Concrete joints:
   1. Flooring joints.
   2. Isolation joints.
   3. Joints between paving or sidewalks and building.
   4. Construction, control and expansion joints.

C. Flashing, reglets and retainers.

D. Openings:
   1. Perimeters of door and window frames, louvers, grilles, etc.
   2. Door thresholds shall be set in a full bed of sealant.

E. Plumbing fixtures.

F. Penetrations of walls, floors and decks.

G. Other joints where sealant, expanding foam sealant or compressible sealant is indicated.

3.4 FIELD QUALITY CONTROL

A. Adhesion Testing:
   1. Perform adhesion tests in accordance with ASTM C1521 per the following criteria:
      a. Water bearing structures: One (1) test per every 1000 LF of joint sealed.
      b. Building expansion joints: One (1) test per every 500 LF of joint sealed.
      c. All other type of joints except butt glazing joints: One (1) test per every 3000 LF of joint sealed.
      d. Manufacturer's authorized factory representative shall recommend, in writing, remedial measures for all failing tests.

3.5 SCHEDULE

A. Furnish sealant as indicated for the following areas:
   1. Exterior areas:
      a. Above grade: Polyether.
      b. Below grade: Polyurethane.
   2. Interior areas:
      a. Noncorrosive areas:
         1) Wet exposure: Polyether.
         2) Dry exposure: Polyether, unless noted otherwise.
      b. Corrosive areas:
         1) Wet exposure: Polysulfide.
         2) Dry exposure: Polyurethane.
   3. Immersion:
      a. Prolonged contact with or immersion in:
         1) Potable water: Polysulfide (NSF-61 approved).
   4. Compressible sealant: Where indicated.
   5. Exterior wall penetrations: Expanding urethane foam, with finish sealant.
      a. Finish sealant:
         1) Exterior side:
            a) Above grade: Polyether.
            b) Below grade: Polyurethane.

2) Interior side:
   a) Noncorrosive area:
      (1) Wet exposure: Polyether.
      (2) Dry exposure: Polyether, unless noted otherwise.

6. Interior concrete slab formed or saw-cut control joints: Polyurea joint filler.

END OF SECTION

SECTION 08 11 00
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. The hollow metal door and frame supplier shall provide door frames that accommodate existing conditions. Coordinate with contractor for more details.

B. Coat new doors and frames to match existing doors.

C. Section Includes:
   1. Metal doors and frames.

D. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 08 70 00 - Finish Hardware.
   4. Section 09 91 00 - Ferrous Metal Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. National Association of Architectural Metal Manufacturers (NAAMM):
      a. Hollow Metal Manufacturers Association (HMMA).
   3. Steel Door Institute (SDI):
      a. 111C, Recommended Louver Details for Standard Steel Doors.
      b. 117, Manufacturing Tolerances for Standard Steel Doors and Frames.
      c. All SDI publications.
   4. Steel Door Institute/American National Standards Institute (SDI/ANSI):
      a. A250.6, Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
      b. A250.7, Nomenclature for Standard Steel Doors and Steel Frames.
      c. A250.8, Specifications for Standard Steel Doors and Frames.
      d. A250.10, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
      e. A250.11, Recommended Erection Instructions for Steel Frames.

B. Qualifications: Manufacturer must be current member of SDI, and NAAMM (HMMA).

C. Wipe coat galvanized steel is not acceptable as substitute for galvanizing finish specified.

1.3 DEFINITIONS

A. As identified in SDI/ANSI A250.7.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. SDI certification.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store doors and frames in accordance with SDI/ANSI A250.11.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Metal doors and frames:
      a. Ceco Door by ASSA ABLOY.
      b. Steelcraft by Allegion PLC.
      c. Curries by ASSA ABLOY.

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

2.2 MATERIALS

A. Steel Sheet: Hot-dipped galvannealed steel, ASTM A653, A60 coating.

B. Frames: Hot-dipped galvannealed steel, ASTM A653, A60 coating.

C. Supports and Reinforcing: Hot-dipped galvannealed steel, ASTM A653, A60 coating.

D. Inserts, Bolts and Fasteners: Manufacturer's standard.

E. Primer: Manufacturer's standard coating meeting SDI/ANSI A250.10.

F. Thermal Insulation: Polyurethane, CFC free.

G. Sound Insulation: Fiberglass batt insulation or impregnated Kraft honeycomb.

2.3 ACCESSORIES

A. Frame Anchors:
   1. Jamb anchors:
      a. Masonry wire anchors: Minimum 0.1875 IN wire, galvanized.
      b. Existing wall anchor: Minimum 18 GA, galvanized.
      c. Stud partition and base anchors: Minimum 18 GA, galvanized.

B. Louvers:
   1. In accordance with SDI 111C.
   2. Size:
      a. 24” by 24” in each door panel.
   3. Galvanized steel: ASTM A653, G60.
   4. Frame: Minimum 18 GA.
   5. Blades: Minimum 22 GA.
   6. Adjustable blades.
   7. Blade profile: “Z” with minimum free area of 50 PCT.
   8. Provide insect screen.
   9. Manufacturers:
      a. Air Louvers
      b. Or Approved Equal.

C. Lights and Vision Panels:
   1. Comply with glazing requirements of SDI 100.

2. Size:
    a. 24” by 24” in each door panel.
3. Provide for glazing with synthetic rubber gaskets. Coordinate with Section 08 80 00 - Glazing.
4. Glass shall not contact metal.

2.4 FABRICATION

A. General:
1. SDI/ANSI A250.8.
2. Fabricate rigid, neat in appearance and free from defects.
3. Form to sizes and profiles indicated on Drawings.
    a. Beveled edge.
4. Fit and assemble in shop wherever practical.
5. Mark work that cannot be fully assembled in shop to assure proper assembly at site.
6. Continuously wire weld all joints, dress exposed joints smooth and flush.
7. Provide minimum 18 GA galvanized steel channel reinforcing on all sides of louver cut out.
8. Fabricate doors and frames to tolerance requirements of SDI 117.
9. Fit doors to SDI clearances.
10. All doors shall be handed.
11. Hinge cut-out depth and size on doors and frames shall match hinge specified in Specification Section 08 70 00.
12. Design and fabricate doors to requirements of the building code.

B. Hollow Metal Doors:
1. General:
    a. 1-3/4 IN thick.
    b. Fabricate with flush top caps.
        1) Thickness and material to match door face.
        2) Exterior doors: Seal weld top cap to door face and grind smooth and flush.
        3) Interior doors:
            a) Attach top cap to door with concealed fasteners or by welding.
            b) Factory seal if attached with fasteners.
            c) No exposed fasteners will be accepted.
    c. Continuously wire weld all joints and dress, smooth and flush.
2. Interior and exterior:
    a. Doors 48 IN wide, or less: SDI/ANSI A250.8, Level 3, and physical performance level A, Model 2.
        1) Face sheet minimum thickness: 16 GA.
        2) Insulated: Minimum R10.

C. Hollow Metal Frames:
1. Door frames:
    a. Installation conditions:
        1) In the Water Treatment Building:
            a) Provide a frame that will accommodate existing conditions.
            b) Existing pre-engineered metal building.
        2) In the Control Building
            a) New wood framed building
    b. Provide 4 IN face at head where required by existing conditions or by wall construction.
    c. 26 GA galvannealed steel boxes welded to frame at back of all hardware cutouts.
    d. Steel plate reinforcement welded to frame for hinge, strikes, closers and surface-mounted hardware reinforcing.
        1) All plate reinforcement shall meet size and thickness requirements of SDI/ANSI A250.8.

e. Split type frames not acceptable.
    1) All horizontal and vertical mullions and transom bars shall be welded to adjacent members.
f. Conceal all fasteners.
g. Frames shall be set up, all face joints continuously wire welded and dressed smooth.
h. Exterior (up to 4 FT wide): 16 GA.
i. Provide removable spreaders at bottom of frame.

D. Prepare for finish hardware in accordance with templates provided by hardware supplier and SDI/ANSI A250.6.
    1. Locate finish hardware in accordance with SDI/ANSI A250.8.
    2. See Specification Section 08 70 00 for hardware.
    3. Prepare doors for swing direction indicated.
        a. Preparing doors for non-handed hinges is not acceptable.

E. After fabrication, clean off mill scale and foreign materials and prime with rust inhibiting primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors and frames in accordance with SDI/ANSI A250.11, the building code and manufacturer's instructions.

B. Plumb, align, and brace frames securely until permanently anchored.
    1. After completion of walls, remove temporary braces and spreaders.
    2. Anchor frames with minimum of three anchors per jamb.
        a. Number and location of anchors shall be in accordance with SDI and frame manufacturer's recommendations.

C. At existing masonry construction, place frames in rough opening using existing opening anchors.

D. Use plastic plugs to keep silencer holes clear during construction.

E. Immediately after erection, sand smooth rusted or damaged areas.
    1. Touch-up with rust-inhibiting primer.
    2. Finish paint door and frame too match existing, surrounding, doors and in accordance with Specification Section 09 91 00.

F. Install three silencers on strike jamb of single door frame and two on head of double door frame.
    1. See Specification Section 08 70 00.

G. Protect doors and frames during construction.

END OF SECTION

SECTION 08 31 00
ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO).
   2. ASTM International (ASTM):
      a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      c. A240, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
      d. A480, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
      e. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      f. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
      g. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
      h. B221,Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 DEFINITIONS

A. Access doors: Generic term for a access hatch. Access door and access hatch are interchangeable.

B. Standard Duty: Will support live load of 150 psf.

C. Heavy Duty: Will support live load of 300 psf.

D. H-20 loading: As defined in AASHTO Guidelines.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Access doors:
      a. Bilco Company.
      b. Babcock Davis Associates.
      c. Dur-Red Products.
      d. Halliday Products.
      e. USF Fabrication Inc.

2.2 MATERIALS

A. Aluminum:
   1. Sheet and Plate: ASTM B209.
   2. Extruded shapes: ASTM B221.

B. Stainless Steel: ASTM A240 or A666.

2.3 MANUFACTURED UNITS

A. General:
   1. All access doors shall be provided by the same manufacturer when possible.
   2. Coat all aluminum components in contact with concrete or masonry with manufacturer's standard bituminous coating.

B. Heavy Duty Access Doors:
   1. Frame: 1/4 IN mill finish aluminum channel with anchor tabs.
      a. 1-1/2 IN DIA drain coupling.
   2. Cover:
      a. 1/4 IN mill finished diamond plate aluminum.
      b. Reinforce cover with aluminum stiffeners.
         1) Live load: 300 psf.
         2) Deflection: Maximum 1/150 of span.
   3. Hardware:
      a. All hardware to be stainless steel.
      b. Positive hold open arm that engages automatically when door reaches full 90 degree open position.
      c. Slam lock and removable key handle.
   4. Bilco Company, Type "J-AL" or "JD-AL."
      a. Size(s): See Drawings.

C. H-20 Loading Doors:
   1. Frame: ¼ IN mill finish aluminum channel with anchor tabs.
      a. 1-1/2 IN DIA drain coupling.
   2. Cover:
      a. ¼ IN mill finished diamond plate aluminum.
      b. Reinforce cover with aluminum stiffeners.
         1) Reinforced for AASHTO H-20 wheel loading for use in off street applications.
         2) Deflection: Maximum 1/150 of span.
   3. Hardware:
      a. All hardware to be stainless steel.
      b. Positive hold open arm that engages automatically when door reaches full 90 degree open position.
      c. Slam lock and removable key handle.
   4. The BILCO Company, Type “J H-20 IN or JD H-20”.
      a. Size(s): Refer to the Contract Drawings.

2.4 ACCESSORIES

A. Secondary Fall Protection System:
   1. Design and install system such that when in the open position, no part of the system obstructs the clear opening size for any of the access doors on the project.
   2. Platform: Design grating to meet OSHA 29 CFR 1910.23 requirements for protection for floor openings.
   3. Finish:
      a. Powder coated.
      b. Color: Safety Orange or Safety Yellow.
   4. Hardware:
      a. Stainless steel Type 316.
      b. Tamper proof Type 316 stainless steel bolts.
   5. Provide positive latch to hold grating in upright position.
   6. Size: Size grating platform to allow 6 IN clear space on each unhinged side for visual observation.
   7. Provide padlock hasp for Owner provided padlock.
   8. Double leaf openings:
      a. Provide two (2) individual grating platforms hinged on the same side of the hatch frame but independent from one another.
         1) Provide each platform with a padlock hasp and positive latch to hold grating in upright position.
   9. Install secondary fall protection system at the factory.

B. Load Rating Plates:
   1. Minimum 18 GA Type 316 stainless steel, ASTM A666.
   2. Engraved with maximum design live load allowed for unit on which it will be mounted.
   3. Display load in English units as well as metric units.
   4. Size as required for text as needed.
   5. Text:
      a. Font: Helvetica Narrow, all caps.
      b. Size: 1/4 IN height.
      c. Depth of engraving: 3 mils.
   6. Finish:
      a. Text:
         1) Black epoxy baked on paint.
         2) Plate to have finish conductive to paint application.
      b. Coat entire plate with baked on clear coat on front and back side.
   7. Attach to top of all floor access doors using stainless steel screws in location determined by manufacturer.
      a. Provide a neoprene gasket under the plate to separate the stainless steel from the aluminum cover or frame.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 08 51 13
WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Windows.

B. Related Sections include but are not necessarily limited to:
   1. Section 07 92 00 - Joint Sealants.
   2. Section 08 81 00 - Glass and Glazing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Architectural Manufacturers Association (AAMA):
      a. 904, Voluntary Specification for Multi-Bar Hinges in Window Applications
      b. 1503, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
      c. 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   2. ASTM International (ASTM):
      a. A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
      b. C1363, Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
      c. E283, Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
      d. E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference.
      e. E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
   3. American Welding Society (AWS):
      a. D1.2, Structural Welding Code - Aluminum.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data for framing system and major accessories including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Hardware being provided by window manufacturer.
      c. Glass being provided by window manufacturer in factory glazed units.
      d. Manufacturer's installation instructions.
   2. Elevation drawings indicating window dimensions and details.

B. Samples:
   1. After initial color selection, provide 2 x 3 IN minimum sample of each color and finish selected.

C. Informational Submittals:
   1. Qualifications of testing laboratory.
   2. Test results.
   3. Warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store units in vertical position off ground with wood spacers between each unit.

1.6 WARRANTY

A. Five year warranty of weathertightness of installation.
   1. Air and water integrity and structural adequacy of units and hardware, including sealants and sealing within and around perimeter of installation.
   2. Signed jointly by fabricator, installer, and contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Windows:
      a. EFCO Windows
      b. Wausau Metals Corp.
      c. Kawneer Company Inc.

2.2 MATERIALS

A. Extruded Aluminum: 6063T5 alloy.

B. Sealants: As specified in Section 07 92 00.

C. Thermal Insulator: Poured in place polyurethane, self-adhering to adjacent aluminum surfaces.

D. Weatherstripping: Sponge neoprene.

2.3 ACCESSORIES

A. Screens:
   1. 18 x 16 mesh aluminum wire screens.
   2. Secure to aluminum shapes with vinyl spline.
   3. Hold in place with spring loaded plungers.
   4. Removable to inside of building.
   5. Finish same as window frames.

B. Flashing:
   1. Minimum 0.040 IN aluminum.
   2. Finish to match window frames.
   3. Mill finish if concealed.

2.4 FABRICATION

A. General:
   1. Fully degrease and clean members prior to assembly or application of protective coatings.
   2. Weld by methods recommended by manufacturer and AWS D1.2 to avoid discoloration at welds.
   3. Grind exposed welds smooth and restore finish.
   4. Ease corners of cut edges to a radius of approximately 1/64 IN.
   5. Conceal fasteners wherever possible.
   6. Fit and assemble work at shop to maximum extent possible.
   7. Maintain true continuity of line and accurate relation of planes and angles.

8. Provide secure attachment and support at mechanical joint, with hairline fit of contacting members.
9. Reinforce work as necessary to withstand wind loadings and to support system.
10. Separate dissimilar metal with paint or preformed separators to prevent corrosion.
11. Separate metal surfaces at moving joints with plastic inserts or other nonabrasive concealed inserts to permanently prevent freeze-up of joint.
12. Reinforce frames for hardware.
13. Structural steel reinforcement hot-dip galvanized after fabrication meeting G-90, ASTM A924, requirements.

B. Thermal Insulator: Provide minimum 1/4 IN separation between exterior and interior metal surfaces after bridge is removed.

C. Weatherstripping:
1. Thermally broken type windows:
a. Casement and projected:
1) Provide two rows of fin type extruded neoprene weatherstrips extending around perimeter of sash at both inner and outer overlap contacts.
2) Provide corners which are securely staked and joined.
3) Provide units which are easily replaceable.

D. Window Hardware:
1. General:
a. Locking device and strikes: White bronze and/or non-magnetic stainless steel.
b. All hardware elements that bridge sash or frame thermal barrier: Reinforced nylon, deirin or suitable non-metallic, low conductivity material.
c. Custodial key operation: Secure sash in closed position and automatically lock in washing position.
d. Safety keys removable only in closed position.
2. Glass: See Section 08 81 00 for types of glass to be installed under this Section.

E. Fasteners:
1. Finish exposed fasteners to match finish of system.
2. Provide Phillips flat head screws where exposed.

F. Finish: AAMA 2605 Fluoropolymer paint; color to be selected by the Owner

G. Utilize the following Article to address tests, inspections, and certifications required to be performed at the shop prior to shipment to site. Include items, e.g., certified pump curves. Copies of such items should be requested under Submittals article of this Section.

2.5 SOURCE QUALITY CONTROL

A. General Test Requirements:
1. Utilize independent testing laboratories specifically qualified to conduct all performance tests required.
2. Performance tests may be conducted in manufacturer's laboratories provided they are witnessed and certified by qualified independent testing laboratory personnel.
3. Perform all tests on "Test Unit":
a. Full-sized window unit for project or a minimum 5 x 8 FT unit mounted in test chamber in exact accordance with job conditions including anchorage system, sealing, etc.
b. Test unit to be completely assembled and glazed.
1) Thermal tests may be conducted on 4 x 6 FT unit.
4. Test air infiltration first, water resistance second.
a. Other tests may be in any order.
5. Test data on vertical pivot windows will be accepted for fixed windows for condensation resistance, thermal, temperature exposure and acoustical tests provided the fixed windows are the same as the vertical windows tested in the following respects:
a. Same frame section (or same family of extrusions).
b. Same basic metal mass inside and outside.

c. Identical thermal break.
d. Same type of glazing.

B. Test Requirements:
1. Air infiltration test:
a. With sash and ventilators closed and locked, test in accordance with ASTM E283.
b. Air infiltration, in CFM/FT of crack length, at pressure differential of 6.24 PSF as follows:
1) Fixed windows: 0.06 maximum, all others 0.10 maximum.
2. Water resistance test:
a. Mount glazed unit in its vertical position, continuously supported around outside perimeter with sash and ventilators closed and locked.
b. Test in accordance with ASTM E331.
c. No uncontrolled leakage allowed, with pressure differential of 6.24 PSF.
3. Uniform load deflection test:
a. Test in accordance with ASTM E330.
b. Subject unit to load of 25 PSF applied to outside of window and 25 PSF applied to inside of window.
c. Maximum allowable deflection of any unsupported span: L/175.
d. No glass breakage, permanent damage to fasteners, hardware parts, support arms or activating mechanisms, or any other damage which would cause window to be inoperable will be allowed.
4. Uniform load structural test:
a. Test in accord with ASTM E330.
b. Subject unit to loads indicated below.
c. Stabilize pressure and maintain it for minimum period of 10 seconds.
d. No glass breakage, permanent damage to fasteners, hardware parts, support arms or activating mechanisms or any other damage which would cause window to be inoperable will be allowed.
e. Maximum permanent deformation of any main frame, sash or ventilator member: 0.4% of its span.
f. After performing Uniform Load Structural Test, increase loads 1-1/2 times and perform safety test.
g. Design unit to withstand following design pressures acting normal to plane of wall, at applicable heights and locations.
5. Condensation resistance test:
a. Perform on "test unit," except size may be 3 x 4 FT, minimum.
b. Test in accordance with AAMA 1503.
c. CRF (Condensation Resistance Factor): 50, minimum.
6. Thermal test:
a. Perform on "test unit" except size may be 4 x 6 FT, minimum.
b. Test in guarded hot box ASTM C1363, with an exterior temperature of 18 DEGF, an interior of 68 DEGF and 15 MPH fan-generated wind velocity on exterior.
c. "U" value: not to exceed 0.65 BTU/HR/SQFT/DEGF.
d. Calculated "U" values from smaller units or data or theoretical assumptions will not be acceptable.
7. Temperature exposure test:
a. Perform on "test unit" except size may be 4 x 6 FT, minimum.
b. Maintain interior chamber temperature at 70 DEGF.
c. Reduce exterior ambient temperature to minus 15 DEGF.
8. Structural thermal barrier tension test:
a. Test urethane filled sections of aluminum.
b. Mechanically secure interior and exterior faces of 12 IN section in horizontal position.
c. Apply heat tape to exterior face to control surface temperature at 180 DEGF 5 minutes before loading, as indicated by a thermocouple wire operated by an automatic controller.

d. Apply direct tension (pull) using a Universal testing machine set in 12,000 LB load range.
e. Test results: No loss of bond at 4000 LB IN/IN/MIN.

9. Structural thermal barrier shear test:
   a. Test urethane filled sections of aluminum.
   b. Mechanically secure interior face of 12 IN section in vertical position.
   c. Apply heat tape to exterior face to control surface temperature at 180 DEGF 5 minutes before loading, as indicated by a thermocouple wire operated by an automatic controller.
   d. Apply load to exterior face by a bearing plate resting on top of exterior face, using Universal Testing machine set in 12,000 LB load range at a strain rate of 0.050 IN/IN/MIN.
   e. Test results: No loss of bond at 5500 LB loading.
10. Structural thermal barrier combined torsion and shear test:
   a. Test urethane filled sections of aluminum.
   b. Secure interior face of 12 IN section in horizontal position.
   c. Apply heat tape to exterior face to control surface temperature at 180 DEGF 5 minutes before loading, as indicated by a thermocouple wire operated by an automatic controller.
   d. Apply load to bearing plate centered on portion of glazing pocket to exterior side of thermal barrier, using a Universal Testing machine set in the 12,000 LB load range.
   e. Test results: No loss of bond at 3900 LB load applied at strain rate of 0.05 IN/IN/MIN.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Set units plumb, level, and true to line.

C. Anchor securely in place.

D. Separate metal surfaces from sources of corrosion or electrolytic action.

E. Set sill and base members in a bed of sealant.

F. Provide joint fillers or gaskets for weathertight construction.

G. Seal all joints within and at perimeter of system.

H. Provide sealant color to match finish of system at exposed locations.

I. Provide sealants compatible with aluminum system and recommended for use with this type of installation.

J. See Section 07 92 00 for sealants.

3.2 FIELD QUALITY CONTROL

A. Installation supervised or inspected by manufacturer's authorized representative.

END OF SECTION

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SECTION 08 70 00
FINISH HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Finish hardware.
   2. Inspection and testing of door operation.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 08 11 00 - Metal Doors and Frames.

1.2 QUALITY ASSURANCE

A. All door hardware shall be provided by a single hardware supplier.
   1. Hardware is to be provided under this Specification Section, unless noted otherwise, for doors specified in:
      a. Specification Section 08 11 00.

B. Referenced Standards:
   1. Americans with Disabilities Act (ADA):
      a. Accessibility Guidelines for Buildings and Facilities (ADAAG).
   2. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
      a. A156.1, Butts and Hinges.
      b. A156.3, Exit Devices.
      c. A156.4, Door Controls -Closers.
      d. A156.6, Architectural Door Trim.
      e. A156.8, Door Controls - Overhead Stops and Holders.
      f. A156.13, Mortise Locks.
      g. A156.16, Auxiliary Hardware.
      h. A156.18, Materials and Finishes.
      i. A156.21, Thresholds.
   3. American National Standards Institute/Steel Door Institute (ANSI/SDI).
      a. A250.8, Specifications for Standard Steel Doors and Frames (SDI-100).
   4. Door and Hardware Institute (DHI).

C. Qualifications:
   1. Installation shall be inspected by a certified Architectural Hardware Consultant (AHC).

1.3 DEFINITIONS

A. AHC: Architectural Hardware Consultant, certified by DHI.

B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

C. All weather: Capable of operation from -50 to +120 DEGF.

D. Active Leaf: Right-hand leaf when facing door from keyed side unless noted otherwise on Drawings.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Qualifications
      a. AHC qualifications.
   3. Certification from AHC stating:
      a. All door hardware has been reviewed by AHC and verified to be compatible with doors and frames.
      b. No submittals will be reviewed until Engineer has received AHC certification.
   4. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   5. Technical data sheets on each hardware item proposed for use.
   6. Warranty information for all hardware devices having extended warranties.

B. Informational Submittals:
   1. Certifications:
      a. Certification from AHC stating all door hardware has been provided per approved Shop Drawings, has been installed in accordance with manufacturer's recommended installation instructions and all doors have been inspected and tested and found to be in proper working order.
         1) Door assemblies required to swing in the direction of egress have been inspected and tested in accordance with NFPA 101.

1.5 WARRANTY

A. Provide all individual manufacturers' extended warranties as advertised.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Hinges:
      a. Hager Companies.
      b. McKinney Manufacturing Co.
      c. Stanley by dormakaba Holding, Inc.
   2. Locksets and latchsets:
      a. Match existing manufacturer.
   3. Closers:
      a. Corbin Russwin, Inc. by ASSA ABLOY.
      b. LCN by Allegion PLC.
      c. Norton by ASSA ABLOY.
   4. Door stops and holders:
      a. Trimco.
      b. Rockwood by ASSA ABLOY.
      c. IVES by Allegion PLC.
   5. Overhead stops:
      a. Glynn-Johnson by Allegion PLC.
      b. Rockwood by ASSA ABLOY.
      c. Trimco.
      d. Rixson by ASSA ABLOY.
   6. Weatherstripping and thresholds:
      a. Pemko by ASSA ABLOY.
      b. Reese Enterprises, Inc.

c. Zero International, Inc.
d. National Guard Products.

7. Door bolts, coordinators and strikes:
   a. IVES by Allegion PLC.
   b. Trimco.
   c. Hager Companies.
   d. Rockwood by ASSA ABLOY.
8. Other materials: As noted.

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

2.2 MATERIALS

A. General: As indicated in the FABRICATION Article in PART 2 of this Specification Section.

B. Fasteners: Stainless steel or aluminum.

C. Closers:
1. Standard closer:
   a. Shell: Aluminum or cast iron.
   b. Arms and piston: Forged steel.

D. Kickplates:
1. Stainless steel.

E. Thresholds: Aluminum.

F. Overhead Stops and Wall Stops: Stainless steel or aluminum.

G. Keys: Brass or bronze.

H. Weatherstripping and Smoke Seals: Polypropylene, neoprene, or EPDM.

I. Pulls and Push Plates: Stainless steel.

J. Silencers: Rubber.

2.3 COMPONENTS

A. Hinges:
1. Butt hinges:
   a. ANSI/BHMA A156.1.
      1) A5111: Stainless steel, full-mortise, anti-friction bearing, Grade 1.
   b. Ball bearing.
   c. Flat button tips.
   d. Butt hinges:
      1) Hager BB1199.
      2) McKinney T4B3386.
   e. Hinge size:
      1) Doors up to and including 46 IN wide: 4.5 IN x 4.5 IN.
      2) Doors over 46 IN up to and including 60 IN wide: 5 IN high x 4.5 IN.

B. Mortise Locks and Latches:
1. ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 1.
   a. Meet requirements of ADA.
2. Antifriction two-piece mechanical latchbolt with stainless steel anti-friction insert.
   a. One-piece stainless steel deadbolt, minimum 1-1/4 IN x 9/ 16 IN thick with 1 IN throw.
   b. 2-3/4 IN backset.
   c. Cylinder: Brass, 6-pin, with interchangeable core.
      1) Match existing keyway.
   d. ADA compliant thumb turn lever.

3. Locking, latching and retracting mechanism and lock case:
    a. Steel, unless noted otherwise.
        1) Chrome or zinc dichromate plated.
4. Trim design: Corbin Russwin, Inc. "NSP".
    a. Match existing.
    b. Functions as indicated in following table in accordance with ANSI/BHMA A156.13.

C. Bolts:
1. ANSI/BHMAA 156.16.
2. Surface bolts: Rockwood 580 Series with top and bottom strikes.

D. Door Closers:
1. ANSI/BHMA A156.4, Grade 1.
2. Size door closers to comply with ANSI recommendations for door size and location.
3. Fabricate all closers with integral back check.
4. Provide integral stop unless noted otherwise.
    a. Do not provide integral stop at closers indicated to be installed on pull side of door.
    b. Provide all weather fluid for all closers used in exterior doors.
5. Full cover.
    a. Manufacturer's standard plastic cover.
6. Arms, brackets, and plates: As required for complete installation.
7. Closers:
    a. LCN 4040 Series or Norton 7500 Series or Corbin Russwin, Inc. DC6200 Series.
8. Provide manufacturer's standard 10 year warranty.

E. Door Stops:
1. ANSI/BHMA A156.16.
    a. Wall stops: IVES WS406-CVX or WS406-CCV.

F. Overhead Door Holders/Stop:
1. ANSI/BHMA A156.8.
2. Provide 'hold-open' function on all stops unless noted otherwise.
3. Surface mounted stops: Rockwood N14400 Series or Glynn Johnson 90 Series.
4. Concealed stops: Rockwood N11000 Series or Glynn Johnson 100 Series.

G. Kickplates:
1. ANSI/BHMA A156.6.
2. 8 IN high x 2 IN less than door width.
3. Beveled on all edges.
1. Thickness:
    a. Stainless steel: 0.050 IN.

H. Thresholds:
1. ANSI/BHMA A156.21.
2. One-piece unit.
3. Height: 1/2 IN high maximum.
4. Width: 4 IN
5. Provide required bolt cutouts.

I. Weatherstripping:
1. Weather seal at jambs and head:
    a. Self-adhesive strip: Reese #797.
    b. Color: Black.
2. Sweep at bottom of doors:
    a. Reese 701.
    b. Color: Clear anodized.
3. Weather seal astragal at meeting edges of pairs of doors:
    a. Reese 92 each leaf.
    b. Color: Clear anodized.

2.4 ACCESSORIES

A. Silencers:
   1. Hollow metal frames: Trimco 1229A or Rockwood 608.
   2. Self-adhesive silencers are not acceptable.

B. Keying:
   1. Establish keying with Owner.
      a. Provide and set up complete visible card indexed system with key tags and control slips.
      b. Tag and identify keys.
      c. Provide two keys for each lock or cylinder.
      d. Master key and key in groups as directed.
      e. Provide construction master keys for all exterior doors.

C. Strikes:
   1. Curved lips.
      a. Extended lips when required.
   2. Furnish strike boxes.
   3. Appropriate for function and hardware listed.

2.5 FABRICATION

A. General:
   1. Generally prepare for Phillips head machine screw installation.
   2. Exposed screws to match hardware finish or, if exposed in surfaces of other work, to match finish of other work as closely as possible.
   3. Provide concealed fasteners unless thru bolted.
   4. Through bolt closers on all doors.
   5. Furnish items of hardware for proper door swing.
   6. Furnish lock devices which allow door to be opened from inside room without a key or any special knowledge.

B. Hardware:
   1. Provide following ANSI/BHMA A156.18 finishes:
      a. Locksets, latchsets and strikes: 630.
      b. Door pulls, push bars, push plates: 630.
      c. Kickplates:
         1) Stainless steel: 630.
      d. Exit devices: 630 where available; 626 if 630 is not available.
         1) Provide 630 finish on trim.
      e. Butt hinges: 630.
      f. Door stops, dead locks, mortise bolts, and miscellaneous hardware: 630 where available, 626 if 630 not available.
      g. Door overhead stops: 630.
      h. Closers: 600 prime coat with 689 finish coat, unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's installation instructions.
   1. Perform installation by or under the direct supervision of an AHC.

B. Provide all hardware in accordance with the building code.

C. Fit hardware before final door finishing.

D. Permanently install hardware after door finishing operations are complete.

E. Locate hardware in accordance with ANSI/SDI A250.8.

F. Butt Hinges:
   1. Provide non-removable pin (NRP) at:
      a. Exterior doors.
      b. Reverse handed doors equipped with locks.
   2. Quantities:
      a. Door height 91 - 114 IN: Four.
      b. Doors over 48 IN wide and over 96 IN high:
         1) Provide top butt hinge within 6 IN of the top of the door to top of hinge.
         2) Provide one additional butt hinge approximately 6 IN below the bottom of the top butt hinge.

G. Closers:
   1. Mount closers on push side of doors unless noted otherwise.

H. Provide coordinator when required by hardware specified.

I. Overhead Stops:
   1. Provide overhead stop when corrosion resistant closer is specified.

J. Provide silencers for door frames.
   1. Hollow metal frames: See Specification Section 08 11 00.

K. Provide weather seal, door sweep and threshold at all exterior doors.
   1. Set thresholds in a full bed of sealant.
   2. Mount door sweeps on exterior face of door.
   3. Mount weather seal astragal at meeting edges of pairs of doors on the exterior face of the doors.

L. Mount kickplates on push side of doors.

3.2 FIELD QUALITY CONTROL

A. Adjust and check each operating item of hardware to assure proper operation or function.
   1. Lubricate moving parts with lubricant recommended by manufacturer.

B. During week prior to startup, make a final check and adjustment of all hardware items.
   1. Clean and lubricate as necessary to assure proper function and operation.
   2. Adjust door control devices to compensate for operation of heating and ventilating equipment.

C. Inspection and Testing:
   1. AHC shall inspect and test all door assemblies and provide written certification that door assemblies are in proper working order.
      a. Door assemblies required to swing in the direction of egress shall be inspected and tested in accordance with NFPA 101.
   2. Submit documentation and certification of testing in accordance with the certifications paragraph in the SUBMITTALS Article in PART 1 of this Specification Section.

END OF SECTION

SECTION 08 81 00
GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass and glazing.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 07 92 00 - Joint Sealants.
   2. Section 08 11 00 - Hollow Metal Doors and Frames.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI):
      a. Z97.1, Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
   2. ASTM International (ASTM):
      a. C864, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
      b. C1036, Standard Specification for Flat Glass.
      c. C1048, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
      d. C1376, Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
      e. E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
      f. E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.
   3. Code of Federal Regulations (CFR):
      a. Title 16 - Commercial Practices, Chapter ii - Consumer Product Safety Commission (CPSC), Subchapter B - Consumer Product Safety Act Regulations:
         1) 16 CFR 1201, Safety Standard for Architectural Glazing Materials.
   4. Glass Association of North America (GANA):
      a. Glazing Manual.
   5. Insulating Glass Certification Council (IGCC).
   6. Insulating Glass Manufacturers Alliance (IGMA):
      a. TM-3000, North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.
   7. National Fire Protection Association (NFPA).
      a. 80, Standard for Fire Doors and Other Opening Protectives.
      b. 251, Standard Methods of Tests of Fire Resistance of Building Construction and Materials.
      c. 252, Standard Methods of Fire Tests of Door Assemblies.
      d. 257, Standard on Fire Test for Window and Glass Block Assemblies.
   8. Underwriters Laboratories, Inc. (UL):
      a. 9, Standard for Fire Tests of Window Assemblies.
      b. 10B, Standard for Fire Tests of Door Assemblies.
      c. 263, Standard for Fire Tests of Building Construction and Materials.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

B. Safety Glazing: Glazing meeting the requirements of the building code and CPSC 16 CFR 1201.

C. Other terms as identified in CSPC 16 CFR 1201.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Certification that glass has been tested and approved for use in fire resistance rated doors or walls.
         1) Copies of all test criteria.
   2. Certification that insulating glass units meet requirements of IGCC and are certified by IGCC to ASTM E2190.

B. Samples:
   1. Two, 12 x 12 IN sample of each type, color, and thickness specified.
      a. Samples are not required for clear monolithic glass.

C. Informational Submittals:
   1. Warranty.

1.5 WARRANTY

A. Provide manufacturer's written 10 year warranty to cover deterioration of glass, glass units, coatings and ceramic frit.
   1. Insulating glass units shall be warranted against failure of hermetic seal resulting in fogging or film formation on the interior glass surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Glass:
      a. Guardian Glass by Guardian Industries.
      b. Insulite Glass Co., Inc.
      c. NSG/Pilkington.
      d. Oldcastle Building Envelope.
      e. Vitro Architectural Glass.
      f. Viracon.
   2. Gaskets, glazing compounds, setting blocks, spacers, sealant, sealant tape, etc., as recommended by glass manufacturer, glass unit fabricator.
      a. Provide materials as required by NFPA for use in fire-rated units.

2.2 MATERIALS

A. General:
   1. ASTM C1036.
      a. Clear glass: Type I, Class 1, Quality Q3.
   2. Thickness: 1/4 IN, unless noted otherwise.

B. Heat Strengthened and Fully Tempered Glass: ASTM C1048.
   1. General use: Kind HS.
   2. Condition:
      a. Clear or tinted vision glass: Condition A.

C. Fire Resistance Rated Glass:

1. ASTM E119 or UL 263 listed.
2. Fire rating required: As scheduled on Drawings.
    a. Fire-rated glazing assemblies shall be marked in accordance with the building code.
3. Thickness required by fire rating.
    a. Minimum 3/16 IN thick.
4. Optically clear, colorless and free from distortion.
5. Impact safety rated in addition to fire rating; meet ANSI Z97.1, Category 11.

2.3 MANUFACTURED UNITS

A. Insulating Glass Units:
    1. ASTM E2190, Class A.
    2. Two lites of glass separated by a hermetically sealed air space.
        a. Spacer: Stainless steel "warm edge" spacer.
            1) Thickness: 1/2 IN.
            2) Color: Black.
        b. Perimeter Sealant: Silicone.
            1) Color: Black.

2.4 ACCESSORIES

A. Glazing Compounds:
    1. Non-sag, non-stain type.
    2. Pigmented to match frame units not requiring painting.
    3. Compatible with adjacent surfaces.
    4. One- or two-part polyurethane or silicone sealant for use in setting glass.
        a. Provide glazing compounds which will not be affected by chemicals stored in rooms where glazing compounds are used.

B. Sealant Tape: Butyl rubber sealant tape or ribbon having a continuous neoprene shim.

C. Gaskets:
    1. Flexible polyvinyl chloride or neoprene.
        a. ASTM C864.
        b. Provide gaskets which will not be affected by chemicals stored in rooms where gaskets are used.
    2. Extruded of profile and hardness required to receive glass and provide a watertight installation.
    3. Provide gaskets in accordance with NFPA in fire resistance rated glazing.

D. Setting Blocks and Spacers:
    1. Neoprene or EPDM, compatible with sealants used.
        a. ASTM C864.

E. Compressible Filler Stock: Closed cell polyethylene or polyethylene jacketed polyurethane foam.

F. Shims, Clips, Screws and Other Miscellaneous Items: As required by condition.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with recommendations of manufacturer, GANA Glazing Manual and IGMA TM-3000.

B. Install setting blocks in adhesive or sealant.

C. Install spacers inside and out, of proper size and spacing, for all glass sizes larger than 50 united inches, except where gaskets are used for glazing.

D. Provide 1/8 IN minimum bite of spacers on glass.

E. Spacer thickness to equal sealant width.

F. Prevent sealant exudation from glazing channels of insulating glass which is more than 1/2 IN thick; colored, heat absorbing, coated or laminated glass sizes larger than 75 united inches; and other glass more than 9/32 IN thick or larger than 125 united inches.
   1. Leave void at heel (or install filler) at jambs and head.
   2. Do not leave void (or install filler) at sill.

G. Miter cut and bond gasket ends together at corners.

H. Immediately after installation, attach crossed streamers to framing held away from glass.

I. Use polysulfide-based glazing sealants in window assembly and as perimeter sealant around frames in areas which may be exposed to chlorine gas or chlorine liquid splash or spillage.
   1. See Specification Section 07 92 00 for sealants.

J. Install fire resistance rated glass in accordance with manufacturer's recommendations and in accordance with applicable fire testing criteria.

3.2 FIELD QUALITY CONTROL

A. Do not install glass with edge damage.

B. Do not apply anything to surfaces of glass.

C. Remove and replace damaged glass.

3.3 CLEANING

A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.

B. Wash and polish glass on both faces not more than seven days prior to acceptance of work in each area.
   1. Comply with glass manufacturer's recommendations.

3.4 SCHEDULES

A. General:
   1. Provide safety glazing for all applications where required by the building code and CPSC 16 CFR 1201.
   2. Provide heat strengthened glazing for all general use applications where safety glazing is not required.

B. Glass Type: Insulating Units.
   1. Exterior lite: 1/4 IN clear.
   2. 1/2 IN dehydrated air space.
   3. Interior lite: 1/4 IN clear.
   4. Performance Requirements:
      a. Transmittance:
         1) Visible light: 76%.
      b. U-Value
         1) Winter: 0.47.
         2) Summer: 0.49.
      c. Solar Heat Gain Coefficient (SHGC): 0.70.

END OF SECTION

SECTION 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Louvers.

B. Related Sections include but are not necessarily limited to:
   1. Section 07 62 00 - Flashing and Sheet Metal.
   2. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA):
      a. DAF 45, Designation System for Aluminum Finishes.
   2. Air Movement and Control Association (AMCA).
   3. ASTM International (ASTM):
      a. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Drawing showing location of each louver or vent, indicating size and arrangement of blank-off plates if required.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Color chart showing manufacturer's full line of colors including exotic and special colors for color selection by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Louvers:
      a. Airolite Company LLC.
      b. Construction Specialties, Inc.
      c. Ruskin Company.
      d. Industrial Louvers, Inc.
      e. American Warming and Ventilating.

2.2 MANUFACTURED UNITS

A. Drainable Adjustable Louvers:
   1. Match wall depth.
   2. Drainable with blades are adjustable to 37-1/2 DEG.
      a. Blades overlapping frames in unacceptable.
   3. Continuous blade appearance.
   4. ASTM B221 extruded aluminum, alloy 6063T5, minimum 0.081 IN thick.
   5. Minimum free area: 8.58 SQFT for 4 x 4 FT louver.
   6. Maximum pressure drop: 0.10 IN of water at 850 FPM.

7. Water penetration: 0.01 OZ/SQFT at 873 FPM.
8. AMCA certified.
9. Insect screen:
    a. 18-16 mesh aluminum.
    b. Install in standard aluminum frame.

B. Anchors, Fasteners, Reinforcing: Aluminum or stainless steel.

C. Size: Refer to Drawings for louver size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchoring and bracing accessories as required.

C. Seal around perimeter on exterior and interior.
1. See Section 07 92 00.

D. Install 0.040 IN aluminum flashing at sill to match louver.
1. See Section 07 62 00.

END OF SECTION

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gypsum board.
   2. Cement backer board.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 07 92 00 - Joint Sealants.
   2. Section 09 22 16 - Non-Structural Metal Framing.
   3. Section 09 91 10 - Architectural Painting.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      b. C475/C475M, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
      c. C840, Standard Specification for Application and Finishing of Gypsum Board.
      d. C1002, Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
      e. C1047, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
      f. C1396/C1396M, Standard Specification for Gypsum Board.
      g. D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
   2. Gypsum Association (GA):
      a. GA-214, Recommended Levels of Gypsum Board Finish.
   3. Underwriters Laboratories, Inc. (UL):
      a. Building Materials Directory.
      b. Fire Resistance Directory.

1.3 DEFINITIONS

A. Wet Area:
   1. Toilet rooms, showers, laboratories, janitor closets, or similar areas.
   2. Areas within 5 FT of emergency showers, eye wash stations, service sinks, or mop sinks.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Drawings of unusual conditions.
      a. Control joint layout.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Manufacturer's adhesive, joint treatment compound and tape recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Gypsum board and accessories:
      a. American Gypsum.
      b. Georgia-Pacific Gypsum LLC.
      c. National Gypsum.
      d. USG Corporation.
   2. Coated Fiber-faced Gypsum Board and Underlayment:
      a. Georgia-Pacific Gypsum LLC.
      b. USG Corporation.

2.2 MATERIALS

A. General:
   1. Provide UL Listed materials in fire-resistant rated construction.
   2. Furnish in lengths as long as practicable.

B. Gypsum Board (GB):
   1. ASTM C1396/C1396M.
   2. Thickness: 5/8 IN unless noted otherwise.
   3. Edges: Tapered.

C. Water and Mold Resistant Gypsum Wall Board (MRGWB):
   1. Water-resistant core and treated paper facers.
      a. Smooth face for finishing similar to standard gypsum board.
   2. Mold-resistant: ASTM D3273.
   3. USG "Sheetrock Mold Tough".

D. Coated Tile Backer Board and Underlayment:
   1. ASTM C1178
   2. Coated glass-mat water-resistant gypsum backer board.
      a. Mold Resistant, ASTM D3273.
   3. Thickness:
      a. Wall board: 5/8 IN Type X.
   4. USG Fiberock Tile Backerboard and Underlayment.

2.3 ACCESSORIES

A. Trim:
   1. ASTM C1047.
   2. Galvanized: ASTM A653/A653M G-60, unless noted otherwise.
   3. Corner bead:
      a. Standard type with perforated flanges.
      b. ClarkDietrich "#103 Deluxe Corner Bead".
   4. Casing and trim bead:
      a. ClarkDietrich "#200-A Metal U-Trim.
   5. Control and expansion joints:
      a. ClarkDietrich "#093 Zinc Control Joint."

B. Fasteners:
   1. Gypsum board, abuse resistant panels and tile backer board:
      a. ASTM C1002.
      b. Self-drilling, corrosion-resistant bugle head screws.
         1) For fastening gypsum board to metal framing: Type S.

C. Adhesive: As recommended by board manufacturer.

D. Joint Tape:
   1. ASTM C475/C475M.
   2. Recommended by manufacturer for specified board type and location.

E. Joint Treatment Compound:
   1. ASTM C475/C475M.
   2. Recommended by manufacturer for specified board type and location.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Verify that metal stud framing has been installed plumb, true, and in accordance with the Contract Documents.
   2. Prior to application of gypsum board, ensure that all blocking, backing and bracing has been installed as necessary for the support of appurtenant items.
   3. Install gypsum board in accordance with ASTM C840.
   4. Install board in fire-rated construction in accordance with UL requirements.
      a. Self-adhesive applied fire rated tape is not acceptable for use on board joints in fire rated walls.
      b. Tape all joints using conventional fire rated joint tape and joint treatment compound.
   5. Erect all board vertically with edges over supporting members.
   6. Secure to each support or framing member with screws.
      a. Provide fasteners of sufficient length to penetrate framing member or stud not less than 3/8 IN.
   7. In curved wall or ceiling applications use 1/4 IN thick board specifically designed for use in radius construction.
      a. Apply in multiple layers as required to meet minimum drywall thickness specified.
   8. In areas having gypsum board ceilings and walls, install ceiling first.
   9. Bring boards into contact, but do not force into place.
   10. Fit neatly and carefully.
   11. Stagger edge joints on opposite side of a partition so they occur on different framing members.
   12. Hold board in firm contact with support while fasteners are being driven.
   13. Proceed with attachment from center of board toward ends and edges.
   14. Scribe board prior to cutting.
   15. Where gypsum board abuts concrete, masonry, metal deck, exterior doors and windows, or other dissimilar material; provide 3/8 IN joint between edge of gypsum board and abutting material.
      a. Provide continuous casing bead trim on edge of board.
      b. Seal joint with sealant and backer rod.
      c. See Specification Section 07 92 00 for sealant.
   16. Use water-resistant gypsum board (WRGB) in wet locations not scheduled to receive tile finish or abuse resistant panels (ARP).
   17. Use Coated Fiber-faced Gypsum Board in wet locations unless noted otherwise.
      a. Install in accordance with ANSI A108.11 and manufacturer's recommendations.

B. Installation:
   1. Set fasteners between 3/8 and 1/2 IN from edges and 2 IN in from board corner.
      a. Space maximum of 12 IN on center at edges and in field of board.
      b. Where board butts at wall/ceiling juncture, hold fasteners back 6 IN from edges.
      c. Space fasteners closer if required by UL.
   2. Install fasteners, in gypsum board, so that head rests in a slight dimple without cutting face paper or fracturing core or as recommended by board/panel manufacturer.

C. Control Joints:
   1. Install prefabricated control joints to provide following maximum unjointed lengths or areas:
      a. Partitions: 30 FT, maximum straight run, and at both sides of jamb from head of each door, borrow lite, or window opening to top of partition.
      b. Ceilings:
         1) 50 FT maximum in one direction,
         2) At change of direction or irregular shapes.
         3) Ceiling area: 2500 SQFT, maximum.
   2. Where control or expansion joints occur in fire or sound rated assemblies, install suitable backing material to maintain required rating.
   3. Where a partition or ceiling abuts a structural element or dissimilar wall or ceiling, install corner bead, casing bead or other trim as required.

D. Gypsum Board Finishing:
   1. Securely attach continuous corner beads to all external corners in accordance with manufacturer's recommendations.
   2. Provide the following minimum levels of gypsum board finish in accordance with GA-214.
      a. Areas exposed to view:
         1) Surfaces to receive vinyl wall covering: Level #4.
         2) Surfaces to receive painted finish: Level #5.
      b. Areas not exposed to view:
         1) Fire rated partitions: Level #2 unless a higher grade of finish is required by UL.
         2) Non-fire rated partitions: Level #2.
      c. Provide additional coats of joint compound as required to completely conceal joints, fasteners and accessories.
         1) Joint photographing will not be acceptable.
   3. Sand each coat to remove excess joint compound.
      a. Avoid roughing paper facing on board.
   4. Finish surface shall be smooth and free of tool marks and ridges.
   5. Prime gypsum board surfaces in accordance with Specification Section 09 91 10.
      a. After primer has been applied, inspect surfaces and repair and refinish all areas which show defects.
   6. Refer to ASTM C840 for additional finishing requirements.

E. Coated Fiber-faced Gypsum Board Finishing:
   1. Follow the manufacturer's published installation instructions.
   2. In showers or similar wet areas scheduled to receive a tile finish:
      a. Seal perimeter, joints and penetrations in accordance with manufacturer's instructions to provide a water-tight installation.
      b. Apply fiberglass mesh tape and finish with latex modified mortar per manufacturer's instructions.
      c. Cover fasteners with latex modified mortar.
   3. In wet areas scheduled to receive a painted finish:
      a. Apply paper joint tape with setting-type joint compound.
      b. Finish per the Gypsum Board Finishing paragraph in this Section.

END OF SECTION

SECTION 09 91 00
FERROUS METAL COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This specification is for the furnishing of all labor, materials, supervision, equipment, tools, associated material, quality control tests and repairs necessary to perform the required installation of the specified polyurethane lining system.
   2. High performance industrial coatings (HPIC) for ferrous metals (non-stainless steel).
   3. The scope of work includes surface preparation, waste disposal, pretreatment, coating application, touch-up protection of surfaces not to be coated, inspection, cleanup, and all appurtenant work.
   4. The specified coating system shall be applied only to the ferrous metals as directed in these and the manufacturer's specifications and the Contract Drawings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Bureau of Standards (NBS):
      a. Certified Coating Thickness Calibration Standards.
   2. National Fire Protection Association (NFPA):
      a. 101, Life Safety Code.
   3. The Society for Protective Coatings (SSPC):
      a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
      b. SP 1, Solvent Cleaning.
      c. SP 2, Hand Tool Cleaning.
      d. SP 3, Power Tool Cleaning.
      e. SP 16, Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
   4. The Society for Protective Coatings/NACE International (SSPC/NACE):
      a. SP 5/NACE No. 1, White Metal Blast Cleaning.
      b. SP 6/NACE No. 3, Commercial Blast Cleaning.
      c. SP 7/NACE No. 4, Brush-off Blast Cleaning.
      d. SP 10/NACE No. 2, Near-White Blast Cleaning.
      e. WJ-4, Waterjet Cleaning of Metals – Light Cleanng.

B. Qualifications:
   1. Copy of a valid State of California Contractor's license is required for the application of coatings.
   2. Five references which verify that the coating subcontractor has demonstrated successful application of the specified coating systems in projects of similar size and scope in the past 5 years. Provide the size (area of coating), time of completion, project name, contact name, address and telephone number of the owner of each installation.
   3. The manufacturer shall provide written certification that the coating subcontractor's supervisor and each applicator performing work on the project have been trained and approved by the manufacturer to apply the selected coating system.
   4. The coating subcontractor shall provide a written certification that they are qualified and experienced in the application of the specified coating systems.
   5. The Contractor shall be licensed to apply polyurethane system proposed shall provide this documentation with their bid.
   6. Contractor shall provide SSPC QP 1 and QP 2 Certifications.

C. Deviation from specified mil thickness or product type is not allowed without written authorization of Engineer.

D. Material shall not be thinned.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Division 1 for requirements for the mechanics and administration of the submittal process.
   2. Applicator experience qualifications.
      a. No submittal information will be reviewed until Engineer has received and approved applicator qualifications.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's application instructions.
      c. Manufacturer's surface preparation instructions.
      d. Contractor's written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.
      e. Manufacturer's recommendation for providing temporary or supplemental heat or dehumidification or other environmental control measures.
   4. Manufacturer's statement regarding applicator instruction on product use.

B. Samples:
   1. Manufacturer's full line of colors for Engineer's preliminary color selection.
   2. After preliminary color selection by Engineer provide two (2) 3 x 5 IN samples of each final color selected.

C. Informational Submittals:
   1. See Division 1 for requirements for the mechanics and administration of the submittal process.
   2. Approval of application equipment.
   3. Applicator's daily records: Submit daily records at end of each week in which coating work is performed unless requested otherwise by Engineer's on-site representative.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 INSPECTION AND TESTING

A. All work relative to preparation for and application of coatings shall be conducted under the supervision of the Inspector. The Owner will hire a full-time certified NACE Inspector to oversee all surface preparation and coatings work. The Inspector shall be a NACE Certified Level III Coating Inspector with at least 5 years of coating inspection experience in similar coating environments and substrates.

B. The Contractor shall give the Owner and Inspector 3 day's advance notice of the start of any field surface preparation work or any coating application work.

C. The Contractor shall be responsible for submitting daily inspection reports to the Owner at the end of each work day.

D. The Contractor shall provide a full time Supervisor at the work site during the working hours for the duration of the project. The Supervisor shall have the Owner to sign change orders, coordinate work, and make decisions pertaining to the fulfillment of the Contract.

E. Inspection by the Owner, or the waiver of inspection of any particular portion of the work, shall not relieve the Contractor of responsibility of performing the work in accordance with these Specifications.

F. Prior to the start of any work, the Contractor shall establish with the Inspector, schedules and notification procedures to ensure that all surface preparation work has been inspected prior to the application of any coating.
   1. These procedures shall remain in effect for the duration of the project.
   2. Under no circumstances shall any surfaces be coated without prior approval of the Inspector.
   3. Coatings applied without the Inspector's authorization shall be removed and reapplied at the sole expense of the Contractor.
   4. Log sheets, approved by the Inspector, shall be used as the permanent record of all inspections with copies forwarded to the Owner daily.

G. Surface Preparation - Surfaces prepared as described in this Specification and per the manufacturer's recommendations shall be observed by the Inspector prior to application of coatings to verify compliance.

H. Film Thickness - Prepared surfaces and all coating system component applications shall be inspected prior to each succeeding application. The procedure for collecting representative thickness data shall be as follows:
   1. The Inspector shall determine where and how often to test for film thicknesses.
   2. The requirements of SSPC-PA 2 will be followed (at a minimum).
   3. Contractor shall take wet mil thickness readings at a minimum of every 100 square feet.

I. The Contractor shall make the following equipment available to the Inspector upon request:
   1. Holiday testers.
   2. Film thickness testers.
   3. Adhesion testers.

1.7 WARRANTY

A. The Contractor and manufacturers shall warrant the coating system applications for a period of 3 years after final acceptance of the work.

B. The Contractor shall submit to the Owner a 3-year warranty bond for the complete coating system.

C. The Contractor, at no cost to the Owner, shall perform all work and supply all equipment and materials associated with the repair of failures identified in the warranty inspection.

D. In the event of fault disagreement, warranty issues will be resolved through mediation involving the services of a NACE Certified Coating Inspector. Mediation and Inspection costs shall be borne by the party found to be responsible for the coating failure.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, only the following manufacturers are acceptable:
   1. Multi-Purpose Epoxy:
      a. Series N69 Hi-Build Epoxoline II, by Tnemec.
      b. Macropoxy 646, by Sherwin Williams
   2. Glass Flake Reinforced Epoxy
      a. Series 142, by Tnemec
      b. Sher-Glass FF, by Sherwin Williams
   3. 100% Solids, High-Build, Epoxy (NSF-61 certified):
      a. AquataPoxy A-61 by Raven lining systems.

B. Submit request for substitution in accordance with Division 1. Product VOC content will be an important factor when determining acceptability of substitution.

2.2 MATERIALS

A. Products of other listed manufacturers are acceptable for use providing the product is of the same generic resin, requires comparable surface preparation, has comparable application requirements, meets the same VOC levels or better, provides the same finish and color options and will withstand the atmospheric conditions of the location where it is to be applied.

B. Coating Systems: HPIC System #1
   1. For use on ferrous metals other than the Filter Treatment units.
   2. Prime coat: Multi-Purpose Epoxy, 3 to 4 mils DFT.
   3. Finish coat: Glass Flake Reinforced Epoxy, 12 to 16 mils DFT.
   4. Surface Preparation:
      a. Refer to Section 3.4 of this Specification for surface preparation.

C. Coating Systems: HPIC System #2
   1. For use on the exterior and interior surfaces of Filter Treatment Units No. 1 and No. 2.
   2. Coat: 100% solids, high-build, epoxy, 30 – 35 mils DFT.
   3. Coordinate with Owner for color.
   4. Surface Preparation:
      a. All surfaces require “Solvent Cleaning” (SSPC-SP 1) to remove oil, grease and other soluble contaminants.
      b. Chemical contaminants shall be removed according to SSPCSP 12/NACE No. 5.
      c. Identification of the contaminants along with their concentrations may be obtained from laboratory and field tests as described in SSPC-TU 4 “Field Methods for Retrieval and Analysis of Soluble Salts on Substrates”.
      d. Surfaces to be coated should then be prepared according to SSPC-SP 5/NACE No.1 “White Blast Cleaning” for immersion service or SSPC-SP 10/NACE No. 2 “Near White Blast Cleaning” for all other service.
      e. The resulting anchor profile shall be 2.5-5.0 mils and be relative to the coating thickness specified.

PART 3 - EXECUTION

3.1 ITEMS TO BE COATED

A. General:
   1. Coat the following surfaces whether exposed to view or not:
      a. The following ferrous metals (non-stainless steel) submerged and exposed, as shown in the Contract Drawings.

1) Valves
2) Piping.
3) Doors.
4) Structural components.
5) Valve operators
6) Pipe support brackets.

3.2 ITEMS NOT TO BE COATED

A. General: Do not coat items listed in this Article unless specifically noted in the Contract Documents to be coated.

B. Items with Approved Factory Finish: These items may require repair of damaged coated areas or coating of welded connections.

C. Electrical Equipment:
   1. Do not field coat electrical equipment except where coating is specifically stated elsewhere in these Contract Documents.

D. Other Items:
   1. Stainless steel surfaces except:
      a. Piping where specifically noted to be coated.
      b. Banding as required to identify piping.
   2. Aluminum surfaces except:
      a. Where specifically shown in the Contract Documents.
      b. Where in contact with concrete.
      c. Where in contact with dissimilar metals.
   3. Interior of pipe, ductwork, and conduits.
   4. Moving parts of mechanical and electrical units where coating would interfere with the operation of the unit.
   5. Code labels and equipment identification and rating plates.

3.3 ENVIRONMENTAL CONDITIONS

A. All coating shall be applied within the environmental limits specified by the manufacturer.

B. No coating work shall be performed under the following conditions:
   1. Temperatures exceed the manufacturer's recommended maximum or minimum allowable.
   2. Dust or smoke laden atmosphere.
   3. Damp or humid conditions, where the relative humidity is above the manufacturer's maximum allowable.
   4. Substrate or ambient temperatures are less than 5 DegF above the dewpoint. Dewpoint shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with J.S. Department of Commerce, Weather Bureau psychometric tables.
   5. Concrete surfaces in ascending temperatures.
   6. Concrete surfaces that contain a moisture content above that specified by the coating manufacturer.
   7. Concrete surfaces that are not visually dry.
   8. Relative humidity exceeds 85 percent.

C. The work is contained within a structure that may be subject to extended periods of high humidity.
   1. The Contractor shall be expected to maintain the established production schedule despite these potentially adverse conditions by providing all labor, equipment and materials necessary to maintain a controlled environment in the area where work is to be performed.
   2. The substrate and atmospheric conditions within the controlled environment, with respect to temperature and relative humidity, shall be maintained within the limits established by the coating manufacturer to ensure proper application and cure of the coating.

D. The Contractor shall dewater and stop any active water leaks into areas to be coated.

E. Contractor to provide appropriate containment. Contractor to provide heating as required to maintain ambient, substrate, and curing conditions as required by the specified coating products.
   1. The containment shall be built to withstand the local adverse conditions such as snow, wind, and driven rain, and to provide shade from the sun.
   2. The containment shall be maintained to provide the above referenced conditions throughout the course of the project during surface preparation, coating application, and all coating-related work.
   3. All damage to adjacent facilities that is incurred by the failure of the containment shall be repaired or replaced at no additional cost to the Owner.

3.4 SURFACE PREPARATION

A. General:
   1. Verify that atmosphere in area where coating is to take place is within coating manufacturer's acceptable temperature, humidity and sun exposure limits.
      a. Provide temporary heating, shade and/or dehumidification as required to bring area within acceptable limits.
         1) Provide temporary dehumidification equipment properly sized to maintain humidity levels required by coat manufacturer.
         2) Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 HR basis.
            a) Vent exhaust gases to exterior environment.
            b) No exhaust gases shall be allowed to vent into the space being coated or any adjacent space.
   2. Prepare surfaces to be coated in accordance with coating manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section. Where discrepancy between coating manufacturer's instructions and this Specification Section exists, the more stringent preparation shall be provided unless approved otherwise, in writing, by the Engineer.
   3. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.
   4. Adhere to manufacturer's recoat time surface preparation requirements. Surfaces that have exceeded coating manufacturer's published recoat time or have exhibited surface chalking shall be prepared prior to additional coating in accordance with manufacturer's published recommendations. Prepare in accordance with SSPC SP-7/NACE No. 4 unless otherwise approved by Engineer.

B. Protection:
   1. Protect surrounding surfaces not to be coated.
   2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.

C. Prepare and coat before assembly all surfaces which are inaccessible after assembly.

D. Ferrous Metal:
   1. Prepare ductile iron pipe in accordance with pipe manufacturer's recommendations.
      a. All piping, fittings, valves, supports, and any other component used in any other ferrous metals that require preparation for coating shall be prepared in accordance with requirements for immersion service.
         1) Surface Preparation: SSPC SP-10/NACE No. 2.
      b. Prepare all areas requiring repair coating in accordance with recommendations of coating manufacturer. The most stringent recommendations shall apply.
   2. Solvent clean in accordance with SSPC SP 1 and low-pressure water clean with detergent in accordance with SSPC/NACE WJ-4 prior to abrasive blasting.

E. Preparation by Abrasive Blasting:
   1. General:

a. Provide 3.0 to 4.0 mil sharp angular anchor profile.
b. Prepare surfaces to be coated in accordance with coating manufacturer's instructions and this Section unless noted otherwise in the Specification.
c. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.

2. Protection:
   a. Protect surrounding surfaces not to be coated.
   b. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
3. Prepare and Coat Before Assembly.
4. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before coating.
5. Surfaces allowed remaining overnight or surfaces which show rust bloom prior to coating shall be abrasive blasted and reinspected prior to coat application.
6. Provide compressed air for blasting that is free of water and oil. Provide accessible separators and traps.

3.5 COATING APPLICATION

A. General:
1. Mix and apply coatings in accordance with manufacturer's installation instructions.
2. Application equipment must be inspected and approved in writing by coating manufacturer.
3. Temperature and weather conditions:
   a. Do not coat surfaces when surface temperature is below 50 DegF unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and coat manufacturer's authorized representative.
   b. Avoid coating surfaces exposed to hot sun.
   c. Do not coat on damp surfaces.
4. Immediately after surface has been inspected and accepted by NACE certified coatings inspector, apply structural steel and miscellaneous steel prime coat in the factory.
   a. Finish coats shall be applied in the field.
   b. Prime coat referred to here is prime coat as indicated in this Specification. Structural steel and miscellaneous steel prime coating applied in factory (shop) as part of Fabricator's standard rust inhibiting and protection coating is not acceptable as replacement for specified prime coating.
5. Provide complete coverage to mil thickness specified.
   a. Thickness specified is dry mil thickness.
   b. All coat systems are "to cover." In situations of discrepancy between manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern.
   c. When color or undercoats show through, apply additional coats until coat film is of uniform finish and color.
6. If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.
7. Apply materials under adequate illumination.
8. Evenly spread to provide full, smooth coverage.
9. Work each application of material into corners, crevices, joints, and other difficult to work areas.
10. Avoid degradation and contamination of blasted surfaces. Clean contaminated surfaces before applying next coat.
11. Smooth out runs or sags immediately, or remove and recoat entire surface.
12. Allow preceding coats to dry before recoating.
    a. Recoat within time limits specified by coating manufacturer.
    b. If recoat time limits have expired re-prepare surface in accordance with coating manufacturer's printed recommendations.
13. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.
14. When coating rough surfaces which cannot be back-rolled sufficiently, hand brush coating to work into all recesses.

B. Finish Coat Application:
   1. Apply finish coats in accordance with coating manufacturer's written instructions and in accordance with this Specification Section; manufacturer instructions take precedent over these Specifications.
   2. Touch up damaged finish coats using same application method and same material specified for finish coat. Prepare damaged area in accordance with the SURFACE PREPARATION Article of this Specification Section.

3.6 FIELD QUALITY CONTROL

A. Contractor to maintain Daily Records:
   1. Contractor to record the following information during application of each coat of coat applied:
      a. Date, starting time, end time, and all breaks taken by applicators.
      b. For exterior coating: Wind speed and direction.
      c. Air temperature.
      d. Relative humidity.
      e. Moisture content and surface temperature of substrate prior to each coat.
      f. Provisions utilized to maintain work area within manufacturer's recommended application parameters including temporary heating, ventilation, cooling, dehumidification and provisions utilized to mitigate wind blown dust and debris from contaminating the wet coat film.
      g. Record environmental conditions, substrate moisture content and surface temperature information not less than once every four (4) hours during application. Record hourly when temperatures are below 50 DegF or above 100 DegF.
   2. Contractor to record the following information daily for the coat manufacturer's recommended curing period:
      a. Date and start time of cure period for each item or area.
      b. For exterior coating:
         1) Sky conditions.
         2) Wind speed and direction.
      c. Record environmental conditions not less than once every 12 hours.
         1) Record once every four (4) hours when ambient temperature is below 35 DegF.
      d. Provisions utilized to protect each item or area and to maintain areas within manufacturer's recommended curing parameters.
   3. Format for daily record to be computer generated.

B. Contractor to measure wet coating with wet film thickness gages.

C. Contractor to measure coating dry film thickness in accordance with SSPC PA 2 using Mikrotest gage calibrated against NBS "Certified Coating Thickness Calibration Standards." Engineer may measure coating thickness at any time during project to assure conformance with these Specifications.

D. Contractor to measure surface temperature of items to be coated with surface temperature gage specifically designed for such.

E. Contractor to measure substrate humidity with humidity gage specifically designed for such.

F. Contractor to provide wet coating signs.

3.7 COATING REPAIRS

A. If an area is found to have an improper finish, insufficient film thickness or other deficiencies; clean, prepare and topcoat the coating surface per the manufacturer's recommendations to obtain the specified finish and coverage at no additional cost to the Owner. Provide a finish which is continuous, uniform in thickness, and verified free of pores and other defects.

B. Damaged or defective coating shall be removed by the Contractor in accordance with the manufacturer's specified blast cleaning to meet the clean surface requirements before recoating at no additional cost to the Owner.

3.8 INSPECTION AND TESTING AFTER COATING APPLICATION

A. Lifting devices or ladders, to facilitate inspection, shall be erected and moved to locations where requested by the Inspector.

B. Whenever required by the Inspector, the Contractor shall provide additional illumination and ventilation required for inspections.
   1. Adequate illumination shall consist of explosion proof lights and electrical equipment required to meet safety standards.
   2. The Inspector shall determine the level of illumination for inspection purposes.

C. Visual Inspection - A visual inspection for holidays and bugholes shall be made on all coated surfaces. The holidays, voids and bugholes shall be marked with a permanent marker and repaired by the Contractor.

D. Inspection Devices - The items listed below, or approved equals, shall be provided to the Inspector, if needed, by the Contractor, in good working condition and with calibration data prior to beginning any work and shall remain available until final acceptance of the coating applications:
   1. Light Meter – Lutron LM-8000 or approved equal.
   2. Dry Film Thickness Testing for concrete: PosiTector 200 or approved equal.
   3. Hardness Testing – Shore D Durometer
   4. Holiday Testing
      a. Tinker & Rasor Model AP-W
      b. D.E. Stearns Model 14/20.
      c. Or approved equal.
   5. Psychrometer - Sling, mechanized, or digital.
   6. Surface Temperature – infrared temperature gauge.

E. Dry Film Thickness Testing
   1. Contractor to measure coating dry film thickness in accordance with SSPC PA 2 using an approved gage calibrated against NBS "Certified Coating Thickness Calibration Standards."
   2. Engineer may measure coating thickness at any time during project to ensure conformance with these Specifications.
   3. To be recorded by the Contractor and submitted to the Inspector:

F. Hardness Testing – The Contractor shall test the completed coating application for hardness in the presence of the Inspector.
   1. Shore D Durometer testing shall be performed in accordance with ASTM D2240.
   2. Test within four hours after application. The minimum results of 50D hardness shall be attained.
   3. If not attained, discuss the results with the coating manufacturer and retest in 24 hours with a minimum result of 65D hardness.
   4. If the 24-hour test result is not attained, discuss the results with the coating manufacturer and retest in 48 hours with a minimum result of 70D hardness.
   5. If the 48-hour test result is not attained, discuss the results with the coating manufacturer and the Owner on how to proceed.
   6. All testing results shall be recorded and mapped referencing the area tested. Submit all results to the Owner in the detailed daily inspection report.

G. Holiday Testing - The Contractor shall test the completed coating application for pinholes and holidays using a high voltage spark tester according to SP0188 and ASTM D4787. The testing shall be witnessed by the Inspector.

1. For surfaces having a total dry film coating thickness exceeding 20 mils, a high voltage detector as specified below shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness or as established by the manufacturer's recommendations and testing of induced holidays.
2. Holiday testing shall be conducted on completed coating sections within a timeframe dictated by the coating manufacturer.
3. The electrode movement over the coating surface shall be continuous at approximately 1 foot per second surface travel speed and shall proceed in a systematic manner, which ensures 100 percent coverage of the coating surface.
4. All defects shall be clearly marked by the Inspector followed by repair and retesting by the Contractor.

3.9 FINAL INSPECTION

A. Lifting devices or ladders, to facilitate inspection, shall be erected and moved to locations where requested by the Inspector.

B. Whenever required by the Inspector, the Contractor shall provide additional illumination and ventilation required for inspections.
   1. Adequate illumination shall consist of explosion proof lights and electrical equipment required to meet safety standards.
   2. The Inspector shall determine the level of illumination for inspection purposes.

C. Final Inspection – At the completion of all coating work, a final inspection shall be conducted. The Contractor and its Supervisor, the Inspector, a representative of the coating manufacturer, a representative of the Engineer and a representative of the Owner, shall conduct a final inspection to establish that all work has been completed per the Contract Documents.

D. The Contractor shall thoroughly document the conditions of each area of work at the time of inspection using video and still photography. Any deficiencies found shall be documented and corrected before final acceptance of the work will be granted. A copy of the photographs and video shall be provided to the Owner, and the Contractor shall keep the originals. The photographs and video shall be the basis of evaluation of the condition of the coating systems at the warranty inspection.

3.10 CLEANING

A. Upon completion of the work, all staging, scaffolding, containers and work related material or debris shall be removed from the site to the satisfaction of the Inspector and Owner. Coating overspray and oil spots or stains on all surrounding surfaces shall be removed and the job site cleaned. All damage to surfaces resulting from the Contractor's work shall be cleaned, repaired or refinished, to the satisfaction of the Owner at no cost to the Owner.

B. Disposal of spent solvents, thinners, coating components and other related materials shall be the Contractor's responsibility and shall meet all County, State and Federal regulations for safe disposal.

3.11 WARRANTY INSPECTION

A. Warranty inspections shall be conducted in the 1st and 3rd year of the warranty following acceptance of the work. All coating applications found to be deficient or defective during the warranty period shall be repaired or replaced by the Contractor, to the satisfaction of the Owner. These repairs or replacements shall be in accordance with this Specification and the material manufacturer's recommendations and at no cost to the Owner. Deficient or defective areas in the coatings include blisters, peeling, disbondment or cracking. The final inspection photographs and video shall be used to assist in determining deficient or defective areas in the coating systems.

B. The Owner shall establish a date for the inspection and notify the Contractor 30 days in advance, so that the Contractor and a representative of the coating manufacturer can be present during the inspection. The Owner will arrange for and cover the cost of the warranty inspection. The Contractor shall arrange for the presence of the coating manufacturer and bear all associated costs. Inspection costs in excess of one re-inspection or cancellation not attributed to the Owner shall be borne by the Contractor. The Contractor shall arrange for and cover all costs for repair work under the warranty.

C. If the warranty inspection is not held during or before 1 month prior to the end of the warranty period, the Contractor is not relieved of its warranty responsibilities under the contract documents. If the contractor fails to conduct an 11-month inspection for reasons not attributed to the Owner, the warranty period shall be extended until the inspection is conducted and defective work is repaired.

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SECTION 09 91 10
ARCHITECTURAL PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Surface Preparation.
   2. Field application of:
      a. Architectural Coatings.
      b. Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Specification Section.
   3. Environmental controls for field application of coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. D523, Standard Test Method for Specular Gloss.
      b. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
      c. D4259, Standard Practice for Abrading Concrete.
      d. D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
      e. D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
      f. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
      g. F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
      h. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. National Fire Protection Association (NFPA):
      a. 101, Life Safety Code.
   3. Steel Door Institute/American National Standards Institute (SDI/ANSI):
      a. A250.10, Test Procedure and Acceptance Criteria For Prime Painted Steel Surfaces for Steel Doors and Frames.
   4. The Society for Protective Coatings (SSPC):
      a. SP 1, Solvent Cleaning.
      b. SP 2, Hand Tool Cleaning.
      c. SP 3, Power Tool Cleaning.
      d. SP 16, Brush-off Blast Cleaning of Non-Ferrous Metals.
   5. The Society for Protective Coatings/NACE International (SSPC/NACE):
      a. SP 6/NACE No. 3, Commercial Blast Cleaning.
      b. SP 7/NACE No. 4, Brush-off Blast Cleaning.
      c. SP 13/NACE No. 6, Surface Preparation of Concrete.
   6. United States Environmental Protection Agency (EPA).

B. Miscellaneous:
   1. Coating used in all corridors and stairways shall meet requirements of NFPA 101 and ASTM E84.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

B. Approved Factory Finish: Finish on a product in compliance with the finish specified in the Specification Section where the product is specified.

C. Exposed Exterior Surface:
   1. Exterior surface which is exposed to view.
   2. Exterior surface which is exposed to weather but not necessarily exposed to view.

D. Finished Area:
   1. An area that is indicated on Drawings to be painted.

E. Gloss Range:
   1. Specular gloss measured in accordance with ASTM D523:
      a. Flat: Below 15, at 60 degrees.
      b. Eggshell: Between 20 and 35, at 60 degrees.
      c. Semi-gloss: Between 35 and 70, at 60 degrees.
      d. Gloss: More than 70, at 60-degrees.

F. Paint includes the following:
   1. Architectural paints (AP) include: Acrylic latex or alkyd enamel coatings.
   2. Special coatings (SC) include: Water-based pigmented resin particles suspended in acrylic latex solution.
   3. Stains and varnish include: Alkyd stain and polyurethane varnish.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's surface preparation instructions.
      c. Manufacturer's application instructions.

B. Samples:
   1. Manufacturer's full line of colors for Engineer's preliminary color selection.
   2. Gloss samples.
   3. After preliminary color selection by Engineer provide two (2) 8 by 10 inches samples of each final color and sheen selected.

C. Informational Submittals:
   1. Test results.
   2. Applicator's daily records:
      a. Submit daily records at end of each week in which painting work is performed unless requested otherwise by Engineer's on-site representative.

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Store materials in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.

1.6 PROJECT CONDITIONS

A. Verify that atmosphere in area where painting is to take place is within paint manufacturer's acceptable temperature, humidity and sun exposure limits.
   1. Provide temporary heating, shade and/or dehumidification as required to bring area within acceptable limits.

a. Provide temporary dehumidification equipment properly sized to maintain humidity levels required by paint manufacturer.
b. Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 hour basis.
1) Vent exhaust gases to exterior environment.
2) No exhaust gases shall be allowed to vent into the space being painted or any adjacent space.

2. Do not apply coatings in snow, rain, fog or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products from a single manufacturer to the greatest extent practicable.

B. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Architectural paints:
a. Benjamin Moore & Co.
b. PPG.
c. Pratt & Lambert.
d. Sherwin-Williams.
e. Tnemec, Inc.

2.2 MATERIALS

A. General:
1. For unspecified materials such as thinner, provide manufacturer's recommended products.
2. Unless noted otherwise, products listed are manufactured by the manufacturer listed below.
a. Products of other manufacturers will be considered for use provided that the product:
1) Is of the same generic formulation.
2) Has comparable application requirements.
3) Meets the same VOC levels or better.
4) Provides the same finish and color options.
3. Coatings shall comply with the VOC limits of EPA.
4. Colors:
a. Colors and gloss will be selected from the manufacturer’s complete offering, including special colors and premium offerings.

B. Architectural Paints:
1. Product List:

Generic Description	Product
Acrylic Primer	PPG Pure Performance 9-900
Acrylic Latex	PPG Pure Performance 9-100/9-300/9-500 Series
Acrylic Gloss	PPG Speedhide 6-8534 Series
Concrete Filler/Surfacer	Tnemec Series 215 and/or Series 218
CMU Block Filler	Tnemec Series 54 Masonry Filler
Dry-Fall Primer	Tnemec Series V115 Uni-Bond DF
Epoxy Barrier Coat	Tnemec Series 135 Chembuild
Fluoropolymer	Tnemec Series 1070V/1071V/1072V Fluoronar
HDP Acrylic	Tnemec Series 1028/1029 Enduratone
Organic Zinc Primer	Tnemec Series 94-H2O Hydro-Zinc

Generic Description	Product
Polycarbamide	Tnemec Series 740/750 UVX
Waterborne Acrylate	Tnemec Series 156 Enviro-Crete

2.3 PAINT SYSTEMS

A. General:
1. Refer to Specification Section 09 96 00 for:
   a. Items in corrosive or highly corrosive environments.
   b. Items subject to immersion service.
   c. Items subject to exterior exposure.
   d. Any other locations where High Performance Industrial Coatings (HPIC) are required.
2. Refer to Specification Section 07 81 00 for steel elements to receive fireproofing.

B. Schedule:

Substrate	Prime Coat[1]	Intermediate Coat(s)[1]	Finish Coat[1]
Structural Steel and Miscellaneous Metals[3]	2.5 to 3.5 mil Organic Zinc Primer	2.0 to 3.0 mil HDP Acrylic[2]	2.0 to 3.0 mil HDP Acrylic[2]
Galvanized Structural Steel and Miscellaneous Metals[3]	2.0 to 4.0 mil Dry-Fall Acrylic	-	2.0 to 3.0 mil HDP Acrylic [2]
Exposed wood	300 to 400 square feet/GAL Acrylic Primer	300 to 400 square feet/GAL Acrylic Gloss	300 to 400 square feet/GAL Acrylic Gloss
Hollow Metal - Interior	4.0 to 5.0 mil DFT Epoxy Barrier Coat	2.0 to 3.0 mil HDP Acrylic[2]	2.0 to 3.0 mil HDP Acrylic[2]
Hollow Metal - Exterior	4.0 to 5.0 mil DFT Epoxy Barrier Coat	2.5 to 3.5 mil Polycarbamide[2]	2.5 to 3.5 mil Polycarbamide[2]
Gypsum Board	300 to 400 square feet/GAL Acrylic Primer	300 to 400 square feet/GAL Acrylic Latex [2]	300 to 400 square feet/GAL Acrylic Latex [2]

1. Application rates (SF/GAL) shown are for unthinned materials.
2. Sheen as selected.

PART 3 - EXECUTION

3.1 ITEMS TO BE PAINTED

A. Exterior surfaces, including but not limited to:
1. Structural steel:
   a. Columns, beams and bracing.
   b. Field welded connections of factory painted structural steel.
2. Miscellaneous ferrous metal surfaces:
   a. Items specifically noted on Drawings to be painted.
3. Miscellaneous galvanized steel surfaces:
   a. Pipe Bollards.
   b. Embed Plates.
   c. Items specifically noted on Drawings to be painted.
4. Doors and frames:
   a. Hollow metal doors and frames.
   b. Hollow metal window frames.

B. Interior Areas:
   1. Refer to the Drawings.
      a. Paint all appurtenant surfaces within the space unless specifically noted otherwise.
      b. Provide coating manufacturer's recommended bonding primer.
      c. Appurtenant surfaces include but are not limited to:
         1) Columns, beams, bracing and similar components.
         2) Underside of roof or floor decks above.
         3) Conduit, boxes, covers and supports.
         4) Ductwork, duct insulation and duct supports.
         5) Piping, pipe insulation and jacketing.
         6) Miscellaneous ferrous metal surfaces.
   2. Doors and frames:
      a. Hollow metal doors and frames
      b. Hollow metal window frames.
      c. Four-fold industrial doors.
      d. Sectional overhead doors.

3.2 ITEMS NOT TO BE PAINTED

A. General: Do not paint items listed in this Article, unless noted otherwise.

B. Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.

C. Electrical equipment.

D. Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.

E. Code labels, equipment identification or rating plates and similar labels, tagging and identification.

F. Contact surfaces of friction-type structural connections.

G. Stainless steel surfaces.

H. Aluminum Surfaces Except:
   1. Where specifically shown in the Contract Documents.
   2. Where in contact with concrete.
   3. Where in contact with dissimilar metals.
   4. Appurtenant surfaces as described in the ITEMS TO BE PAINTED article.

I. Fiberglass Surfaces Except:
   1. Fiberglass piping where specifically noted to be painted.
   2. Piping supports where specifically noted to be painted.
   3. Appurtenant surfaces as described in the ITEMS TO BE PAINTED article.

J. Galvanized steel items, unless specifically noted to be painted.

K. Architectural finishes:
   1. Exterior concrete indicated to receive another finish.
   2. Precast concrete surfaces, unless specifically indicated to be painted.
   3. Plastic laminate.
   4. Solid surface material.
   5. Standing and running trim.
   6. Fiberglass fabrications.
   7. Anodized aluminum.
   8. PVDF coated metals.
   9. Factory finished doors and frames.
   10. Aluminum windows, curtainwall and storefront framing systems.
   11. Finish hardware.
   12. Glass and glazing.

13. Ceramic, porcelain, quarry tile or natural stone.
14. Acoustical materials.
15. Building specialties.
16. Louvers.
17. Casework and countertops.
18. Pipe insulation and jacketing.
19. Standing seam metal roof, fascia, trim, soffit and accessories.

3.3 EXAMINATION

A. Concrete:
   1. Test pH of surface to be painted in accordance with ASTM D4262.
      a. If surface pH is not within paint manufacturer's required acceptable range, use methods acceptable to paint manufacturer as required to bring pH within acceptable range.
      b. Retest pH until acceptable results are obtained.
   2. Verify that moisture content of surface to be painted is within paint manufacturer's recommended acceptable limits.
      a. Test surface to be coated in accordance with ASTM D4263 to determine the presence of moisture.
         1) If moisture is detected, test moisture content of surface to be coated in accordance with ASTM F1869.
         2) Provide remedial measures as necessary to bring moisture content within paint manufacturer’s recommended acceptable limits.
         3) Retest surface until acceptable results are obtained.

B. Concrete Unit Masonry:
   1. Test pH of surface to be painted in accordance with ASTM D4262.
      a. If surface pH is not within paint manufacturer's required acceptable range, use methods acceptable to paint manufacturer as required to bring pH within acceptable limits.
      b. Retest pH until acceptable results are obtained.
   2. Verify that moisture content of surface to be painted is within paint manufacturer's recommended acceptable limits.
      a. Test surface to be coated in accordance with ASTM D4263 to determine the presence of moisture.
         1) If moisture is detected, test moisture content of surface to be coated in accordance with ASTM F1869.
         2) Provide remedial measures as necessary to bring moisture content within paint manufacturer’s recommended acceptable limits.
         3) Retest surface until acceptable results are obtained.

3.4 PREPARATION

A. General:
   1. Prepare surfaces to be painted in accordance with paint manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.
      a. Where discrepancy between paint manufacturer's instructions and this Specification Section exists, the more stringent preparation shall be provided unless approved otherwise, in writing, by the Engineer.
   2. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of paint to surface.
   3. Adhere to manufacturer's recoat time surface preparation requirements.
      a. Surfaces that have exceeded paint manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional paint in accordance with manufacturer's published recommendations.

B. Protection:
   1. Protect surrounding surfaces not to be coated.
   2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.

3. Protect code labels, equipment identification or rating plates and similar labels, tagging and identification.

C. Prepare and paint before assembly all surfaces which are inaccessible after assembly.

D. Existing Surfaces:
   1. Wherever existing work is cut, patched or modified; repair and repaint to match new work.
   2. Where a wall or ceiling is disturbed and patched, paint entire wall or ceiling.

E. Wood:
   1. Sandpaper smooth, remove dust.
   2. Opaque Finishes:
      a. Seal all knots, pitch and resinous sapwood after prime coat has dried.
      b. Putty holes and imperfections; sand smooth.
   3. Transparent Finishes:
      a. Treat wood with compatible wash-coat prior to stain application.
      b. Putty holes and imperfections to match wood color; sand smooth.

F. Ferrous Metal:
   1. Complete fabrication, welding or burning before beginning surface preparation.
      a. Chip or grind off flux, spatter, slag or other laminations left from welding.
      b. Remove mill scale.
      c. Grind smooth rough welds and other sharp projections.
   2. Solvent clean in accordance with SSPC SP 1 to remove all dust, grease, oil, compounds, dirt and other foreign matter.
   3. Exterior exposure:
      a. Commercial blast clean in accordance with SSPC SP 6/NACE No. 3.
   4. Interior exposure:
      a. Hand tool cleaning in accordance with SSPC SP 2 and/or power tool cleaning in accordance with SSPC SP 3.

G. Hollow Metal:
   1. Solvent clean in accordance with SSPC SP 1 to remove all dust, grease, oil, compounds, dirt and other foreign matter.
   2. Lightly sand primed surfaces with fine grit sandpaper as recommended by hollow metal manufacturer.

H. Galvanized Steel and Non-ferrous Metals:
   1. Solvent clean to remove all dust, grease, oil, compounds, dirt and other foreign matter.
   2. Brush-off blast in accordance with SSPC SP 16 or hand tool cleaning in accordance with SSPC SP 2 to remove surface contaminants.

I. Gypsum Wallboard:
   1. Repair minor irregularities left by finishers.
   2. Avoid raising nap of paper face on gypsum wallboard.
   3. Verify moisture content is less than 8% before painting.
   4. After application of prime coat and between subsequent coats, inspect surface and repair holes, dents, irregularities or other defects as necessary to provide a smooth, uniform finish.

J. Concrete:
   1. Cure for minimum of 28 days.
   2. Clean in accordance with ASTM D4258.
      a. Remove all soil, grease, oil, or other surface contaminants.
   3. Grind fins and protrusions in accordance with ASTM D4259, flush to plane of wall.
   4. Abrasive blast in accordance with ASTM D4259 and SSPC SP13/NACE No. 6.
      a. Remove all laitance, efflorescence, scabbing and other foreign matter.
      b. Provide minimum concrete surface profile CSP 3 per ICRI 310.2.
   5. Test pH and moisture content in accordance with EXAMINATION article in this specification section.

6. Repair tie holes, voids, bugholes or other surface defects as necessary to provide smooth, uniform surface.

3.5 APPLICATION

A. General:
   1. Thin, mix and apply paints in accordance with manufacturer's installation instructions.
      a. Where discrepancy exists between manufacturer's instructions and this Specification Section, the more stringent requirement shall apply.
      b. When materials have been thinned, adjust application rates as necessary to achieve film coverage indicated in Part 2 for unthinned materials.
      c. Backroll spray applied paints.
   2. Temperature and weather conditions:
      a. Do not paint surfaces when surface temperature is below 50 degrees F unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and paint manufacturer's authorized representative.
      b. Avoid painting surfaces exposed to hot sun.
      c. Do not paint on damp surfaces.
   3. Apply materials under adequate illumination.
   4. Evenly spread to provide full, smooth coverage.
      a. All paint systems are "to cover."
         1) When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.
      b. Finished paint system shall be uniform and without voids, bugholes, holidays, laps, brush marks, roller marks, runs, sags or other imperfections.
   5. If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.
   6. Work each application of material into corners, crevices, joints, and other difficult to work areas.
   7. When painting rough surfaces, hand brush and backroll paint to work into all recesses.
   8. Smooth out runs or sags immediately, or remove and recoat entire surface.
   9. Allow preceding coats to dry before recoating.
      a. Recoat within time limits specified by paint manufacturer.
      b. If recoat time limits have expired re-prepare surface in accordance with paint manufacturer's printed recommendations.
   10. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.
   11. Finish colors not otherwise indicated shall be selected by Engineer from paint manufacturer's complete offering.

B. Fillers, surfacers or patching compounds:
   1. Provide fillers, surfacers or patching compounds in accordance with manufacturer's recommendations and as specified herein as necessary to provide a smooth, defect free substrate.

C. Prime Coat Application:
   1. Prime all surfaces indicated to be painted.
      a. Apply prime coat in accordance with paint manufacturer's written instructions and as written in this Specification Section.
   2. Ensure field-applied paints are compatible with factory-applied paints or existing coatings.
      a. Employ services of coating manufacturer's qualified technical representative.
         1) Certify through material data sheets.
         2) Perform test patch.
      b. If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.
      c. At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate paint system listed in the MATERIALS Article, Paint Systems paragraph of this Specification Section.

1) All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.

3. Special coatings prime coat application:
   a. Prime new gypsum board surfaces using sealer as recommended by manufacturer.
      1) Apply at rate per manufacturer's recommendation.
   b. Prime and fill new concrete and masonry using sealer coat as recommended by manufacturer followed by modified epoxy filler as specified.
   c. Prime filled concrete and masonry surfaces with primer at rates and as recommended by manufacturer.
4. Back prime all wood to be painted, prior to installation.
5. Touch up damaged primer coats prior to applying finish coats.
   a. Restore primed surface equal to surface before damage.

D. Finish Coat Application:
1. Apply finish coats in accordance with paint manufacturer's written instructions and in accordance with this Specification Section.
2. Touch up damaged finish coats using same application method and same material specified for finish coat.
   a. Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.
3. Hollow metal frames and doors:
   a. Finish coats shall be spray applied only.
   b. Finish edges same as faces of doors.
4. Varnish:
   a. Apply first coat of varnish: Gloss.
      1) Allow to dry a minimum of 48 hours.
   b. Apply second and third coats of varnish: Satin.
      1) Allow a minimum of 48 hours between each coat.
   c. Lightly sand between coats as required and remove dust.

3.6 FIELD QUALITY CONTROL

A. Application Deficiencies:
1. Surfaces showing runs, laps, brush marks, telegraphing of surface imperfections or other defects will not be accepted.
2. Surfaces showing evidence of fading, chalking, blistering, delamination or other defects due to improper surface preparation, environmental controls or application will not be accepted.

B. Provide protection for painted surfaces.
1. Surfaces showing soiling, staining, streaking, chipping, scratches, or other defects will not be accepted.

C. Maintain Daily Records:
1. Record the following information during application of each coat of paint applied:
   a. Date, starting time, end time, and all breaks taken by painters.
   b. For exterior painting:
      1) Sky condition.
      2) Wind speed and direction.
   c. Air temperature.
   d. Relative humidity.
   e. Moisture content and surface temperature of substrate prior to each coat.
   f. Provisions utilized to maintain work area within manufacturer's recommended application parameters including temporary heating, ventilation, cooling, dehumidification and provisions utilized to mitigate wind blown dust and debris from contaminating the wet paint film.
   g. Record environmental conditions, substrate moisture content and surface temperature information not less than once every four (4) hours during application.
      1) Record hourly when temperatures are below 50 degrees F or above 100 degrees F.

2. Record the following information daily for the paint manufacturer's recommended curing period:
    a. Date and start time of cure period for each item or area.
    b. For exterior painting:
        1) Sky conditions.
        2) Wind speed and direction.
    c. Record environmental conditions not less than once every 12 hours.
        1) Record once every 4 hours when ambient temperature is below 35 degrees F.
    d. Provisions utilized to protect each item or area and to maintain areas within manufacturer's recommended curing parameters.
3. Format for daily record to be computer generated.

D. Measure surface temperature of items to be painted with surface temperature gage specifically designed for such.

E. Measure substrate humidity with humidity gage specifically designed for such.

F. Provide wet paint signs.

3.7 CLEANING

A. Clean paint spattered surfaces.
1. Use care not to damage finished surfaces.

B. Remove masking, adhesive residue or other foreign materials.

C. Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.

D. Remove surplus materials, scaffolding, and debris.

END OF SECTION

SECTION 09 96 00
HIGH PERFORMANCE INDUSTRIAL COATINGS (STORAGE TANK NO. 2)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. High performance industrial coatings (HPIC).
   2. Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Specification Section.
   3. Minimum surface preparation requirements.

B. Scope of work:
   1. The work performed under this section includes surface preparation and coating of interior and exterior surfaces on 1.5-million-gallon water storage tank (no. 2) and related appurtenances.
   2. The scope of work includes but is not limited to surface preparation, waste disposal, pretreatment, coating application, touch-up, protection of surfaces not to be coated, inspection, cleanup, and all appurtenant work.
      a. Contractor is solely responsible for performing a lead analysis on existing coatings. Not all landfills accept lead containing sand blast residue. Comply with federal and state agencies and state EPA branch for safe disposal of lead containing sand blast residue.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. D3359, Standard Test Methods for Rating Adhesion by Tape Test.
      b. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
      c. D4414, Standard Practice for Measurement of Wet Film Thickness by Notch Gages.
      d. D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
      e. D6677, Standard Test Method for Evaluating Adhesion by Knife.
      f. D7091, Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
   2. American Water Works Association (AWWA):
      a. C651, Standard for Disinfecting Water Mains.
      b. C652, Standard for Disinfection of Water-Storage Facilities
   3. National Association of Pipe Fabricators (NAPF):
      a. 500-03, Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings:
         1) 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe.
         2) 500-03-05, Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
   4. The Society for Protective Coatings (SSPC):
      a. PA 2, Procedure for Determining Conformance to Dry Coating Thickness Requirements.
      b. SP 1, Solvent Cleaning.
      c. SP 16, Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
   5. The Society for Protective Coatings/ NACE International (SSPC/ NACE):
      a. SP 5/ NACE No. 1, White Metal Blast Cleaning
      b. SP 6/ NACE No. 3, Commercial Blast Cleaning.
      c. SP 7/ NACE No. 4, Brush-off Blast Cleaning.

d. SP 10/ NACE No. 2, Near-White Blast Cleaning.
e. SP 13/ NACE No. 6, Surface Preparation of Concrete.

B. Qualifications:
1. Coating manufacturer's authorized representative shall provide written statement attesting that applicator has been instructed on proper preparation, mixing and application procedures for coatings specified.
2. Applicators shall have minimum of 10 years of experience in application of similar products on similar project.
a. Provide references for minimum of three (3) different projects completed in last five (5) years with similar scope of work.
b. Include name and address of project, size of project in value (painting) and contact person.
c. Copy of a valid State of California C-33 Contractor’s license is required for the application of coatings.
d. Contractor shall provide SSPC QP-1 and SSPC QP-2 Certification.
e. Proof of any necessary federal, state or local permits or licenses necessary for the project.

C. Coating Manufacturer Quality Assurance Services:
1. The coating manufacturer shall conduct an on-site training with the Contractor, Applicator, engineer and the Owner's representative to review and provide details, and answer questions regarding product being applied.
2. Arrange for coating manufacturer's representative to attend the preconstruction conference and three additional visits to the site to provide consultation services during surface preparation work and application of coatings.
3. The coating manufacturer's representative shall provide as-needed technical support to resolve field problems associated with the manufacturer's products furnished under this contract.
4. The coating manufacturer's representative shall be present during the final inspection of the finished coating.

D. Miscellaneous:
1. Furnish coatings through one (1) manufacturer unless noted otherwise.

E. Deviation from specified MIL thickness or product type is not allowed without written authorization of Engineer.

F. Material shall not be thinned unless approved, in writing, by coating manufacturer's authorized representative or exclicity stated in the Project Data Sheet.

G. Pre-construction meeting: Convene a pre-construction meeting 3 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Owner, Contractor, Inspector, applicator, and manufacturer’s representative. Review the following:
1. Safety.
2. Shutdown plan and schedule.
3. Environmental requirements.
4. Protection of surfaces not scheduled to be coated.
5. Field quality control.
6. Cleaning.
7. Surface preparation.
8. Application.
9. Repair.
10. Inspection.
11. Coordination with other work.
12. Reports.
13. Contractor/Inspector/Owner Relationship.

H. Contractor shall submit over-spray prevention procedures to the Inspector for review and approval. Approval by the Inspector does not relieve the Contractor of responsibility for over-spray or fallout.

I. Contractor shall submit a fall protection plan for review.

J. The Contractor shall submit to the Owner's representative any revisions or changes agreed upon, reasons thereof, and parties agreeing or disagreeing with them.

K. Submit plan for worker and public safety for fugitive lead containing dust or sand blast residue.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field, at the Project site, or at an approved shop facility.
   2. Installer and applicator are synonymous.

B. Holiday:
   1. A void, crack, thin spot, foreign inclusion, or contamination in the coating film that significantly lowers the dielectric strength of the coating.
   2. May also be identified as a discontinuity or pinhole.

C. Exposed Exterior Surface:
   1. Exterior surface which is exposed to view.
   2. Exterior surface which is exposed to weather but not necessarily exposed to view.

D. Immersion Service:
   1. Any surface immersed in water or some other liquid.
   2. Surface of any pipe, valve, or any other component of the piping system subject to frequent wetting.
   3. Surfaces within two feet above high water level in water bearing structures.

E. Surface Hidden from View:
   1. Within pipe chases.
   2. Between top side of ceilings and underside of floor or roof structures above.

F. HPIC: High performance industrial coatings.
   1. Epoxies, urethanes, vinyl ester, waterborne vinyl acrylic emulsions, acrylates, silicones, alkyds, acrylic emulsions and any other coating listed as a HPIC.

G. Water level for purposes of coating: See Drawings.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Applicator experience qualifications.
      a. No submittal information will be reviewed until Engineer has received and approved applicator qualifications.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's application instructions.
      c. Manufacturer's surface preparation instructions.
      d. If products being used are manufactured by Company other than listed in the MATERIALS Article of this Specification Section, provide complete individual data sheet comparison of proposed products with specified products including application procedure, coverage rates and verification that product is designed for intended use.
      e. Contractor's written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.
      f. Coating manufacturer's recommendation on abrasive blasting.

g. Manufacturer's recommendation for universal barrier coat.
h. Manufacturer's recommendation for providing temporary or supplemental heat or dehumidification or other environmental control measures.

4. Results of discontinuity testing indicating any corrective action taken.
5. Manufacturer's statement regarding applicator instruction on product use.
6. Certification that High Performance Coating Systems proposed for use have been reviewed and approved by Senior Corrosion Specification Specialist employed by the coating manufacturer.

B. Samples:
1. Manufacturer's full line of colors for Engineer's preliminary color selection.
2. After preliminary color selection by Engineer provide two (2) 3 x 5 IN samples of each final color selected.

C. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Qualifications of lab performing Volatile Organic testing and disinfection testing.
3. Test Report:
a. Volatile organic test report.
b. Disinfection test report.
4. Approval of application equipment.
5. Applicator's daily records:
a. Submit daily records at end of each week in which coating work is performed unless requested otherwise by Engineer's on-site representative.

D. Submit a plan for ensuring a safe and clean work site during all field activities.

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Store materials as per manufacturer’s recommendations. If no recommendations are given store materials in tightly covered containers in well ventilated areas with ambient temperature continuously maintained at not less than 45 DEGF and not more than 100 DEGF.

C. Do not use products that have exceeded the manufacturer's recommended shelf life.

D. The Contractor is responsible for safely containing the materials within the storage facility and the work area in the event of a spill.

E. The location of the storage container shall be approved in advance by the Inspector and Owner.

1.6 PROJECT CONDITIONS

A. Verify that atmosphere in area where coating is to take place is within coating manufacturer's acceptable temperature, humidity and sun exposure limits.
1. Provide temporary heating, and/or dehumidification as required to bring area within acceptable limits.
a. Provide temporary dehumidification equipment properly sized to maintain humidity levels required by coating manufacturer.
b. Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 HR basis.
1) Vent exhaust gases to exterior environment.
2) No exhaust gases shall be allowed to vent into the space being coated or any adjacent space.

2. Provide tent to enclose Storage Tank No. 2 prior to coatings work. This is not optional. Contractor to include complete tenting of in their base bid.
3. All coatings to be performed in an enclosed, controlled tented or covered environment. Items designated for removal prior to coating, will need to be coated under the Storage Tank No. 2 tenting system.
4. Do not apply coatings in snow, rain, fog or mist.

1.7 HEALTH AND SAFETY

A. The inside of Storage Tank No. 2 is a confined space. The Contractor shall conform to all requirements for confined space entry in accordance OSHA requirements.

B. Contractor shall test existing coatings for lead. In the scenario that lead is found to exceed permissible exposure limits in the existing coatings, contractor is solely responsible for providing a safe working environment for employees and other affected by the contractor's work. Refer to OSHA requirements for more information.

C. The Contractor shall provide all head and face protection equipment and respiratory devices required to safely perform this work.
   1. Equipment shall include any applicable masks recommended by the manufacturer while performing blasting or application of the coating materials.

D. Whenever the occupational noise exposure exceeds maximum allowable sound levels as specified by OSHA requirements, the Contractor shall provide and require the use of approved ear protection devices by all personnel working in the areas of excess noise.
   1. Equipment shall be placed in locations or muffled to reduce exterior noise with respect to nearby residents.
   2. Maximum outside noise levels shall not exceed 120 db.

E. All temporary ladders and scaffolding shall conform to OSHA requirements. They shall be erected where requested by the Inspector to facilitate inspection and be moved by the Contractor to locations requested by the Inspector.

F. Failure to comply with health and safety laws, regulations, codes, permits, and Standard Operation Procedures will be grounds for shutting down the Work.
   1. All costs resulting from a shutdown of the Work that are due to the Contractor's negligence or failure to comply with applicable safety requirements shall be borne by the Contractor.
   2. After a shutdown of the Work, the Work will not be permitted to begin again until the Inspector is satisfied that all necessary health and safety precautions are being taken.

1.8 PERMITS, CERTIFICATES, LAWS AND ORDINANCES

A. The Contractor shall, at his own expense, procure all permits, certificates, and licenses required by law for the execution of the work. The Contractor shall comply with all Federal, State, County, or District laws, ordinances, or rules and regulations relating to the performance of the work.

1.9 FIRE/EXPLOSION HAZARD

A. Flammable, volatile solvents in coating system components constitute a major hazard with regard to fire and explosions wherever flame or spark exposure is possible.
   1. All flames, smoking, and welding, etc., are strictly prohibited in work or storage areas.
   2. Fire abatement devices shall be readily available and in operating condition.
   3. Necessary precautions shall be taken to keep fire hazard to a minimum.
   4. All oily rags, waste, and other combustibles not in covered containers shall be removed from the area daily.
   5. All coatings, solvents, thinners and related products shall be stored in conformance with applicable State, County and/or Local Fire Codes pertaining to flammable materials.

1.10 INSPECTION AND TESTING

A. All work relative to preparation for and application of coatings shall be conducted under the supervision of the Inspector. The Owner will hire a full-time certified NACE Inspector to oversee all surface preparation and coatings work.
   1. The Inspector shall be a NACE Certified Level III Coating Inspector.

B. The Contractor shall give the Owner and Inspector 3 day's advance notice of the start of any field surface preparation work or any coating application work.

C. The Contractor shall be responsible for submitting daily inspection reports to the Owner at the end of each work day.

D. The Contractor shall provide a full time Supervisor at the work site during the working hours during the Storage Tank No. 2 shutdown. The Supervisor shall have the authority to sign change orders, coordinate work, and make decisions pertaining to the fulfillment of the Contract.

E. Inspection by the Owner, or the waiver of inspection of any particular portion of the work, shall not relieve the Contractor of responsibility of performing the work in accordance with these Specifications.

F. Prior to the start of any work, the Contractor shall establish with the Inspector, schedules and notification procedures to ensure that all surface preparation work has been inspected prior to the application of any coating.
   1. These procedures shall remain in effect for the duration of the project.
   2. Under no circumstances shall any surfaces be coated without prior approval of the Inspector.
   3. Coatings applied without the Inspector's authorization shall be removed and reapplied at the sole expense of the Contractor.
   4. Log sheets, approved by the Inspector, shall be used as the permanent record of all inspections with copies forwarded to the Owner daily.

G. Surface Preparation - Surfaces prepared as described in this Specification and per the manufacturer's recommendations shall be observed by the Inspector prior to application of coatings to verify compliance.

H. Film Thickness - Prepared surfaces and all coating system component applications shall be inspected prior to each succeeding application. The procedure for collecting representative thickness data shall be as follows:
   1. The Inspector shall determine where and how often to test for film thicknesses.
   2. The requirements of SSPC-PA 2 will be followed (at a minimum).
   3. Contractor shall take wet mil thickness readings at a minimum of every 100 square feet.

I. The Contractor shall make the following equipment available to the Inspector upon request, including but not limited to:
   1. Holiday testers.
   2. Film thickness testers.
   3. Adhesion testers.

1.11 WARRANTY

A. The Contractor and manufacturers shall warrant the coating system applications for a period of 3 years after final acceptance of the work.

B. The Contractor shall submit to the Owner a 3-year warranty bond for the complete coating system.

C. The Contractor, at no cost to the Owner, shall perform all work and supply all equipment and materials associated with the repair of failures identified in the warranty inspection.

D. In the event of fault disagreement, warranty issues will be resolved through mediation involving the services of a NACE Certified Coating Inspector. Mediation and Inspection costs shall be borne by the party found to be responsible for the coating failure.

PART 2 - PRODUCTS

2.1 GENERAL

A. Suitability: The Contractor shall use suitable coating materials as recommended by the manufacturers.

B. Compatibility: For any coating system, only compatible materials from a single manufacturer or the manufacturer's approved supplier shall be used, including but not limited to thinners, cleaners, driers and additives. Only one coating system shall be used throughout the duration of the project.

C. Color: The Contractor shall submit color samples for selection by the Owner.

2.2 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, only the following manufacturers are acceptable for all metal coating systems:
   1. High performance industrial coatings:
      a. TNEMEC Company.
      b. Carboline Company.
      c. Sherwin Williams.

2.3 ABRASIVES

A. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendations.

B. The following manufacturers are acceptable:
   1. Kleen Blast abrasives
   2. Or approved equal.

C. All abrasives shall be new, clean, and delivered to the project in unopened, weather resistant containers.

D. Use a recyclable steel grit or a recyclable natural mineral, low-dusting abrasive. Do not use silica sands, mineral slags, or other types of nonmetallic abrasives that contain more than 0.5 percent free silica, by weight, have a chloride salt content of more than 10 ppm, and contain any organic material. Use an abrasive that produces an angular profile.

E. All abrasives shall be disposed of in accordance with all County, State, and Federal laws at no cost to the Owner. No abrasives shall be disposed of on site.

2.4 MATERIALS

A. General:
   1. Surface anchor profile shall be in accordance with coating manufacturer's product data sheet.
   2. Products of other manufacturers than those listed will be considered for use provided that the product:
      a. Is of the same generic resin.
      b. Requires comparable surface preparation.
      c. Has comparable application requirements.
      d. Meets the same VOC levels or better.
      e. Provides the same finish and color options.
      f. Will withstand the atmospheric or immersion conditions of the location where it is to be applied.
   3. Where manufacturer’s product data sheet indicates a minimum MIL thickness per coat that is greater than specified herein, MIL thickness for entire coating system shall be increased proportionately.

B. Coatings shall comply with the VOC limits of EPA and CARB.

C. For unspecified materials such as thinner, provide manufacturer's recommended products.

2.5 COATING SYSTEMS

A. For unspecified materials such as thinner, provide manufacturer's recommended products.

B. Paint Systems - General:
   1. P = prime coat.
   2. F1, F2 … Fn = first finish coat, second finish cot … nth finish coat, color s selected by Engineer.
   3. If two (2) finish coats of same material are required, Contractor may, at his option and by written approval from paint manufacturer, apply one (1) coat equal to mil thickness of two (2) coats specified.

C. HPIC products listed in the PRODUCTS Article, Paint systems paragraph are manufactured by the acceptable manufacturers.
   1. Products of other listed manufacturers are acceptable for use providing the product is of the same generic resin, requires comparable surface preparation, has comparable application requirements, meets the same VOC levels or better, provides the same finish and color options and will withstand the atmospheric conditions of the location where it is to be applied.

D. Coating Systems:
   1. HPIC System #1 –Tank Interior (immersion) Surfaces
      a. Prime coat:
         1) P1 = 1 coat, 4 mils minimum DFT, Series 140N Pota-Pox Plus by TNEMEC
      b. Finish coat:
         1) F1 = 4 mils DFT, Series 140N Pota-Pox Plus by TNEMEC
         2) F2 = 4 mils DFT, Series 140N Pota-Pox Plus by TNEMEC
      c. Total dry film thickness shall be a minimum of 12 to 16 mils. Any deficiency in dry film thickness (DFT) shall be corrected per manufacturer’s recommendation at no additional cost to the City. Maximum DFT shall not to exceed twenty (20) mils or the maximum allowed thickness from the Manufacturer’s NSF certification document.
      d. HPIC System #1 shall be used for all tank interior ferrous metal surfaces, including but not limited to surfaces in potable water immersion.
      e. All coatings shall be NSF-61 certified.
   2. HPIC System #1 – Tank Exterior Surfaces
      a. Prime coat:
         1) P1 (Zinc Rich Urethane) = 1 coat, 4 mils minimum DFT, Series 94-H20 Hydro-Zinc by TNEMEC.
      b. Finish coat:
         1) F1 (Multi-purpose Epoxy) = 4 mils DFT, Series N69 Hi-Build Epoxoline II by TNEMEC.
         2) F2 (Hybrid Urethane) = 4 mils DFT, Series 740 UVX by TNEMEC.
      c. Total dry film thickness shall be a minimum of 12 to 16 mils. Any deficiency in dry film thickness (DFT) shall be corrected per manufacturer’s recommendation at no additional cost to the City. Maximum DFT shall not to exceed twenty (20) mils or the maximum allowed thickness from the Manufacturer’s NSF certification document.
      d. HPIC System #2 shall be used for all ferrous metal surfaces.
   3.

2.6 METAL REPAIR SYSTEM

A. Following, 2 part, epoxy-based repair composite may be used for metal repair. Metal repair to be performed prior to metal coatings.
   1. Belzona 1311.
   2. Approved equal.

PART 3 - EXECUTION

3.1 ITEMS TO BE COATED

A. Exterior Surfaces, including but not limited to:
   1. Piping, valves, fittings, gates and supports:
      a. As indicated on Drawings.
   2. Miscellaneous ferrous metal and galvanized steel surfaces:
      a. Items specifically noted on Drawings to be painted.
   3. Appurtenant surfaces attached to or adjacent to a surface indicated to be painted:
      a. Boxes, covers and supports.

B. Interior Areas:
   1. Refer to Drawings.
      a. If space is scheduled to be painted, paint all appurtenant surfaces within the space unless specifically noted otherwise. Appurtenant surfaces include but are not limited to:
         1) Equipment supports.
         2) Underside of roof or floor decks above:
            a) Including semi-exposed or concealed from view unless noted otherwise.
         3) Boxes, covers and supports.
         4) Miscellaneous ferrous metal surfaces.
   2. Piping, valves, fittings, and supports:
   3. Ferrous metal and galvanized steel process equipment.
      a. Exterior and interior face of tankage and related appurtenances.
      b. Valves and operators.
      c. Items specifically noted on Drawings to be painted.

3.2 ITEMS NOT TO BE PAINTED

A. General: Do not paint items listed in this Article, unless noted otherwise.

B. Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.

C. Electrical Equipment.

D. Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.

E. Code labels, equipment identification or rating plates and similar labels, tagging and identification.

F. Contact surfaces of friction-type structural connections.

G. Stainless Steel Surfaces, except:
   1. Piping where specifically noted to be painted.
   2. Banding as required to identify piping.

H. Fiberglass Surfaces, except:
   1. Fiberglass piping where specifically noted to be painted.
   2. Piping supports where specifically noted to be painted.
   3. Appurtenant surfaces as described in the ITEMS TO BE PAINTED article.

I. Mechanical piping scheduled to be insulated.

J. Interior of Pipe, Ductwork, and Conduits.

K. Galvanized Steel Items, unless specifically noted to be painted.

3.3 ENVIRONMENTAL CONDITIONS

A. All coatings shall be applied within the environmental limits specified by the manufacturer of each product.

B. No coating work shall be performed under the following conditions:
   1. Temperatures exceed the manufacturer's recommended maximum or minimum allowable.
   2. Dust or smoke laden atmosphere.
   3. Damp or humid conditions, where the relative humidity is above the manufacturer's maximum allowable.
   4. Substrate or ambient temperatures are less than 5 DegF above the dewpoint. (Dewpoint shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce, Weather Bureau psychometric tables.)
   5. Ambient temperature is expected to drop below 50 DegF or less than 5 DegF above the dewpoint within 8 hours after application of coating.

C. The work is contained within a structure that may be subject to extended periods of high humidity.
   1. The Contractor shall be expected to maintain the established production schedule despite these potentially adverse conditions by providing all labor, equipment and materials necessary to maintain a controlled environment in the area where work is to be performed.
   2. The substrate and atmospheric conditions within the controlled environment, with respect to temperature and relative humidity, shall be maintained within the limits established by the manufacturer of the selected coating system to ensure proper application and cure of the coating.

D. The Contractor shall dewater and stop any active water leaks into areas to be coated.

E. Contractor to provide tenting and heating as required to maintain ambient, substrate, and curing conditions as required by selected coating products.

3.4 METAL REPAIR PROCEDURE

A. Contractor shall repair all existing metallic surfaces as identified by inspector prior to commencement of recoat work and after abrasive blasting.

B. All repair procedures shall conform to manufacturer's instructions.

C. If Contractor discovers metallic components with section loss greater than 25 percent of metal thickness Owner and Engineer shall be promptly notified.

3.5 PREPARATION

A. General:
   1. Exterior surfaces contain lead. Testing for concentrations of lead and other heavy metals shall be performed prior to any exterior surface preparation.
      a. All federal, state and local rules applying to the removal and disposal of hazardous waste shall be strictly followed.
   2. Prepare surfaces to be painted in accordance with coating manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.
      a. Where discrepancy between coating manufacturer's instructions and this Specification Section exists, the more stringent surface preparation shall be provided unless approved otherwise, in writing, by the Engineer.
   3. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.
   4. Adhere to manufacturer's recoat time surface preparation requirements.
      a. Surfaces that have exceeded coating manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional coating in accordance with manufacturer's published recommendations.
         1) Minimum SSPC-SP 7/ NACE No. 4 unless otherwise approved by Engineer.

B. Protection:
   1. Protect surrounding surfaces not to be coated.
   2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.

3. Protect code labels, equipment identification or rating plates and similar labels, tagging and identification.

C. Prepare and paint before assembly all surfaces which are inaccessible after assembly.

D. Ferrous Metal Surface Preparation:
   1. General:
      a. Prepare ductile iron pipe in accordance with pipe manufacturer's recommendations and NAPF.
         1) All piping, pumps, valves, fittings and any other component used in any water piping system that requires preparation for painting shall be prepared in accordance with requirements for immersion service.
            a) Pipe: NAPF 500-03-04.
            b) Fittings: NAPF 500-03-05
         2) Prepare all areas requiring patch painting in accordance with recommendations of manufacturer and NAPF.
         3) Remove bituminous coating per piping manufacturer, paint manufacturer and NAPF recommendations.
            a) The most stringent recommendations shall apply.
      b. Complete fabrication, welding or burning before beginning surface preparation.
         1) Chip or grind off flux, spatter, slag or other laminations left from welding.
         2) Remove mill scale.
         3) Grind smooth rough welds and other sharp projections.
      c. Solvent clean in accordance with SSPC SP 1 or detergent and low-pressure water clean in accordance with SSPC SP 12/NACE No. 5 all surfaces scheduled to receive additional SSPC surface preparation.
      d. All surfaces subject to immersion service:
         1) Near-white blast clean in accordance with SSPC SP 10/NACE No. 2.
      e. All exterior surfaces:
         1) Commercial Blast Cleaning in accordance with SSPC SP 6/NACE No. 3
      f. All wastewater shall be collected and not allowed to come in contact with the ground or be released into any storm drain. All rust spots, abrasions, areas of paint scale, runs from previous paint applications or other problem areas shall be power tool cleaned (SSPC-SP 3) with approved HEPA filtered tools as directed by the Engineer.
      g. Restore surface of field welds and adjacent areas to original surface preparation.
      h. Black iron piping: Remove surface varnish by solvent or waterjet and detergent cleaning or brush-off blast cleaning in accordance with SSPC SP 7/NACE No. 4.
   2. Preparation by abrasive blasting:
      a. General:
         1) Provide 3.0 to 5.0 mil sharp angular anchor profile.
         2) Prepare surfaces to be painted in accordance with coating manufacturer's instructions and this Section unless noted otherwise in the Specification.
         3) Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.
      b. Protection:
         1) Protect surrounding surfaces not to be coated.
         2) Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
      c. Prepare and Paint Before Assembly: Where component is subject to corrosive or highly corrosive environment, prepare and paint, before assembly, all surfaces which may be subject to environment which are inaccessible after assembly.
      d. Ferrous metal:
         1) Prepare ductile iron pipe in accordance with NAPF 500-03-06, AWWA C 210 and SSPC surface preparation standards.
         2) Complete fabrication, welding or burning before beginning surface preparation.
         3) Clean all surfaces in accordance with SSPC-SP-1 prior to abrasive blasting.
         4) Surfaces subject to high temperatures.

a) Heat in excess of 600 Deg. F: SSPC SP-5/NACE No. 1.
b) Heat in excess of 200 Deg. F but less than 600 Deg. F: SSPC SP-10/NACE No. 2.

e. Ferrous metal components that have been stored on-site:
1) Test surfaces to be coated for the presence of soluble salts.
2) Chlorides: 3 ppm or greater chloride shall be considered detrimental.
3) Sulfates as comparison to soluble ferrous ions: 7 ppm or greater shall be considered detrimental.

f. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before painting.

g. Perform additional blasting and cleaning as required to achieve surface preparation required. Prior to painting, reblast surfaces allowed to set overnight and surfaces that show rust bloom.

h. Surfaces allowed remaining overnight or surfaces which show rust bloom prior to painting shall be abrasive blasted and reinspected prior to paint application.

i. Provide compressed air for blasting that is free of water and oil. Provide accessible separators and traps.

j. Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Engineer's review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process

3. Chloride Contamination:
a. If steel members were stored outside where chloride exists, chloride contamination shall be removed before surface preparation and coating operations begin or after abrasive blasting. Prior to abrasive blasting, the existing steel surfaces shall be tested for chloride contamination according to SSPC-TU 15-August 2013: Field Method for Retrieval and Analysis of Soluble Salts on Steel and other Non porous Substrates.

b. Surfaces to be coated shall be tested for Soluble Salt Contamination in accordance with SSPC-TU 15, “Field Method for Retrieval and Analysis of Soluble Salts on Steel and other Non-porous Substrates.” The allowable levels of soluble salts are as follows: 3 microsiemens/cm for chlorides, 7 microsiemens/cm for nitrates, and 5 microsiemens/cm for sulfates.

c. High-pressure water clean (HPWC) at 5,000 psi (34,473kPa) utilizing a chloride-removing cleaner injected into the water stream. Portable washing equipment should be operated at a minimum water temperature of 200°F (93°C), and minimum consumption of six gallons a minute should be used to wash the surface of visible and non-visible contamination. After high pressure water cleaning with Chloride, allow the washed areas to rust bloom a minimum of 24 hours or when the surface began to exhibit “dark orange” rusting. The inspector shall select random areas for re-testing prior to abrasive blasting. Ensure that chloride levels are within the product manufacturer’s product data sheets.

E. Galvanized Steel Surface Preparation:
1. Follow coating manufacturer's recommendations.

3.6 PROCEDURES FOR APPLICATION OF FERROUS METAL COATINGS

A. General:
1. Thin, mix and apply coatings by brush, roller, or spray in accordance with manufacturer's installation instructions.
a. Application equipment must be inspected and approved in writing by coating manufacturer.
2. Temperature and weather conditions:
a. Do not paint surfaces when surface temperature is below 50 DegF unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and paint manufacturer's authorized representative.
b. Avoid painting surfaces exposed to hot sun.
c. Do not paint on damp surfaces.

3. Immediately after surface has been inspected and accepted by NACE certified coatings inspector, apply structural steel and miscellaneous steel prime coat.
    a. Finish coats shall be applied in the field.
    b. Prime coat referred to here is prime coat as indicated in this Specification.
        1) Structural steel and miscellaneous steel prime coating applied in factory (shop) as part of Fabricator's standard rust inhibiting and protection coating is not acceptable as replacement for specified prime coating.
4. Provide complete coverage to mil thickness specified.
    a. Thickness specified is dry mil thickness.
    b. All paint systems are "to cover."
        1) In situations of discrepancy between manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern.
    c. When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.
5. If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.
6. Apply materials under adequate illumination.
7. Evenly spread to provide full, smooth coverage.
8. Work each application of material into corners, crevices, joints, and other difficult to work areas.
9. Avoid degradation and contamination of blasted surfaces and avoid intercoat contamination.
    a. Clean contaminated surfaces before applying next coat.
10. Smooth out runs or sags immediately, or remove and recoat entire surface.
11. Allow preceding coats to dry before recoating.
    a. Recoat within time limits specified by coating manufacturer.
    b. If recoat time limits have expired re-prepare surface in accordance with coating manufacturer's printed recommendations.
12. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.
13. Coat all aluminum in contact with dissimilar materials.
14. When coating rough surfaces which cannot be backrolled sufficiently, hand brush coating to work into all recesses.

B. Prime Coat Application:
1. Prime all surfaces indicated to be painted.
    a. Apply prime coat in accordance with coating manufacturer's written instructions and as written in this Specification Section.
2. Ensure field-applied coatings are compatible with factory-applied coatings.
    a. Employ services of coating manufacturer's qualified technical representative.
        1) Certify through material data sheets.
        2) Perform test patch.
    b. If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.
    c. At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate paint system listed in the MATERIALS Article, Paint Systems paragraph of this Specification Section.
        1) All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.
3. Prime ferrous metals embedded in concrete to minimum of 1 IN below exposed surfaces.
4. Back prime all wood scheduled to be painted, prior to installation.
5. After application of primer to gypsum board surfaces, inspect surface and repair in accordance with the PREPARATION Article of this Specification Section.
    a. Re-prime repaired surfaces to uniform finish before application of finish coat(s).
6. Apply zinc-rich primers while under continuous agitation.
7. Ensure abrasive blasting operation does not result in embedment of abrasive particles in paint film.

8. Brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over entire surface.
9. Touch up damaged primer coats prior to applying finish coats.
    a. Restore primed surface equal to surface before damage.

C. Finish Coat Application:
1. Apply finish coats in accordance with coating manufacturer's written instructions and in accordance with this Specification Section; manufacturer instructions take precedent over these Specifications.
2. Touch up damaged finish coats using same application method and same material specified for finish coat.
    a. Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.

3.7 MISCELLANEOUS WORK

A. Center roof vent shall be removed, and interior surfaces shall be cleaned and coated in accordance with this specification.

B. Broken screens and bolts shall be replaced as needed.

C. The cathodic protection and interior safety climb rod system shall be removed prior to blasting and shall be replaced after coating. Damaged bolts associated with the climb rod and cathodic protection shall be replaced and all bolts and steel covers shall be coated in accordance with this specification.

D. The exterior safety climb rod shall be removed prior to coating installation and shall be replaced after coating is complete.

3.8 COMPONENT MIXING

A. Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing and handling its coating materials shall be strictly observed.
1. Prepare multiple component coatings using all of the contents of the container for each component as packaged by the manufacturer.
2. Do not use partial batches.
3. Do not use multiple component products that have exceeded their pot life.
4. Provide four kits for touch-up and small area work.
5. Mix only the components specified and furnished by the manufacturer.
6. Do not intermix additional components for reasons of color or otherwise.

3.9 CURING OF COATINGS

A. The Contractor shall provide curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the highest requirement, prior to placing the completed coating system into service.

B. Forced air ventilation is required for the application and curing of coatings on the interior surfaces of enclosed hydraulic structures.
1. Continuously exhaust air during curing periods from the lowest level of the structure using portable ducting.
2. After all interior coating operations are complete, provide a final curing period as required by the manufacturer and continuously operate the forced ventilation system.

3.10 INSPECTION AND TESTING AFTER COATING APPLICATION

A. Lifting devices or ladders, to facilitate inspection, shall be erected and moved to locations where requested by the Inspector.

B. Whenever required by the Inspector, the Contractor shall provide additional illumination and ventilation required for inspections.

1. Adequate illumination shall consist of explosion proof lights and electrical equipment required to meet safety standards.
2. The Inspector shall determine the level of illumination for inspection purposes.

C. Inspection Devices - The items listed below, or approved equals, shall be provided to the Inspector, if needed, by the Contractor, in good working condition and with calibration data prior to beginning any work and shall remain available until final acceptance of the coating applications:
   1. Film Thickness Testing – To be recorded by the Contractor and submitted to the Inspector.
   2. The Contractor shall test the completed coating application for pinholes and holidays using a high or low voltage spark tester according to RP0188 and ASTM D4787. The testing shall be witnessed by the Inspector.
      a. The required test voltage shall be established by the manufacturer's recommendations and testing of induced holidays.
      b. Pinhole and holiday testing shall be conducted on completed coating sections within 48 hours of final application.
      c. The electrode movement over the coating surface shall be continuous and shall proceed in a systematic manner, which ensures 100 percent coverage of the coating surface.
      d. All defects shall be clearly marked by the Inspector followed by repair and retesting by the Contractor.
      e. For surfaces having a total dry film coating thickness exceeding 20 mils, a high voltage detector as specified below shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness. The following products are approved:
         1) Tinker & Rasor Model AP-W
         2) D.E. Stearns Model 14/20.
      f. For surfaces having a total dry film coating thickness of 20 mils or less, a low voltage holiday detector as specified below shall be used. The unit shall operate at less than 75 volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo, or equivalent, shall be added to the water prior to wetting the detector sponge. The following products are approved:
         1) Tinker & Rasor M1
         2) K-D Bird Dog
   3. Psychrometer - Sling, mechanized or digital.
   4. Surface Temperature – Magnetic surface temperature gauge.

D. Visual Inspection – At the completion of all coating work, a final inspection shall be conducted. The Contractor and its Supervisor, the Inspector, a representative of the coating manufacturer, a representative of the Engineer and a representative of the Owner, shall conduct a final inspection to establish that all work has been completed per the Contract Documents.
   1. A visual inspection for holidays and bugholes shall be made on all coated surfaces. The holidays and bugholes shall be marked with a permanent marker and repaired by the Contractor.

E. The Contractor shall thoroughly document the conditions of each area of work at the time of inspection using video and still photography. Any deficiencies found shall be documented and corrected before final acceptance of the work will be granted. A copy of the photographs and video shall be provided to the Owner, and the Contractor shall keep the originals. The photographs and video shall be the basis of evaluation of the condition of the coating systems at the warranty inspection.

3.11 REPAIRS

A. If an area is found to have an improper finish, insufficient film thickness or other deficiencies; clean, prepare and topcoat the coating surface per the manufacturer's recommendations to obtain the specified finish and coverage. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

B. Damaged or defective coating shall be removed by the Contractor in accordance with the manufacturer's specified blast cleaning to meet the clean surface requirements before recoating.

3.12 TESTING FOR VOLATILE ORGANIC COMPOUNDS

A. Following the curing period, the contractor shall test for volatile organic compounds (VOCs) in accordance to the California State Water Resources Control Board, Division of Drinking Water, refer to Appendix A attached at the end of this specification section.

B. Water filling and testing shall be at the Contractor's expense. In some instances, the Contractor may find it necessary to extend coating cure times beyond manufacturer's recommendations in order to achieve satisfactory action levels, due to temperature and humidity conditions at the project site.

C. If test results reveal unacceptable levels of impurities or volatile organic compounds, reservoir shall be drained, flushed, refilled, and retested. Such remedial action will be performed by the Contractor at the Contractor's expense and will be continued until satisfactory levels are achieved.

3.13 DISINFECTION

A. Where connection involves potable water systems, provide disinfection methods as prescribed in this Specification Section.

B. Disinfection of tank and piping:
   1. After favorable performance of VOC testing and pressure test of piping and prior to Final Acceptance, thoroughly flush entire potable water system including supply, source and any appurtenant devices and perform disinfection as prescribed.
   2. Perform work, including preventative measures during construction, in full compliance with AWWA C651 and C652.
   3. Perform disinfection using sodium hypochlorite complying with AWWA B300.
   4. Flush each segment of system to provide flushing velocity of not less than 2.5 FT per second.
   5. Drain flushing water to sanitary sewer.
      a. Do not drain flushing water to receiving stream.
   6. Use continuous feed method of application.
      a. Tag system during disinfection procedure to prevent use.
   7. After required contact period, flush system to remove traces of heavily chlorinated water.
   8. After final flushing and before placing water in service, obtain an independent laboratory approved by the Owner to collect samples and test for bacteriological quality.
      a. Repeat entire disinfection procedures until satisfactory results are obtained.
   9. Secure and deliver to Owner, satisfactory bacteriological reports on samples taken from system.
      a. Ensure sampling and testing procedures are in full compliance to AWWA C651 and C652, local water purveyor and applicable requirements of State of California.

3.14 CLEANUP

A. Upon completion of the work, all staging, scaffolding, containers and work-related material or debris shall be removed from the site to the satisfaction of the Inspector and Owner. Coating overspray and oil spots or stains on all surrounding surfaces shall be removed and the job site cleaned. All damage to surfaces resulting from the Contractor's work shall be cleaned, repaired or refinished, to the satisfaction of the Owner at no cost to the Owner.

B. Disposal of spent solvents, thinners, coating components and other related materials shall be the Contractor's responsibility and shall meet all County, State and Federal regulations for safe disposal.

3.15 FIELD QUALITY CONTROL

A. Application Deficiencies:

1. Surfaces showing runs, laps, brush marks, telegraphing of surface imperfections or other defects will not be accepted.
2. Surfaces showing evidence of fading, chalking, blistering, delamination or other defects due to improper surface preparation, environmental controls or application will not be accepted.
    a. Epoxy surfaces showing evidence of chalking or amine blush shall be prepared and recoated as follows:
        1) Solvent clean surfaces in accordance with SSPC-SP1 and abrasive blast in accordance with SSPC-SP7/ NACE No. 4.
        2) Recoat with intermediate and finish coats in accordance with coating system specified herein.

B. Provide protection for painted surfaces.
1. Surfaces showing soiling, staining, streaking, chipping, scratches, or other defects will not be accepted.

C. Contractor Performed Testing:
1. Provide ongoing testing and inspection, including but not limited to the following:
    a. Measurement and recording of environmental conditions as specified herein.
    b. Measurement and recording of substrate conditions as specified herein.
    c. Thickness Testing:
        1) Wet film thickness during application in accordance with ASTM D4414.
        2) Dry Film Thickness (DFT) in accordance with SSPC-PA 2 and ASTM D7091.

D. Instrumentation:
1. Provide instrumentation as necessary to measure and record atmospheric and substrate conditions, including but not limited to:
    a. Dry Film Thickness Gauge.
    b. Wet Film Thickness Gauge.
    c. Sling Psychrometer.
    d. Surface Temperature Gauge.
    e. Anemometer.
    f. Moisture Meter.

E. Maintain Daily Records:
1. Record the following information during application:
    a. Date, starting time, end time, and all breaks taken by painters.
    b. Air temperature.
    c. Relative humidity.
    d. Dew point.
    e. Surface temperature of substrate.
    f. Provisions utilized to maintain work area within manufacturer's recommended application parameters including temporary heating, ventilation, cooling, dehumidification and provisions utilized to mitigate wind blown dust and debris from contaminating the wet paint film.
    g. For exterior painting:
        1) Sky condition.
        2) Wind speed and direction.
    h. Record environmental conditions, substrate moisture content and surface temperature information not less than once every 4 HRS during application.
        1) Record hourly when temperatures are below 50 DEGF or above 100 DEGF.
2. Record the following information daily for the paint manufacturer's recommended curing period:
    a. Date and start time of cure period for each item or area.
    b. For exterior painting:
        1) Sky conditions.
        2) Wind speed and direction.
        3) Air temperature.

a) Dry Bulb.
b) Wet Bulb.
4) Relative humidity.
5) Dew point.
6) Surface temperatures.

c. Record environmental conditions not less than once every 4 HRS.
1) Record hourly when temperatures are below 50 DEGF or above 100 DEGF.

d. Provisions utilized to protect each item or area and to maintain areas within manufacturer's recommended curing parameters.

3. Format for daily record to be computer generated.

F. Measure wet coating with wet film thickness gages in accordance with ASTM D4414.

G. Measure coating dry film thickness in accordance with SSPC-PA 2.
1. Engineer may measure coating thickness at any time during project to assure conformance with these Specifications.

H. Measure surface temperature of items to be painted with surface temperature gage specifically designed for such.

I. Measure substrate humidity with humidity gage specifically designed for such.

J. Provide wet paint signs.

3.16 WARRANTY INSPECTION

A. Warranty inspections shall be conducted in the 1st and 3rd year of the warranty following acceptance of the work. All coating applications found to be deficient or defective during the warranty period shall be repaired or replaced by the Contractor, to the satisfaction of the Owner. These repairs or replacements shall be in accordance with this Specification and the material manufacturer's recommendations and at no cost to the Owner. Deficient or defective areas in the coatings include blisters, peeling, disbondment or cracking. The final inspection photographs and video shall be used to assist in determining deficient or defective areas in the coating systems.

B. The Owner shall establish a date for the inspection and notify the Contractor 30 days in advance, so that the Contractor and a representative of the coating manufacturer can be present during the inspection. The Owner will arrange for and cover the cost of the warranty inspection. The Contractor shall arrange for the presence of the coating manufacturer and bear all associated costs. Inspection costs in excess of one re-inspection or cancellation not attributed to the Owner shall be borne by the Contractor. The Contractor shall arrange for and cover all costs for repair work under the warranty.

C. If the warranty inspection is not held during or before 1 month prior to the end of the warranty period, the Contractor is not relieved of its warranty responsibilities under the contract documents. If the contractor fails to conduct an 11-month inspection for reasons not attributed to the Owner, the warranty period shall be extended until the inspection is conducted and defective work is repaired.

3.17 COLOR SCHEDULE

A. Coordinate with Owner for color selection during submittal phase.

END OF SECTION

APPENDIX A – SWRCB VOC TESTING PROCEDURES

State Water Resources Control Board
Division of Drinking Water
50 D Street, Suite 200
Santa Rosa, CA 95404-3752
(707) 576-2145 Fax: (707) 576-2722

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Recommended Testing Procedure Following Steel Water Tank Coating Applications

On December 30, 1985, the Department of Public Health began requiring volatile organic chemical testing of water from all newly coated potable water storage tanks. This action was taken because organic solvents contained in certain coatings were found to leach into the water following the coating application. However, as early as 1989, the National Science Foundation began certifying tank coatings to meet NSF Standard 61 for direct additives. The Department's current policy is that water utilities should use coatings that are certified to meet NSF Standard 61. As long as the certified coatings are applied according to the manufacturers instructions, utilities are no longer required by the Department to conduct the testing described below. However, if the utility wishes to conduct the volatile organic soak test after coating a storage tank as a quality control check to verify that the applicator has applied the coating correctly, the following procedure is recommended:

Note: The Waterworks Standards specify tank coatings and all other components that come in contact with drinking water to be certified to meet NSF Standard 61. The tank must be disinfected after the coating is applied even if the coating is NSF certified.

Volatile Organic Testing

1. The Material Safety Data Sheet (MSDS) must be obtained from the manufacturer of the coating to be used. The MSDS lists all organic solvents used in the coating and should be used to determine which organic chemicals should be sampled for.

2. Following the curing period, the tank must be filled and allowed to soak for 5 days. At the end of the 5-day soak period, a sample of water must be analyzed for volatile organic chemicals using EPA Method 524.2 or 502.2. In addition, analysis should be conducted for any other organic chemicals from the MSDS that are not analyzed as part of the 524.2 or 502.2 scan.

3. Upon receipt of the test results, the water supplier should notify the Department if any regulated chemical exceeds the State maximum contaminant level, or if any unregulated chemical has been detected. The tank should remain out of service until corrective action is taken and resamples indicate that the water is of acceptable quality.

4. If test results indicate that all chemicals are within acceptable limits, the tank can be placed into service. The test results should be submitted to the Department for our files.

Disinfection

Before the tank is placed into service, it must be disinfected in accordance with AWWA Standard C652-92. After the tank is disinfected, a sample must be collected while the tank is full and analyzed for bacteriological quality. Negative results must be obtained before the tank can be placed into service.

SECTION 10 14 00
IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 QUALITY ASSURANCE

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

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. W.H. Brady Co.
   2. Panduit.
   3. Seton.
   4. National Band and Tag Co.
   5. Carlton Industries, Inc.

2.2 MANUFACTURED UNITS

A. Type A1 - Round Metal Tags:
   1. Materials:
      a. Aluminum or stainless steel.
      b. Stainless steel shall be used in corrosive environments.

2. Size:
    a. Diameter: 1-1/2 IN minimum.
    b. Thickness: 0.035 IN (20 GA) minimum.
3. Fabrication:
    a. 3/16 IN minimum mounting hole.
    b. Legend: Stamped and filled with black coloring.
4. Color: Natural.

B. Type A2 - Rectangle Metal Tags:
1. Materials: Stainless steel.
2. Size:
    a. 3-1/2 IN x 1-1/2 IN minimum.
    b. Thickness: 0.036 IN (20 GA) minimum.
3. Fabrication:
    a. 3/16 IN minimum mounting hole.
    b. Legend: Stamped and filled with black coloring.
4. Color: Natural.

C. Type A3 - Metal Tape Tags:
1. Materials: Aluminum or stainless steel.
2. Size:
    a. Width 1/2 IN minimum.
    b. Length as required by text.
3. Fabrication:
    a. 3/16 IN minimum mounting hole.
    b. Legend: Embossed.
4. Color: Natural.

D. Type B1- Square Nonmetallic Tags:
1. Materials: Fiberglass reinforced plastic.
2. Size:
    a. Surface: 2 x 2 IN minimum.
    b. Thickness: 100 mils.
3. Fabrication:
    a. 3/16 IN mounting hole with metal eyelet.
    b. Legend: Preprinted and permanently embedded and fade resistant.
4. Color:
    a. Background: Manufacturer standard or as specified.
    b. Lettering: Black.

E. Type B2 - Nonmetallic Signs:
1. Materials: Fiberglass reinforced or durable plastic.
2. Size:
    a. Surface: As required by text.
    b. Thickness: 60 mils minimum.
3. Fabrication:
    a. Rounded corners.
    b. Drilled holes in corners with grommets.
    c. Legend: Preprinted, permanently embedded and fade resistant for a 10 year minimum outdoor durability.
4. Color:
    a. Background: Manufacturer standard or as specified.
    b. Lettering: Black.
5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.

F. Type C - Laminated Name Plates:
1. Materials: Phenolic or DR (high impact) acrylic.

2. Size:
    a. Surface: As required by text.
    b. Thickness: 1/16 IN.
3. Fabrication:
    a. Outdoor rated and UV resistant when installed outdoors.
    b. Two (2) layers laminated.
    c. Legend: Engraved through top lamination into bottom lamination.
    d. Two (2) drilled side holes, for screw mounting.
4. Color: Black top surface, white core, unless otherwise indicated.

G. Type D - Self-Adhesive Tape Tags and Signs:
1. Materials: Vinyl tape or vinyl cloth.
2. Size:
    a. Surface: As required by text.
    b. Thickness: 5 mils minimum.
3. Fabrication:
    a. Indoor/Outdoor grade.
    b. Weather and UV resistant inks.
    c. Permanent adhesive.
    d. Legend: Preprinted.
    e. Wire markers to be self-laminating.
4. Color: White with black lettering or as specified.
5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.

H. Type E - Heat Shrinkable Tape Tags:
1. Materials: Polyolefin.
2. Size: As required by text.
3. Fabrication:
    a. Legend: Preprinted.
4. Color: White background, black printing.

I. Type F - Underground Warning Tape:
1. Materials: Polyethylene.
2. Size:
    a. 6 IN wide (minimum).
    b. Thickness: 3.5 mils.
3. Fabrication:
    a. Legend: Preprinted and permanently imbedded.
    b. Message continuous printed.
    c. Tensile strength: 1750 psi.
4. Color: As specified.

J. Type G - Stenciling System:
1. Materials:
    a. Exterior type stenciling enamel.
    b. Either brushing grade or pressurized spray can form and grade.
2. Size: As required.
3. Fabrication:
    a. Legend: As required.
4. Color: Black or white for best contrast.

K. Underground Tracer Wire:
1. Materials:
    a. Wire:
        1) 12 GA AWG.
        2) Solid.

b. Wire nuts: Waterproof type.
c. Split bolts: Brass.

2.3 ACCESSORIES

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

2.4 MAINTENANCE MATERIALS

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

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install identification devices at specified locations.

B. All identification devices to be printed by mechanical process, hand printing is not acceptable.

C. Attach tags to equipment with sufficient surface or body area with solvent activated adhesive applied to back of each tag.

D. Attach tags with 1/8 IN round or flat head screws to equipment without sufficient surface or body area, or porous surfaces.
1. Where attachment with screws should not or cannot penetrate substrate, attach with plastic strap.

E. Single items of equipment enclosed in a housing or compartment to be tagged on outside of housing.
1. Several items of equipment mounted in housing to be individually tagged inside the compartment.

F. Tracer Wire:
1. Attach to pipe at a maximum of 10 FT intervals with tape or tie-wraps.
2. Continuous pass from each valve box and above grade at each structure.
3. Coil enough wire at each valve box to extend wire a foot above the ground surface.
4. 1,000 FT maximum spacing between valve boxes.
5. If split bolts are used for splicing, wrap with electrical tape.
6. If wire nuts are used for splicing, knot wire at each splice point leaving 6 IN of wire for splicing.
7. Use continuous strand of wire between valve box where possible.
a. Continuous length shall be no shorter than 100 FT.

3.2 SCHEDULES

A. Process Systems:
1. General:
a. Provide arrows and markers on piping.
1) At 20 FT maximum centers along continuous lines.
2) At changes in direction (route) or obstructions.
3) At valves, risers, "T" joints, machinery or equipment.
4) Where pipes pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.
b. Position markers on both sides of pipe with arrow markers pointing in flow direction.
1) If flow is in both directions use double headed arrow markers.
c. Apply tapes and stenciling in uniform manner parallel to piping.

2. Trenches with piping:
    a. Tag type: Type F - Underground Warning Tape
    b. Location: Halfway between top of piping and finished grade.
    c. Letter height: 1-1/4 IN minimum.
    d. Potable water:
        1) Color: Blue with black letters.
        2) Legend:
            a) First line: “CAUTION CAUTION CAUTION”
            b) Second line: “BURIED WATER LINE BELOW”
    e. Storm and sanitary sewer lines:
        1) Color: Green with black letters.
        2) Legend:
            a) First line: “CAUTION CAUTION CAUTION”
            b) Second line: “BURIED SEWER LINE BELOW”
    f. (Nonpotable) water piping, except 3 IN and smaller irrigation pipe:
        1) Color: Green with black letters.
        2) Legend:
            a) First line: “CAUTION CAUTION CAUTION”
            b) Second line: “BURIED NONPOTABLE WATER LINE BELOW”
    g. Other piping (e.g., compressed air, irrigation, refrigerant, heating water, etc.):
        1) Color: Yellow with black letters.
        2) Legend:
            a) First line: “CAUTION CAUTION CAUTION”
            b) Second line: “BURIED PIPE LINE BELOW”
3. Yard valves, buried, with valve box and concrete pad:
    a. Tag type: Type A2 - Rectangle Metal Tags.
    b. Fastener: 3/16 IN x 7/8 IN plastic screw anchor with 1 IN #6 stainless steel pan head screw.
    c. Legend:
        1) Letter height: 1/4 IN minimum.
        2) Valve designation as indicated on the Drawings (e.g., “V-xxx”).
4. Valves:
    a. Tag type:
        1) Outdoor locations: Type B1 - Square Nonmetallic Tags.
        2) Indoor noncorrosive:
            a) Type A1 - Round Metal Tags.
            b) Type B1 - Square Nonmetallic Tags.
        3) Indoor corrosive:
            a) Stainless steel Type A1 - Round Metal Tags.
            b) Type B1 - Square Nonmetallic Tags.
    b. Fastener:
        1) Type A1: Chain of the same material.
        2) Type B1: Stainless steel chain.
    c. Color: Per ASME A13.1 corresponding to the piping system.
    d. Legend:
        1) Letter height: 1/4 IN minimum.
        2) Valve designation as indicated on the Drawings (e.g., “V-xxx”).
5. Process equipment (e.g., pumps, pump motors, blowers, air compressors, bar screens, clarifier drive mechanism, etc.):
    a. Tag type:
        1) Type B2 - Nonmetallic Signs.
        2) Type D - Self-Adhesive Tape Tags and Signs.
        3) Type G - Stenciling System.
    b. Fastener:
        1) Self.

2) Screws.
3) Adhesive.

c. Legend:
1) Letter height: 1/2 IN minimum.
2) Equipment designation as indicated on the Drawings (e.g., “Primary Sludge Pump P-xxx”).

6. Piping systems:
a. Tag type:
1) Outdoor locations: Type G - Stenciling System.
2) Indoor locations:
a) Type D - Self-Adhesive Tape Tags and Signs.
b) Type G - Stenciling System.

b. Fastener: Self.
c. Color: Per ASME A13.1.
d. Legend:
1) Letter height: Manufacturers standard for the pipe diameter.
2) Mark piping in accordance with ASME A13.1.
3) Use piping designation as indicated on the Drawings.
4) Arrow: Single arrow.

7. Process tanks (over 1000 GAL) and basins, (e.g., biological treatment basins, etc):
a. Tag type:
1) Type B2 - Nonmetallic Signs.
2) Type G - Stenciling System.

b. Fastener:
1) Screw.
2) Self.

c. Location as directed by Owner.
d. Legend:
1) Letter height: 4 IN minimum.
2) Equipment designation as indicated on the Drawings (e.g., “Clarifier CL-xxx”).

8. Equipment that starts automatically:
a. Tag type:
1) Type B2 - Nonmetallic Signs.
2) Type D - Self-Adhesive Tape Tags and Signs.

b. Fastener:
1) Type B2 - Screw or adhesive.
2) Type D - Self.

c. Size: 5 IN x 7 IN
d. Location: Blowers.
e. Legend:
1) OSHA Warning Sign.
2) Description of Warning: “THIS MACHINE STARTS AUTOMATICALLY”.

B. Instrumentation Systems:
1. Instrumentation Equipment (e.g., flow control valves, primary elements, etc.):
a. Tag type:
1) Outdoor locations: Type B1 - Square Nonmetallic Tags.
2) Indoor noncorrosive:
a) Type A1 - Round Metal Tags.
b) Type B1 - Square Nonmetallic Tags.
3) Indoor corrosive:
a) Stainless steel Type A1 - Round Metal Tags.
b) Type B1 - Square Nonmetallic Tags.

b. Fastener:
1) Type A1: Chain of the same material.
2) Type B1: Stainless steel chain.

c. Legend:
1) Letter height: 1/4 IN minimum.
2) Equipment ISA designation as indicated on the Drawings (e.g., “FIT-xxx”).

2. Enclosure for instrumentation and control equipment, (e.g., PLC control panels, etc.):
a. Tag type: Type C - Phenolic Name Plates.
b. Fastener: Screws.
c. Legend:
1) Letter height: 1/2 IN minimum.
2) Equipment name (e.g., "PLC CONTROL PANEL PCP-xxx").

3. Components inside equipment enclosure, (e.g., PLC’s, control relays, contactors, and timers):
a. Tag type: Type D - Self-Adhesive Tape Tags.
b. Fastener: Self.
c. Legend:
1) Letter height: 3/16 IN minimum.
2) Description or function of component (e.g., "PLC-xxx” or “CR-xxx").

4. Through enclosure door mounted components (e.g., selector switches, controller digital displays, etc.):
a. Tag type: Type C - Phenolic Name Plates.
b. Fastener: Screws.
c. Legend:
1) Letter height: 1/4 IN minimum.
2) Component ISA tag number as indicated on the Drawings (e.g., “HS-xxx”).

C. HVAC Systems:
1. General:
a. Provide arrows and markers on ducts.
1) At 20 FT maximum centers along continuous lines.
2) At changes in direction (route) or obstructions.
3) At dampers, risers, branches, machinery or equipment.
4) Where ducts pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.
b. Position markers on both sides of duct with arrow markers pointing in flow direction.
1) If flow is in both directions use double headed arrow markers.
c. Apply tapes and stenciling in uniform manner parallel to ducts.

2. HVAC Equipment (e.g., unit heaters, exhaust fans, air handlers, etc.):
a. Tag type:
1) Type B2 - Nonmetallic Signs.
2) Type C - Phenolic Name Plates.
b. Fastener: Screws.
c. Legend:
1) Letter height: 1 IN minimum.
2) Equipment designation as indicated on the Drawings (e.g., "EF-xxx").

3. Ductwork:
a. Tag type:
1) Type D - Self-Adhesive Tape Tags and Signs.
2) Type G - Stenciling System.
b. Fastener: Self.
c. Legend:
1) Letter height: 1 IN minimum.
2) Description of ductwork, (e.g., “AIR SUPPLY”).
3) Arrows: Single arrow.

4. Enclosure for instrumentation and control equipment, (e.g., fan control panels, etc.):
a. Tag type: Type C - Phenolic Name Plates.
b. Fastener: Screws.
c. Legend:

1) Letter height: 1/2 IN minimum.
2) Equipment designation as indicated on the Drawings (e.g., "FAN CONTROL PANEL FCP-xxx").

5. Wall mounted thermostats:
   a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
   b. Fastener: Self.
   c. Legend:
      1) Letter height: 3/16 IN minimum.
      2) Description of equipment controlled (e.g., "UH-xxx" or AHU-xxx").
6. Components inside equipment enclosure, (e.g., controller's, control relays, contactors, and timers):
   a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
   b. Fastener: Self.
   c. Legend:
      1) Letter height: 3/16 IN minimum.
      2) Description or function of component (e.g., "CR-xxx").
7. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1/4 IN minimum.
      2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., "HS-xxx").

D. Electrical Systems:
1. Trenches with ductbanks, direct-buried conduit, or direct-buried wire and cable.
   a. Tag type: Type F - Underground Warning Tape.
   b. Letter height: 1-1/4 IN minimum.
   c. Location:
      1) Where trench is 12 IN or more below finished grade: In trench 6 IN below finished grade.
      2) Where trench is less than 12 IN below finished grade: In trench 3 IN below finished grade.
   d. Electrical power (e.g., low and medium voltage):
      1) Color: Red with black letters.
      2) Legend:
         a) First line: "CAUTION CAUTION CAUTION".
         b) Second line: "BURIED ELECTRIC LINE BELOW".
   e. Communications (e.g., telephone, instrumentation, LAN, SCADA):
      1) Color: Orange with black letters.
      2) Legend:
         a) First line: "CAUTION CAUTION CAUTION".
         b) Second line: "BURIED COMMUNICATION LINE BELOW".
2. Switchgear, switchboards and motor control centers:
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Main equipment legend:
      1) Letter height:
         a) First line: 1 IN minimum.
         b) Subsequent lines: 3/8 IN minimum.
      2) First line: Equipment name (e.g., "MAIN SWITCHBOARD MSBxxx").
      3) Second line:
         a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").
         b) Include the building name or number if the source is in another building.
      4) Third line: System voltage and phase (e.g., "480/277 V, 3PH").

d. Main and feeder device legend:
    1) Letter height: 3/8 IN minimum.
    2) Description of load (e.g., “MAIN DISCONNECT”, "PUMP Pxxx" or "PANELBOARD HPxxx").

3. Panelboards and transformers:
    a. Tag type: Type C - Phenolic Name Plates.
    b. Fastener: Screws.
    c. Legend:
        1) Letter height:
            a) First line: 3/8 IN minimum.
            b) Subsequent lines: 3/16 IN minimum.
        2) First line: Equipment name (e.g., "PANELBOARD LPxxx" or "TRANSFORMER Txxx").
        3) Second line (panelboards only): System voltage and phase (e.g., “208/120V, 3PH”).
        4) Third line:
            a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").
            b) Include the building name or number if the source is in another building.
4. Transfer switches:
    a. Tag type: Type C - Phenolic Name Plates.
    b. Fastener: Screws.
    c. Legend:
        1) Letter height:
            a) First line: 3/8 IN minimum.
            b) Subsequent lines: 3/16 IN minimum.
        2) First line: Equipment name (e.g., "AUTOMATIC TRANSFER SWITCH ATSxxx").
5. Safety switches, separately mounted circuit breakers and motor starters, VFD’s, etc.:
    a. Tag type: Type C - Phenolic Name Plates.
    b. Fastener: Screws.
    c. Legend:
        1) Letter height: 1/4 IN minimum.
        2) First line: Description of load equipment is connected to (e.g., "PUMP Pxxx").
6. Enclosure for instrumentation and control equipment, (e.g., lighting control panels, etc.):
    a. Tag type: Type C - Phenolic Name Plates.
    b. Fastener: Screws.
    c. Legend:
        1) Letter height: 1/2 IN minimum.
        2) Equipment name (e.g., "LIGHTING CONTROL PANEL LCPxxx").
7. Components inside equipment enclosures (e.g., circuit breakers, fuses, control power transformers, control relays, contactors, timers, etc.):
    a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
    b. Fastener: Self.
    c. Legend:
        1) Letter height: 3/16 IN minimum.
        2) Description or function of component (e.g., "M-xxx”, “CR-xxx” or “TR-xxx").
8. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
    a. Tag type: Type C - Phenolic Name Plates.
    b. Fastener: Screws.
    c. Legend:
        1) Letter height: 1/4 IN minimum.
        2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., “HS-xxx”).
9. Conductors in control panels and in pull or junction boxes where multiple circuits exist.
    a. Tag type: Type D - Self-Adhesive Tape Tags.

b. Fastener: Self.
c. Tag conductor at both ends.
d. Legend:
1) Letter height: 1/8 IN minimum.
2) Circuit number or wire number as scheduled on the Drawings or as furnished with the equipment.

10. Conductors in handholes and manholes.
a. Tag type: Type A3 - Metal Tape Tags.
b. Fastener: Nylon strap.
c. Tag conductor at both ends.
d. Legend:
1) Letter height: 1/8 IN minimum.
2) Circuit number or wire number as scheduled on the Drawings.

11. Grounding conductors associated with grounding electrode system in accordance with the following:
a. Tag type: Type D - Self-Adhesive Tape Tags.
b. Fastener: Self.
c. Legend:
1) Letter height: 1/8 IN minimum.
2) Function of conductor (e.g., "MAIN BONDING JUMPER", "TO GROUND RING", "TO MAIN WATER PIPE").

12. Flash protection for switchboards, panelboards, industrial control panels and motor control centers:
a. Tag type: Type D - Self-Adhesive Tape Signs.
b. Fastener: Self.
c. Legend: Per NFPA 70.

13. Entrances to electrical rooms:
a. Tag type: Type B2 - Nonmetallic Signs.
b. Fastener: Screw or adhesive.
c. Size: 5 IN x 7 IN.
d. Location: Each door to room.
e. Legend:
1) OSHA Danger Sign.
2) Description of Danger: “HIGH VOLTAGE, AUTHORIZED PERSONNEL ONLY”.

14. Equipment where more than one (1) voltage source is present:
a. Tag type:
1) Type B2 - Nonmetallic Signs.
2) Type D - Self-Adhesive Tape Signs.
b. Fastener:
1) Screw or adhesive.
2) Self.
c. Size: 1-3/4 IN x 2-1/2 IN.
d. Location: Exterior face of enclosure or cubical.
e. Legend:
1) OSHA Danger Sign.
2) Description of Danger: “MULTIPLE VOLTAGE SOURCES”.

3.3 HAZARD AND SAFETY SIGNS

A. Provide 4 Hazard and Safety Signs:
1. Type B2.
2. Inscription as directed by Owner.

END OF SECTION

SECTION 12 35 53
WOOD LABORATORY CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Laboratory casework (wood).
   2. Laboratory counter tops (epoxy resin).
   3. Laboratory sinks (epoxy resin).
   4. Laboratory service fittings.
   5. Selected laboratory equipment as listed.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 06 10 00 - Rough Carpentry.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Americans with Disabilities Act (ADA):
      a. Accessibility Guidelines (ADAAG).
   2. ASTM International (ASTM):
      a. C1036, Standard Specification for Flat Glass.
      b. D543, Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
      c. D570, Standard Test Method for Water Absorption of Plastics.
      d. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
      e. D785, Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
      f. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
      g. F1861, Standard Specification for Resilient Wall Base.
   3. Hardwood Plywood and Veneer Association (HPVA):
      a. HP-1, American National Standard for Hardwood and Decorative Plywood.
   4. National Fire Protection Association (NFPA):
      a. 30, Flammable and Combustible Liquids Code.
      b. 45, Standard on Fire Protection for Laboratories Using Chemicals.
   5. Scientific Apparatus Makers Association (SAMA):
      a. LF 8, Performance Requirements for Laboratory Furniture.
   6. Scientific Equipment and Furniture Association (SEFA):
      a. 2.3, Installation of Scientific Laboratory Furniture and Equipment.
      b. 3, Work Surfaces.
      c. 4.1, Glossary of Terms.
      d. 7, Laboratory and Hospital Fixtures.
      e. 8, Laboratory Furniture, Casework, Shelving and Tables.

B. Qualifications:
   1. Manufacturer qualifications:
      a. Minimum 10 years' experience in manufacturing of units specified.
      b. Five similar installations in past two years.
   2. Installer qualifications:
      a. Employed or approved in writing by manufacturer.

b. Minimum five years' experience installing wood casework and epoxy resin tops.
c. Five installations of wood casework and epoxy resin tops in past two years of similar scope.

C. Miscellaneous:
1. Furnish all wood casework, service fittings, accessories, sinks, drains, and epoxy resin tops from one manufacturer unless noted otherwise.

1.3 DEFINITIONS

A. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

B. Terms referred to in Performance Test Results (PART 2):
1. "A" (Excellent):
a. Indicated excellent to superior integrity of finish film.
b. Includes no effect to slight allowable change in gloss (dulling or increase in gloss) and slight discoloration.
2. "B"(Good):
a. Indicated good to very good integrity of finish film.
b. Allows change of gloss or discoloration.
c. Any effect can be removed from the tested area by abrading with 325-mesh silica powder and water, indicating that the discoloration is only superficial and that the finish film is good below the surface.

C. Exposed: Surfaces normally exposed to view, including but not limited to cabinet exteriors, doors and drawer fronts, interiors of and shelving in open or glazed cases, tops of cases less than 84 IN above finished floor and bottoms of wall cases 48 IN or more above finished floor.

D. Semi-exposed: Surfaces not normally exposed to view, including but not limited to interiors of and shelving in cases with solid doors and/or drawers, tops of cases 84 IN or more above finished floor and bottoms of wall cases less than 48 IN above finished floor.

E. Concealed: Surfaces not exposed to view after installation, including but not limited to cabinet end panels, tops and backs not exposed to view after installation.

F. Additional terminology common to the laboratory furniture and equipment industry as defined in SEFA 4.1.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's installation instructions.
c. Product technical data sheets on all components.
3. Scaled drawing showing layout, controlling dimensions, elevations, etc.
a. Minimum plan scale: 1/8 IN = 1 FT-0 IN.
b. Minimum elevation scale: 1/2 IN = 1 FT-0 IN.
c. Minimum detail scale: 1-1/2 IN = 1 FT-0 IN.

B. Samples:
1. Available casework, work top and base molding colors for Engineer's color selection.
2. Base molding minimum 6 IN long.
3. Minimum 4 x 4 IN work top sample showing raised edge in color specified.

C. Contract Closeout Information:
1. Operation and Maintenance Data:

a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

D. Informational Submittals:
1. Certification of manufacturer qualifications.
2. Certification of installer qualifications.
3. Listing of five installations in past two years of similar scope.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Area to receive casework to be enclosed with temperature and humidity controlled prior to delivery of casework.
1. Temperature range: 65 - 80 DEGF.
2. Humidity range: 30 - 50 PCT RH.

B. Building finish and environmental conditions: In accordance with SEFA 2.3.

C. Prior to delivery to jobsite, hold stored material in a conditioned environment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Epoxy Resin Laboratory Countertops, Cup Sinks, Drain Troughs, Curbs and Service Ledges:
a. Kewaunee Scientific Corporation.
b. Wilsonart.
c. Durcon Company.
2. Casework:
a. Kewaunee Scientific Corporation.
b. Or Approved Equal.

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

2.2 MATERIALS

A. Wood:
1. Kiln dry in humidity controlled kilns to a moisture content of 4-1/2 PCT.
a. Then temper all kiln-dried lumber to a moisture content of 6 PCT before use.
2. Solid wood components:
a. Provide clear solid woods with color and graining in conformance with standards required of the Scientific Laboratory Equipment Industry.
3. Hardwood plywood:
a. HPVA HP-1 1994 - 3.13; 3.15.
b. Book-matched, A-1 plain sliced, select grade 1 face.
1) Veneer core: 7- ply, with type II interior plies.
2) Lumber core: 5-ply, solid core.
c. Hardwood plywood for drawer box construction:
1) Veneer core: 9-ply.
d. Softwoods and particleboard are not acceptable.

B. Glass:
1. Framed swinging and sliding doors:
a. 1/8 IN thick.
b. ASTM C1036.
c. Clear glass: Type I, Class I, Quality q3.

C. Countertop and Curbs: Molded Epoxy Resin.

2.3 ACCESSORIES

A. Hardware and Trim:
   1. Door and drawer pulls:
      a. Meet requirements of ADA.
      b. Satin finished extruded aluminum with clear lacquer coating.
   2. Hinges:
      a. Institutional, five knuckle.
      b. Stainless steel with brushed satin finish.
      c. Minimum 2-1/2 IN high.
   3. Friction catches: Adjustable nylon roller-type with strike.
   4. Locks:
      a. Heavy-duty cylindrical-type.
      b. 5-disc tumbler removable core.
      c. Minimum 200 primary key changes.
      d. Master key.
      e. Satin nickel plated and stamped with identifying number.
   5. Shelf support system.
      a. Twin pin-type for mounting in interior of cabinet.
      b. Corrosion-resistant material.
      c. Secure shelves from accidental removal.
      d. Shelves adjustable on 1.25 IN centers.
      e. Surface-mounted metal supports and clips are not acceptable.
   6. Elbow catches:
      a. Bronze-finished cast aluminum.

B. Countertops and Curbs:
   1. Countertops:
      a. Modified epoxy resin having the following minimum physical properties:
         1) Density: 140 PCF.
         2) Modulus of rupture: 3,500 PSI.
         3) Modulus of elasticity: 4.46 x 106 PSI.
         4) Compressive strength: 15,900 PSI; ASTM D695.
         5) Shear strength: 5,400 PSI.
      b. Chemical and corrosion resistant.
      c. Minimum 1 IN thick.
      d. Radius or bevel all exposed edges to a 1/8 IN radius.
      e. All sink cut-outs and holes for services shall be factory drilled and cut.
         1) Sink cut outs shall be provided with 3/4 IN radius (minimum) corners.
      f. Color: Black.
      g. Backsplash curbs:
         1) 4 IN high x 1 IN thick.
         2) Top set, sealed to work surface with epoxy adhesive.
         3) Same construction and color as work surface.
         4) Provide at back and exposed ends of countertops unless noted otherwise.

C. Resilient Base:
   1. Top set, coved toe.
   2. ASTM F1861.
   3. 1/8 IN x 4 IN.
   4. Mitered inside corners and wrapped outside corners.
   5. Color: Black.

D. Miscellaneous Support Struts:
   1. Pair of nominal 1 IN x 1-1/2 IN vertical channels with adjustable U-shaped connectors top and bottom.
   2. Minimum 16 GA steel coated with corrosion resistant paint coating.

3. Size as required for pipe chase and to support items as shown on Drawings.
4. Compatible with commercially available pipe clamps and accessories.

E. Laboratory Service Fittings:
1. Laboratory grade.
2. Manual operation.
3. Finish:
   a. Chrome plated.
4. Service indexes:
   a. Identify services with tamperproof color coded plastic index buttons as follows:

SERVICE	COLOR	CODE	COLOR OF LETTERS
Cold Water	Dark Green	CW	White
Hot Water	Red	HW	White
Air	Orange	Air	Black
Gas	Dark Blue	Air	White
Dist. Water	White	DW	Black
All other rare gases	Light Blue	Chem Symbol	Black

5. Water fittings:
   a. Cast red brass or bronze.
   b. Provide with renewable unit containing all operating parts subject to wear.
   c. Integral volume control device.
   d. All units capable of converting from compression to self-closing without altering faucet body.
   e. Four arm forged brass handles wrist blade handles with service index buttons as required.
6. Goosenecks:
   a. 3/8 IN I.P.S. spout.
   b. Removable anti-splash outlet.
   c. Minimum 7-1/2 IN clearance between outlet and top with two 90 degree bends.
   d. Capable of conversion from fixed to swinging type.
7. Vacuum breaker:
   a. Integral with fixture assembly.
   b. Provide where indicated or where required by code.

F. Electrical Fittings: To be furnished in the Electrical Design.

G. Support Rods:
1. Upright rods, cross rods and ring support rods, where specified: Anodized Duralumin 1/2 IN or 3/4 IN DIA, as required.
2. Rod sockets: Chrome plated brass, secured through table tops with lock nut and spring washer.
3. Rod clamps: Heavy-duty, designed to securely hold rod assembly in any position.
4. Use of wood rod assemblies is not acceptable.

2.4 FABRICATION

A. General:
1. Exposed wood species: Appalachian Red Oak.
2. Semi-exposed wood to be poplar, birch or similar clear hardwood.
3. Each individual unit shall be complete such that any unit may be relocated at any time without requiring field modification, other than field application of finished end panels.
4. Flush case interiors.

5. No exposed fasteners allowed.
    a. Use fluted hardwood dowels not less than 3/8 IN DIA to join frames and panels.
6. Integrally joined parts shall result in a totally enclosed cabinet.

B. Cases-General:
1. End panels:
    a. Minimum 3/4 IN thick hardwood plywood with minimum 1/8 IN thick solid hardwood facing on exposed edges.
    b. Fasten end panels to top frame members, intermediate rails and bottoms with multiple dowels, glue and/or screws.
2. Backs:
    a. 1/4 IN thick.
    b. Exposed: Hardwood plywood.
    c. Semi-exposed: Tempered hardboard.
    d. Dado back into end panels and bottom and fasten securely.
        1) Provide removable back where required for access to utilities, service chases or as otherwise indicated.
3. Bottoms: Minimum 3/4 IN thick hardwood plywood with minimum 1/8 IN solid hardwood facing on front edge.
4. Top:
    a. Base cabinets: horizontal frame.
    b. Wall cases, counter-mounted cases and full-height cases: Solid top, minimum 3/4 IN thick hardwood plywood with minimum 1/8 IN solid hardwood facing on front edge.
5. Doors:
    a. General:
        1) Solid doors: Solid core plywood with minimum 1/32 IN thick face veneer to match casework.
            a) Under 48 IN high: Minimum 3/4 IN thick.
            b) 48 IN high and greater: Minimum 1 IN thick.
        2) Glazed doors: Hardwood frame, mortised, tenoned and glued.
            a) Under 48 IN high: Minimum 3/4 IN thick.
            b) 48 IN high and greater: Minimum 1 IN thick.
            c) Set glass into door and secure with a plastic retainer.
    b. Hinged doors:
        1) Rabbeted edge to overlap case opening all four sides.
        2) Hinges:
            a) Drilled for screw attachment to door and case.
            b) Doors less than 48 IN high: 1 pair.
            c) Doors 48 IN high up to 84 IN high: 1-1/2 pair.
        3) Provide hardwood astragal applied to left-hand door of double-door cases.
        4) Provide elbow catches on left-hand door of double-door cases specified to receive locks.
    c. Adjustable shelves:
        1) Minimum 3/4 IN thick hardwood plywood with minimum 1/8 IN hardwood facing on front edge.
        2) Adjustable and fixed shelving up to 48 IN long to support an evenly distributed load of 40 PSF up to a maximum of 200 LBS.

C. Base Cabinets:
1. Base cabinets to support a minimum of 400 LBS/SF of cabinet top area including work surface without distortion resulting in interference with door and drawer operation.
2. Top horizontal frame:
    a. Front top rail:
        1) Two pieces of hardwood, grooved and glued together.
            a) Exposed member: Minimum 1-1/2 IN x 7/16 IN hardwood to match hardwood plywood.
            b) Concealed member: Minimum 2-1/2 IN x 3/4 IN hardwood.

b. Side members: Minimum 1-3/4 IN x 3/4 IN hardwood, mortised and glued into front and rear rails and blind screwed into cabinet end panels.
c. Rear member: Minimum 2-1/2 IN x 3/4 IN hardwood.

3. Intermediate rails:
   a. Minimum 3 IN x 3/4 IN plywood with 3/4 IN x minimum 1/8 IN solid hardwood facing on exposed edge to match casework.
   b. Mount intermediate rails at the front between the drawers and between all drawers and doors.
      1) Attach with multiple dowels and glue.
4. Security panels:
   a. Provide minimum 1/4 IN tempered hardboard security panels above locked compartments where access to locked compartment is possible by removal of drawer above.
      1) Security panels to be full depth and width of cabinet.
      2) Securely fasten to provide a tamper-resistant installation.
      3) Design panels so as not to interfere with operation of doors and/or drawers.
5. Toe space:
   a. Minimum 3/4 IN x 4 IN hardwood plywood toe space rail to form a 2-1/2 IN deep x 4 IN high, totally enclosed toe space.
6. Drawers:
   a. Sides: Minimum 1/2 IN thick, 9-ply hardwood plywood.
   b. Fronts: Minimum 3/4 IN thick, 5-ply solid core plywood.
      1) Attach using dovetail joints and glue for drawers over 3 IN deep.
      2) Attach using mortise and tenon joints for all drawers 3 IN deep or less.
   c. Back : Minimum 1/2 IN thick 9-ply hardwood plywood.
      1) Dadoed, glued and nailed to the sides.
   d. Bottom: Minimum 1/4 IN thick tempered hardboard, set and glued into 1/4 IN grooves, all sides.
   e. Drawer suspension:
      1) Provide drawer suspension assemblies rated for 100 LBS minimum.
      2) Construction:
         a) Two epoxy-coated steel sections providing quiet, smooth operation on nylon rollers.
         b) Case channels to maintain drawer alignment.
         c) Drawers to be removable without tools.
         d) Slides to wrap under and support drawer sides.

D. Full-height Cases:
1. Fasten center shelf to end panels with multiple dowels and glue to assure a completely rigid case.
   a. All other shelves to be adjustable on 1-1/4 IN centers using support system specified.
2. Toe space/base rail:
   a. 22 IN deep cases: Minimum 3/4 IN x 4 IN hardwood plywood toe space rail to form a 2-1/2 IN deep x 4 IN high, totally enclosed toe space.
   b. 12 IN and 15 IN deep cases: Minimum 1 IN x 4-3/4 IN solid hardwood (to match case) base rail mounted flush with the face of the cabinet.

E. Apron Frames:
1. Minimum 3/4 IN thick hardwood veneer plywood.
   a. Groove top edge for securing top fasteners.
2. Drawers: Materials and construction same as drawers specified above.

F. Open-Leg Tables:
1. Construct to guarantee equal tension in wood and metal parts.
2. Apron frames: Materials and construction per this Specification Section.
3. Table legs:
   a. 2-1/2 IN square solid hardwood with all corners radiused 1/4 IN.

b. Secure to apron frame with heavy-duty corner bolt and 14 GA metal corner brace.
c. Lock corner braces into apron rails in vertical groves and securely fasten with screws.
d. Leg stretchers (where required):
1) 1-5/16 IN x 2-1/2 IN solid hardwood.
2) Secure to legs with mortise and tenon joints and 4 IN long through-bolt.

G. Kneespace Panels and Miscellaneous Fillers:
1. 1/4 IN minimum thick hardwood plywood to match casework.
2. Attach to blind cleats with stainless steel screws and finish washers where concealed fastening is not possible or access to utilities is required.

H. Wood Finish:
1. Surface preparation:
a. Sand all surfaces to remove loose fibers, scratch marks and abrasions prior to application of wood finish.
b. Thoroughly remove all sanding dust with compressed air and tack cloth.
2. Wood finish application:
a. Apply finishes under controlled atmospheric conditions.
b. Cure finish after application in a humidified oven at 140 DEGF and 30 PCT relative humidity.
3. Wood casework finish:
a. Finished surface shall meet the performance requirements as set forth by SAMA LF 8.
b. Concealed and semi-exposed surfaces:
1) Double-pass coat of resinous wood sealer
c. Exposed surfaces, including interiors of and shelving in open or glazed cases:
1) Provide finish resistant to acid, alkali, solvent, water and abrasion.
2) Double-coat surfaces with a non-fiber-lifting stain or toner to secure specified color.
3) Thoroughly dry color coat.
4) Apply, thoroughly dry, sand and dust first sealer coat.
5) Apply and thoroughly dry second sealer coat.
6) Apply and thoroughly dry double-pass coat of chemical resistant synthetic varnish, providing semi-gloss finish.

2.5 SOURCE QUALITY CONTROL

A. Casework Finish:
1. Performance test results (heat resistance):
a. Allow hot water (190 DEGF - 205 DEGF) to trickle on the finished surface, setting at an angle of 45 degrees from horizontal, for a period of 5 minutes.
b. Finish must show no visible effect from the hot water treatment after cooling and wiping dry.
2. Performance test results (moisture resistance):
a. Soak a 2 IN x 3 IN x 1 IN cellulose sponge with water and place on the finished surface for a period of 100 HRS.
b. Maintain sponge in wet condition throughout the entire test period.
c. Finish will show no visible effect after drying.
3. Performance test results (impact resistance):
a. Drop a 1 LB ball (approximately 2 IN DIA) from a distance of 1 FT onto the finished surface of a 3/4 IN thick plywood panel supported underneath by a solid surface.
b. Finish will show no evidence of cracks or checks in the finish due to impact upon close examination.

B. Work surface:
1. Performance test results:
a. Black molded epoxy resin:
1) Physical properties:
a) Flexural strength (ASTM D790): 15,000 PSI.

b) Compressive strength (ASTM D695): 30,000 PSI.
c) Hardness, Rockwell E (ASTM D785): 100.
d) Water absorption (ASTM D570) percent by weight:
(1) 24 HRS: 0.04.
(2) Percent by weight, seven days: 0.05.
(3) Percent by weight, 2 HR boil: 0.04.
e) Specific gravity: 1.97.
f) Tensile strength: 8,500 PSI.

2) Performance test results (heat resistance):
a) Heat a size 0, 15 ml capacity, high form crucible over a Bunsen burner until the bottom attains an incipient red heat.
b) Immediately transfer the hot crucible to the top surface and allow to cool to room temperature.
c) Upon removal of the cooled crucible, the top surface shall show no blisters, crack or any breakdown whatsoever.

3) Performance tests results (chemical resistance):
a) Tops shall resist chemical attacks from normally used laboratory reagents.
b) Less than 0.1 PCT weight change for top samples submerged in reagents for a period of seven days.
(1) Tests performed in accordance with ASTM D543 at 77 DEGF.

PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation:
1. Prior to beginning installation of casework, check and verify that no irregularities exist that would affect quality of execution of work specified.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Follow manufacturer's printed instructions and Drawings in all cases where items or details are not indicated.

C. Casework:
1. Set casework components plumb, square, and straight with no distortion.
a. Securely anchor to building structure.
b. Shim as required using concealed shims.
2. Screw continuous cabinets together with joints flush, tight and uniform, and with alignment of adjacent units within 1/16 IN tolerance.
3. Secure wall cabinets to solid supporting material.
a. Do not secure to plaster or gypsum board.
4. Abut top edge surfaces in one true plane.
a. Provide flush joints not to exceed 1/8 IN between top units.
5. Provide all trim, fillers, closures, stands, supports, sleeves, collars, escutcheons, ferrules, brackets, braces or other miscellaneous items required for complete installation.
6. Install base molding after installation of base cabinets is complete.

D. Work surfaces:
1. Scribe to abutting surfaces as required.
2. Only factory-prepared field joints, located per approved shop drawings, are permitted.
a. Secure joints in the field, where practical, in the same manner as in the factory.
3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.
4. If field cutting or drilling of epoxy resin countertop, backsplash curb or service ledge assembly is required, make holes using saw blades or drill bits as recommended by countertop manufacturers.

5. Seal all joints in epoxy resin countertops, backsplash curbs and service ledges using materials and methods as recommended by manufacturer.
6. Seal joints in tops, backsplashes, etc., with sealant as specified by countertop manufacturer.

E. Furnish and set in place all service and plumbing fixtures as indicated.
1. Except for final mechanical and electrical connections, complete installation of each item in every respect, including all necessary items required for proper operation and appearance.
2. Where an item of equipment is furnished without a cord and plug, bring electrical wiring in or on equipment to an equipment junction box located on and part of the equipment such that flexible connection no longer than 3 FT is needed to make final connection between items and rough-in junction box.

3.3 ADJUSTING AND CLEANING

A. Repair all damage to surrounding area as result of this installation.
1. Remove all debris and leave area broom clean.

B. Test and adjust all items of equipment for satisfactory operation.

C. Patch all damaged areas of casework in accordance with manufacturer's recommendations.

3.4 PROTECTION

A. Cover work surfaces as recommended by manufacturer.
1. Protect all installed casework and accessories per manufacturer instructions.

B. Remove protection upon acceptance of Project by Owner.

END OF SECTION

SECTION 23 34 00
HVAC: FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fans.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Air Movement and Control Association (AMCA).
      a. AMCA Publication 203 "Field Performance Measurement of Fan Systems"
      b. ANSI/AMCA 210 "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating".
   2. Air Conditioning and Refrigeration Institute (ARI).
   3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. HVAC Applications Handbook, Chapter entitled "Sound and Vibration Control."
      b. 20, Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.
      c. 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
   4. Canadian Standards Association (CSA).
   5. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   6. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   7. National Roofing Contractors Association (NRCA).
   8. Underwriters Laboratories, Inc. (UL):
      a. 507, Standard for Electric Fans.
   9. Building code:
      a. International Code Council (ICC):
         1) International Building Code and associated standards, referred to herein as California Building Code.

B. Miscellaneous:
   1. Gage thickness specified herein shall be manufacturer's standard gage for steel and Brown and Sharpe gage for non-ferrous metals.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Wiring diagrams.
      d. Control diagrams.
      e. Manufacturer's catalog cuts and technical data.
      f. Fan curves.
      g. Sound data.
      h. Vibration isolation.
      i. Performance data on all equipment.

2. Certifications:
    a. Provide certification of thickness of corrosion-protection coating.
    b. Fan systems have been tested in accordance with AMCA Standard 210 or 260, and are licensed to bear the AMCA Certified Ratings Seal.

B. Static pressure rating equal to or greater than 1.5 inches WC.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
    1. Vibration isolation assemblies:
        a. Mason.
        b. Vibration Mounting and Controls Co.
        c. Vibro-Acoustics.
    2. Wall-mounted centrifugal exhaust fans:
        a. Loren Cook.
        b. PennBarry Ventilator Co., Inc.
    3. Roof-mounted centrifugal exhaust fans:
        a. Loren Cook.
        b. Greenheck.
        c. PennBarry Ventilator Co., Inc.

2.2 GENERAL

A. All Manufactured Units:
    1. Factory wired and assembled.
    2. Use fasteners made of same material as unit.
    3. Fabricate motor assemblies and unit housings with vibration isolation assemblies:
        a. Type: As per Table 47, Chapter 48, ASHRAE HVAC Applications Handbook.

B. All manufactured units shall be constructed with corrosion-resistant materials or have corrosion-resistant coating.
    1. Type:
        a. Corrosion-resistant materials:
            1) Aluminum.
            2) Stainless steel.
            3) FRP.

2.3 MANUFACTURED UNITS

A. Wall-Mounted Centrifugal Exhaust Fan (EF-1):
    1. Located inside the control building.
    2. AMCA certified.
    3. Non-overloading horsepower capabilities.
    4. Materials:
        a. Housing: Spun aluminum.
        b. Wheel: Aluminum.
        c. Drive shaft: Stainless steel.
        d. Minimum 10 GA motor mounting plate.
    5. Backward inclined blades.
    6. Statically and dynamically balanced wheel.
    7. Bearings:
        a. Cast iron pillow blocks.
        b. Concentric bearing locking collar for drive shafts 1 IN and larger.
            1) SKF "ConCentra."
            2) Dodge "D Lock."

c. Regreaseable.
d. 200,000 HR average life.

8. Weathertight compartment for motor and drives.
    a. Separated from airstream.
9. Belt drive.
10. Motor:
    a. Belt Drive Units:
        1) TEFC Motor.
        2) Driver and driven sheaves:
            a) Keyed hub type.
            b) Drive sheaves: Fixed pitch diameter.
            c) Driver:
                (1) Shipped with variable pitch diameter sheave.
                (2) Fixed pitch diameter size based on approved test and balance reports.
            d) V-belt drives sized for 150 percent motor horsepower.
        3) Automatic drive belt tensioner.
    b. Vibration isolated motor assembly.
    c. Integral attachment collar.
11. Accessories:
    a. Aluminum birdscreen.
    b. Backdraft damper
    c. Extended grease lines and fittings.
12. Capacity
    a. 1,700 CFM, at 0.25 IN WC.
    b. Variable Speed.

B. Roof-Mounted Centrifugal Exhaust Fans (F-130, F-135):
1. Located in water treatment building roof.
2. AMCA certified.
3. Non-overloading horsepower capability.
4. Materials:
    a. Top cap: Spun aluminum.
    b. Wheel and inlet shroud: Aluminum.
    c. Baffle: Aluminum.
    d. Base: One-piece aluminum.
    e. Drive assembly supports: Steel.
    f. Drive shaft: Solid stainless steel.
    g. Minimum 10 GA motor mounting plate.
5. Backward inclined blades.
6. Tapered inlet shroud.
7. Statically and dynamically balanced wheel.
8. Bearings:
    a. Cast iron pillow blocks.
    b. Concentric bearing locking collar for drive shafts 1 IN and larger.
        1) SKF "ConCentra."
        2) Dodge "D Lock."
    c. Regreaseable.
    d. 200,000 HR average life.
    e. 5-to-1 load capability to actual load ratio.
9. Weathertight compartment for motor and drives.
    a. Separated from airstream.
10. Motor:
    a. TEFC Motor.
    b. See Specification Section 01 61 03.
    c. Belt Drive Units:
        1) Driver and driven sheaves:

a) Keyed hub type.
b) Drive sheaves: Fixed pitch diameter.
c) Driver:
(1) Shipped with variable pitch diameter sheave.
(2) Fixed pitch diameter size based on approved test and balance reports.
d) V-belt drives sized for 150% motor horsepower.
2) Automatic drive belt tensioner.
d. Vibration isolated drive assembly.
11. Accessories:
a. Prefabricated insulated aluminum roof curb.
b. Backdraft damper
c. Bird screen.
d. Extended grease lines and fittings.
12. Size and capacity to match existing.
a. 2,500 CFM, at 0.25 IN WC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixed pitched drive sheave after sheave has been sized based on accepted test and balance report.

B. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated and fan has been test run under observation.

3.2 FIELD QUALITY CONTROL

A. Comply with Specification Section 23 05 93.

3.3 ADJUSTING

A. Install new filters on units which have been running prior to acceptance of Project.

END OF SECTION

SECTION 26 05 00
ELECTRICAL: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Basic requirements for electrical systems.
   2. PG&E Installation Requirements for Project (Attachment 1).

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA).
   2. American Iron and Steel Institute (AISI).
   3. ASTM International (ASTM):
      a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   4. ETL Testing Laboratories (ETL).
   5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C2, National Electrical Safety Code (NESC).
   6. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   7. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   8. Underwriters Laboratories, Inc. (UL).

B. Where UL test procedures have been established for the product type, use UL or ETL approved electrical equipment and provide with the UL or ETL label.

1.3 DEFINITIONS

A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
   1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
   2. Architecturally finished interior area: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.
   3. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
   4. Corrosive area: Areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.
   5. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of submittal process.
   2. See Specification Section 01 61 03 and individual specification sections for submittal requirements for products defined as equipment.

3. General requirements:
    a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
    b. Include data sheets that include manufacturer's name and product model number.
        1) Clearly identify all optional accessories.
    c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
    d. Manufacturer's delivery, storage, handling and installation instructions.
    e. Product installation details.
    f. See individual specification sections for any additional requirements.

B. Operation and Maintenance Manuals:
    1. See Specification Section 01 33 04 for requirements for:
        a. The mechanics and administration of the submittal process.
        b. The content process of Operation and Maintenance Manuals.

C. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Specification Section 01 33 00 and all Specification Sections shall be submitted simultaneously.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 01 65 50.

B. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
    1. Outdoor areas including within open sided canopy structures:
        a. Wet.
        b. Also, corrosive when specifically designated on the Drawings or in the Specifications.
    2. Indoor areas:
        a. Dry.
        b. Also, wet or corrosive when specifically designated on the Drawings or in the Specifications.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to specific Electrical Specification Sections and specific material paragraphs below for acceptable manufacturers.

B. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

A. Electrical Equipment Support Pedestals and/or Racks:
    1. Approved manufacturers:
        a. Modular strut:
            1) Unistrut Building Systems.
            2) Eaton B-Line.
            3) Globe Strut.
            4) Thomas & Betts Superstrut.
            5) Or approved equal.
    2. Material requirements:
        a. Modular strut:
            1) Galvanized steel: ASTM A123/123M or ASTM A153/A153M.
            2) Stainless steel: AISI Type 316 or 304.

b. Mounting hardware:
   1) Galvanized steel.
   2) Stainless steel.
c. Anchorage per Specification Section 05 50 00.

B. Field touch-up of galvanized surfaces.
1. Zinc-rich primer.
   a. One (1) coat, 3.0 mils, ZRC by ZRC Products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and wire all equipment, including pre-purchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.

B. Install equipment in accordance with the requirements of:
1. NFPA 70.
2. IEEE C2.
3. The manufacturer's instructions.

C. In general, conduit routing is not shown on the Drawings.
1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.

D. When complete branch circuiting is not shown on the Drawings:
1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
4. See Specification Section 26 05 19 for combining multiple branch circuits in a common conduit.

E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.

F. Install equipment plumb, square and true with construction features and securely fastened.

G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.

H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operation and maintenance requirements of other equipment.

I. Device Mounting Schedule:
1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
   a. Light switch (to center): 48 IN.
   b. Receptacle in architecturally finished areas (to center): 18 IN.
   c. Receptacle on exterior wall of building (to center): 18 IN.
   d. Receptacle in non-architecturally finished areas (to center): 48 IN.
   e. Telephone outlet in architecturally finished areas (to center): 18 IN.
   f. Telephone outlet for wall-mounted phone (to center): 54 IN.
   g. Safety switch (to center of operating handle): 54 IN.

h. Separately mounted motor starter (to center of operating handle): 54 IN.
i. Pushbutton or selector switch control station (to center): 48 IN.
j. Panelboard (to top): 72 IN.

J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.
1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments of up to 12 IN in equipment location without approval.
2. Changes in equipment location exceeding those defined above require approval.

K. Provide electrical equipment support system per the following area designations:
1. Dry areas:
a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
2. Wet, outdoor and corrosive areas:
a. Stainless steel system consisting of stainless steel channels and fittings, nuts and hardware.

L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
1. See Specification Section 05 50 00.
2. Do not cut, or weld to, building structural members.
3. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

M. Provide corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Reservoirs, etc.

N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.

O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.

P. Do not use materials that may cause the walls or roof of a building to discolor or rust.

Q. Identify electrical equipment and components in accordance with Specification Section 10 14 00.

R. Install PG&E service equipment in accordance with the Drawings and PG&E requirements.
1. Coordinate with PG&E for required service shutdowns and reenergization.

3.2 FIELD QUALITY CONTROL

A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.
1. See Specification Section 01 73 20 for openings and penetrations in structures.

B. Replace equipment and systems found inoperative or defective and re-test.

C. Cleaning:
1. See Specification Section 01 74 13.

D. The protective coating integrity of support structures and equipment enclosures shall be maintained.
1. Repair galvanized components utilizing a zinc rich paint.
2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
3. Repair surfaces which will be inaccessible after installation prior to installation.

4. See Specification Section 26 05 33 for requirements for conduits and associated accessories.

E. Replace nameplates damaged during installation.

3.3 DEMONSTRATION

A. Demonstrate equipment in accordance with Specification Section 01 75 00.

END OF SECTION

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SECTION 26 05 19
WIRE AND CABLE: 600 VOLT AND BELOW

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Building wire.
      b. Power cable.
      c. Control cable.
      d. Instrumentation cable.
      e. Wire connectors.
      f. Insulating tape.
      g. Pulling lubricant.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Insulated Cable Engineers Association (ICEA):
      a. S-58-679, Standard for Control Cable Conductor Identification.
   2. National Electrical Manufacturers Association (NEMA):
      a. ICS 4, Industrial Control and Systems: Terminal Blocks.
   3. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
      a. WC 57/S-73-532, Standard for Control Cables.
      b. WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
      b. 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
   5. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
      a. 568, Commercial Building Telecommunications Cabling Standard.
   6. Underwriters Laboratories, Inc. (UL):
      a. 44, Standard for Safety Thermoset-Insulated Wires and Cables.
      b. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
      c. 467, Standard for Safety Grounding and Bonding Equipment.
      d. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
      e. 486C, Standard for Safety Splicing Wire Connections.
      f. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
      g. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
      h. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
      i. 2250, Standard for Safety Instrumentation Tray Cable.

1.3 DEFINITIONS

A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

B. Instrumentation Cable:
   1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.

2. The following are specific types of instrumentation cables:
    a. Analog signal cable:
        1) Used for the transmission of low current (e.g., 4-20mA DC) or low voltage (e.g., 0-10 Vdc) signals, using No. 16 AWG and smaller conductors.
        2) Commonly used types are defined in the following:
            a) TSP: Twisted shielded pair.
            b) TST: Twisted shielded triad.
    b. Digital signal cable: Used for the transmission of digital signals between computers, PLC's, RTU's, etc.

C. Power Cable: Multi-conductor, insulated, with outer sheath containing building wire, No. 8 AWG and larger.

D. Control Cable: Multi-conductor, insulated, with outer sheath containing building wires, No. 14, No. 12 or No. 10 AWG.

E. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data:
    a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
        1) Wire connectors.
        2) Insulating tape.
        3) Cable lubricant.
    b. See Specification Section 26 05 00 for additional requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Building wire, power and control cable:
    a. Aetna Insulated Wire.
    b. Alphawire.
    c. Cerrowire.
    d. Encore Wire Corporation.
    e. General Cable.
    f. Okonite Company.
    g. Southwire Company.
    h. Or approved equal.
2. Instrumentation cable:
    a. Analog cable:
        1) Alphawire.
        2) Belden Inc.
        3) General Cable.
        4) Or approved equal.
3. Wire connectors:
    a. Burndy Corporation.
    b. Buchanan.

c. Ideal.
d. Ilsco.
e. 3M Co.
f. Teledyne Penn Union.
g. Thomas and Betts.
h. Phoenix Contact.
i. Or approved equal.

4. Insulating and color coding tape:
   a. 3M Co.
   b. Plymouth Bishop Tapes.
   c. Red Seal Electric Co.
   d. Or approved equal.

2.2 MANUFACTURED UNITS

A. Building Wire:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.
   3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
   4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and THHN/THWN-2 insulation.
   5. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.

B. Power Cable:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
   3. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
   4. Number of conductors as required, including a bare ground conductor.
   5. Individual conductor color coding:
      a. ICEA S-58-679, Method 4.
      b. See PART 3 of this Specification Section for additional requirements.
   6. Conform to NFPA 70 Type TC.

C. Control Cable:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
   3. Conform to NEMA/ICEA WC 57/S-73-532 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
   4. Number of conductors as required, provided with or without bare ground conductor of the same AWG size.
      a. When a bare ground conductor is not provided, an additional insulated conductor shall be provided and used as the ground conductor (e.g., 6/c No. 14 w/g and 7/c No. 14 are equal).
   5. Individual conductor color coding:
      a. ICEA S-58-679, Method 1, Table E-2.
      b. See PART 3 of this Specification Section for additional requirements.
   6. Conform to NFPA 70 Type TC.

D. Electrical Equipment Control Wire:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Conductors shall be stranded.
   3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.

4. Conform to UL 44 for Type SIS insulation.
5. Conform to UL 83 for Type MTW insulation.

E. Instrumentation Cable:
1. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
2. Analog cable:
   a. Tinned copper conductors, No. 16 AWG minimum.
   b. 600 V PVC insulation with PVC jacket.
   c. Twisted with 100 percent foil shield coverage with drain wire.
   d. Six (6) twists per foot minimum.
   e. Individual conductor color coding: ICEA S-58-679, Method 1, Table E-2.
   f. Conform to UL 2250, UL 1581 and NFPA 70 Type ITC.
3. Digital cable:
   a. As recommended by equipment manufacturer.
   b. Horizontal voice and data cable:
      1) Category 6 per TIA/EIA/ANSI 568.
      2) Cable shall be label-verified.
      3) Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.
      4) Conductors: No. 24 AWG solid untinned copper.
      5) Rated CMP per NFPA 70.
   c. Conform to NFPA 262 and NFPA 70 Type ITC.

F. Wire Connectors:
1. Twist/screw on type:
   a. Insulated pressure or spring type solderless connector.
   b. 600 V rated.
   c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
   d. Phase and neutral conductors: Conform to UL 486C.
2. Compression and mechanical screw type:
   a. 600 V rated.
   b. Ground conductors: Conform to UL 467.
   c. Phase and neutral conductors: Conform to UL 486A.
3. Terminal block type:
   a. High density, screw-post barrier-type with white center marker strip.
   b. 600 V and ampere rating as required, for power circuits.
   c. 600 V, 20 ampere rated for control circuits.
   d. 300 V, 15 ampere rated for instrumentation circuits.
   e. Conform to NEMA ICS 4 and UL 486A.

G. Insulating and Color Coding Tape:
1. Pressure sensitive vinyl.
2. Premium grade.
3. Heat, cold, moisture, and sunlight resistant.
4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.
5. For cold weather or outdoor location, tape must also be all-weather.
6. Color:
   a. Insulating tape: Black.
   b. Color coding tape: Fade-resistant color as specified herein.
7. Comply with UL 510.

H. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Permitted Usage of Insulation Types:
   1. Type XHHW-2 and Type THHN/THWN and THHN/THWN-2
      a. Building wire and power and control cable in architectural and non-architectural finished areas.
      b. Building wire and power and control cable in conduit below grade.
   2. Type SIS and MTW:
      a. For the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers.

B. Conductor Size Limitations:
   1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
   2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.
   3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated.

C. Color Code All Wiring as Follows:
   1. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red	Orange
Phase 3	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

      a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
      b. Conductors larger than No. 6 AWG:
         1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
            a) Continuous colored outer finish along its entire length.
            b) 3 IN of colored tape applied at the termination.
         2) Insulated grounding conductor shall be identified by one (1) of the following methods:
            a) Continuous green outer finish along its entire length.
            b) Stripping the insulation from the entire exposed length.
            c) Using green tape to cover the entire exposed length.
         3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.
   2. Power cables ICEA S-58-679, Method 4 with:
      a. Phase and neutral conductors identified with 3 IN of colored tape, per the Table herein, applied at the terminations.
      b. Ground conductor: Bare.
   3. Control cables ICEA S-58-679, Method 1, Table E-2:
      a. When a bare ground is not provided, one (1) of the colored insulated conductors shall be re-identified by stripping the insulation from the entire exposed length or using green tape to cover the entire exposed length.
      b. When used in power applications the colored insulated conductors used as phase and neutral conductors may have to be re-identified with 3 IN of colored tape, per the Table herein, applied at the terminations.

D. Install all wiring in raceway unless otherwise indicated on the Drawings.

E. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
   1. Where specifically indicated on the Drawings.
   2. Where field conditions dictate and written permission is obtained from the Engineer.
   3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
      a. The combinations shall comply with the following:
         1) 12 Vdc, 24 Vdc and 48 Vdc may be combined.
         2) 125 Vdc shall be isolated from all other AC and DC circuits.
         3) AC control circuits shall be isolated from all DC circuits.
   4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.
      a. The combinations shall comply with the following:
         1) Analog signal circuits may be combined.
         2) Digital signal circuits may be combined but isolated from analog signal circuits.
   5. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway.
      a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NFPA 70, including but not limited to:
         1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
         2) The neutral conductor may be shared on sequential circuits (e.g., circuit numbers 1,3,5) if multiple circuit breakers are provided.
         3) Size raceway for the size and quantity of conductors.

F. Ground the drain wire of shielded instrumentation cables at one (1) end only.
   1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).

G. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
   1. Feeder and branch power circuits:
      a. Device outlet boxes:
         1) Twist/screw on type connectors.
      b. Junction and pull boxes and wireways:
         1) Twist/screw on type connectors for use on No. 8 and smaller wire.
         2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
      c. Motor terminal boxes:
         1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
         2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.
      d. Manholes or handholes:
         1) Twist/screw on type connectors pre-filled with epoxy for use on No. 8 AWG and smaller wire.
         2) Watertight compression or mechanical screw type connectors for use on No. 6 AWG and larger wire.
   2. Control circuits:
      a. Junction and pull boxes: Terminal block type connector.
      b. Manholes or handholes: Twist/screw on type connectors pre-filled with epoxy.
      c. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.
   3. Instrumentation circuits can be spliced where field conditions dictate and written permission is obtained.

a. Maintain electrical continuity of the shield when splicing twisted shielded conductors.
b. Junction and pull boxes: Terminal block type connector.
c. Control panels and motor control centers: Terminal block or strip provided within the equipment or field installed within the equipment by the Contractor.

4. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.

H. Insulating Tape Usage:
1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.

I. Color Coding Tape Usage: For color coding of conductors.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing:
1. See Specification Section 26 08 13.

END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for grounding and bonding system(s).

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
   3. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   4. Underwriters Laboratories, Inc. (UL):
      a. 467, Grounding and Bonding Equipment.

B. Assure ground continuity is continuous throughout the entire Project.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
         1) Grounding clamps, terminals and connectors.
         2) Exothermic welding system.
      b. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Ground rods and bars and grounding clamps, connectors and terminals:
      a. Erico Products, Inc.
      b. Harger Lightning & Grounding.
      c. Heary Brothers.
      d. Hubbell - Burndy.
      e. Robbins Lightning Protection.
      f. Thomas & Betts - Blackburn.
      g. Thompson Lightning Protection.
      h. Or approved equal.
   2. Exothermic weld connections:
      a. Erico Products Inc., Cadweld.
      b. Harger Lightning & Grounding - Ultraweld.
      c. Hubbell - Burndy (Thermoweld).

d. Thomas & Betts - Furseweld.
e. Or approved equal.

2.2 COMPONENTS

A. Wire and Cable:
1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
2. Insulated conductors: Color coded green, per Specification Section 26 05 19.

B. Conduit: As specified in Specification Section 26 05 33.

C. Ground Bars:
1. Solid copper:
a. 1/4 IN thick.
b. 2 or 4 IN wide.
c. 24 IN long minimum in main service entrance electrical rooms, 12 IN long elsewhere.
2. Predrilled grounding lug mounting holes.
3. Stainless steel or galvanized steel mounting brackets.
4. Insulated standoffs.

D. Ground Rods:
1. 3/4 IN x 10 FT.
2. Copper-clad:
a. 10 mil minimum uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
b. Corrosion resistant bond between the copper and steel.
c. Hard drawn for a scar-resistant surface.

E. Grounding Clamps, Connectors and Terminals:
1. Mechanical type:
a. Standards: UL 467.
b. High copper alloy content.
2. Compression type for interior locations:
a. Standards: UL 467.
b. High copper alloy content.
c. Non-reversible.
d. Terminals for connection to bus bars shall have two bolt holes.
3. Compression type suitable for direct burial in earth or concrete:
a. Standards: UL 467, IEEE 837.
b. High copper alloy content.
c. Non-reversible.
d. Factory filled with oxide inhibiting compound.

F. Exothermic Weld Connections:
1. Copper oxide reduction by aluminum process.
2. Molds properly sized for each application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install products in accordance with manufacturer's instructions.
2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250, except where larger sizes are indicated on the Drawings.
3. Remove paint, rust, or other non-conducting material from contact surfaces before making ground connections.
4. Where ground conductors pass through floor slabs or building walls provide nonmetallic sleeves and install per Specification Section 01 73 20.

5. Do not splice grounding conductors except at ground rods.
6. Install ground rods and grounding conductors in undisturbed, firm soil.
    a. Provide excavation required for installation of ground rods and ground conductors.
    b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
    c. Unless otherwise specified, connect conductors to ground rods with compressor type connectors or exothermic weld.
    d. Provide sufficient slack in grounding conductor to prevent conductor breakage during backfill or due to ground movement.
    e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
7. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.

B. Grounding Electrode System:
1. Provide a grounding electrode system in accordance with NFPA 70, Article 250 and as indicated on the Drawings.
2. Grounding conductor terminations:
    a. Ground bars mounted on wall, use compression type terminal and bolt it to the ground bar with two bolts.
    b. Ground bars in electrical equipment, use compression type terminal and bolt it to the ground bar.
    c. Piping systems use mechanical type connections.
    d. Building steel, below grade and encased in concrete, use compression type connector or exothermic weld.
    e. At all above grade terminations, the conductors shall be labeled per Specification Section 10 14 00.

C. Supplemental Grounding Electrode:
1. Provide the following grounding in addition to the equipment ground conductor supplied with the feeder conductors whether or not shown on the Drawings.
2. Metal light poles:
    a. Connect metal pole to a butt ground.
    b. Grounding conductor: Bare #6 AWG minimum.
3. Equipment support rack and pedestals mounted outdoors:
    a. Connect metallic structure to a ground rod.
    b. Grounding conductor: #6 AWG minimum.

D. Low Voltage Transformer Separately Derived Grounding System:
1. Ground separately mounted step-down transformers XO terminal to one of the following:
    a. Closest grounded building steel using mechanical type terminal bolted to the steel, compression type connection or exothermic weld.
    b. Closest grounded water pipe using a mechanical type connection.
2. Ground step-down transformer integrally mounted in motor control center or fed from a motor control center to motor control center ground bus.

E. Raceway Bonding/Grounding:
1. All metallic conduit shall be installed so that it is electrically continuous.
2. All conduits to contain a grounding conductor with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
3. NFPA 70 required grounding bushings shall be of the insulating type.
4. Provide double locknuts at all panels.
5. Bond all conduit, at entrance and exit of equipment, to the equipment ground bus or lug.
6. Provide bonding jumpers if conduits are installed in concentric knockouts.
7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.

F. Equipment Grounding:
   1. All utilization equipment shall be grounded with an equipment ground conductor.

G. Handhole Grounding:
   1. Provide a ground rod and ground bar, when indicated or as needed, in each handhole with exposed metal parts.
      a. Expose a minimum of 4 IN of the rod above the floor for field connections to the rod.
   2. Connect all exposed metal parts (e.g., metallic conduits and cable racks) to the ground rod.

3.2 FIELD QUALITY CONTROL

A. Leave grounding system uncovered until observed by Owner.

B. Acceptance testing:
   1. See Specification Section 26 08 13.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Conduits.
      b. Conduit fittings.
      c. Conduit supports.
      d. Wireways.
      e. Outlet boxes.
      f. Pull and junction boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Iron and Steel Institute (AISI).
   2. ASTM International (ASTM):
      a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      c. D2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit (IMC).
      c. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
      d. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
      e. TC 14-2002, Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
   4. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
      a. C80.1, Electric Rigid Steel Conduit (ERSC).
      b. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   6. Underwriters Laboratories, Inc. (UL):
      a. 1, Standard for Flexible Metal Conduit.
      b. 6, Standard for Electrical Rigid Metal Conduit - Steel.
      c. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
      d. 360, Standard for Liquid-Tight Flexible Steel Conduit.
      e. 467, Grounding and Bonding Equipment.
      f. 514A, Metallic Outlet Boxes.
      g. 514B, Conduit, Tubing, and Cable Fittings.
      h. 651, Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
      i. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
      j. 1684, Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

2. Product technical data:
    a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
        1) Conduit fittings.
        2) Support systems.
    b. See Specification Section 26 05 00 for additional requirements.
3. Fabrication and/or layout drawings:
    a. Identify dimensional size of pull and junction boxes to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Rigid metallic conduits:
    a. Allied Tube and Conduit Corporation.
    b. Triangle PWC Inc.
    c. Western Tube and Conduit Corporation.
    d. Wheatland Tube Company.
    e. Cooper Industries.
    f. Calbrite.
    g. Gibson.
    h. Or approved equal
2. PVC coated rigid metal conduit:
    a. Ocal® by Thomas & Betts.
    b. Robroy Industries.
    c. Or approved equal.
3. Fiberglass conduit:
    a. Champion fiberglass, Inc.
    b. United Fiberglass of America.
    c. Or approved equal.
4. Rigid stainless steel conduit:
    a. Calbrite.
    b. Gibson.
    c. Or approved equal.
5. Rigid nonmetallic conduit:
    a. Prime Conduit (Carlon).
    b. Cantex.
    c. Osburn Associates.
    d. Or approved equal.
6. Flexible conduit:
    a. Thomas & Betts.
    b. Delikon.
    c. Electri-Flex.
    d. Calbrite.
    e. Gibson.
    f. Triangle PWC Inc.
    g. Or approved equal.
7. Wireway:
    a. Hoffman Engineering Company.
    b. Wiegmann.
    c. Square D.

d. Or approved equal.

8. Conduit fittings and accessories:
   a. Appleton Electric Co.
   b. Carlon.
   c. Cantex.
   d. Crouse-Hinds.
   e. Killark.
   f. Osburn Associates.
   g. OZ Gedney Company.
   h. RACO.
   i. Steel City.
   j. Thomas & Betts.
   k. Or approved equal.
9. Support systems:
   a. Unistrut Building Systems.
   b. Eaton B-Line.
   c. Kindorf.
   d. Minerallac Fastening Systems.
   e. Caddy.
   f. Thomas & Betts Superstrut.
   g. Or approved equal.
10. Outlet, pull and junction boxes:
    a. Appleton Electric Co.
    b. Eaton Crouse-Hinds.
    c. Killark.
    d. O-Z/Gedney.
    e. Thomas & Betts Steel City.
    f. Raco.
    g. Bell.
    h. Hoffman Engineering Co.
    i. Wiegmann.
    j. Eaton B-Line.
    k. Adalet.
    l. Rittal.
    m. Or approved equal.
11. Fiberglass junction boxes:
    a. Stahlin only.

B. Rigid Stainless Steel Conduit:
   1. Stainless steel with continuous welded seam, 304 or 316.
   2. Polished after fabrication.
   3. Standards: NFPA 70, UL 6.

2.2 RIGID METALLIC CONDUITS

A. Rigid Galvanized Steel Conduit (RGS):
   1. Mild steel with continuous welded seam.
   2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
   3. Threads galvanized after cutting.
   4. Internal coating: Baked lacquer, varnish or enamel for a smooth surface.
   5. Standards: NEMA/ANSI C80.1, UL 6.

B. PVC-Coated Rigid Stee Conduit (PVC-RGS):
   1. Nominal 40 MIL Polyvinyl Chloride Exterior Coating:
      a. Coating: Bonded to hot-dipped galvanized rigid steel conduit conforming to NEMA/ANSI C80.1.
      b. The bond between the PVC coating an the conduit surface: Greater than the tensile strength of the coating.

2. Nominal 2 mil, minimum, urethate interior coating.
3. Urethane coating on threads.
4. Conduit: Epoxy prime coated prior to application of PVC and urethane coatings.
5. Feamale Ends:
    a. Have a plastic sleeve extending a minimum of one pipe diameter or 2 IN, whichever is less beyond the opening.
    b. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.
6. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.1, UL 6, NEMA RN 1.

2.3 RIGID NONMETALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80):
    1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
    2. Rated for direct sunlight exposure.
    3. Fire retardant and low smoke emission.
    4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 DegC".
    5. Standards: NEMA TC 2, UL 651.

B. Fiberglass:
    1. Epoxy based resin system using an anhydride curing agent.
    2. Continuous E-glass roving.
    3. Winding angle approximately 54.75 DEG.
    4. Smooth internal walls with all fibers imbedded in the epoxy.
    5. Above grade rated: Halogen free additive for flame spread and smoke control.
    6. Ultraviolet inhibitor: Carbon black.
    7. Two (2) step curing process.
    8. Tensile strength: 11,000 PSI per ASTM D2105.
    9. Dimensions: Iron Pipe Size (IPS).
    10. Wall thickness:
        a. Standard: 3/4 IN to 4 IN nominal size.
        b. Medium: 5 IN to 6 IN nominal size.
        c. Extra heavy for "bullet proof" and Class 1, Division 2 areas: 3/4 IN to 6 IN nominal size.
    11. Integral bell and spigot.
    12. Conduits and fittings to be joined with an interference joint and epoxy adhesive creating a concrete and water tight connection.
    13. Standard: NFPA 70 type RTRC, NEMA TC14.AG, NEMA TC14.BG, UL 2420, UL 2415.

2.4 FLEXIBLE CONDUIT

A. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
    1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
    2. Extruded PVC outer jacket positively locked to the steel core.
    3. Liquid and vaportight.
    4. Standard: UL 360.

2.5 WIREWAY

A. General:
    1. Suitable for lay-in conductors.
    2. Designed for continuous grounding.
    3. Covers:
        a. Hinged or removable in accessible areas.
        b. Non-removable when passing through partitions.
    4. Finish: Rust inhibiting primer and manufacturers standard paint inside and out except for stainless steel type.

5. Standards: UL 870, NEMA 250.

B. Watertight (NEMA 4X rated) Wireway:
   1. 14 GA Type 304 or 316 stainless steel bodies and covers without knockouts and 10 GA stainless steel flanges.
   2. Cover: Fully gasketed and held in place with captive clamp type latches.
   3. Flanges: Fully gasketed and bolted.

C. Dusttight (NEMA 12 rated) Wireway:
   1. 14 GA steel bodies and covers without knockouts and 10 GA steel flanges.
   2. Cover: Fully gasketed and held in place with captive clamp type latches.
   3. Flanges: Fully gasketed and bolted.

2.6 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with RGS:
   1. General:
   2. Locknuts:
      a. Threaded steel or malleable iron.
      b. Gasketed or non-gasketed.
      c. Grounding or non-grounding type.
   3. Bushings:
      a. Threaded, insulated metallic.
      b. Grounding or non-grounding type.
   4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
   5. Couplings:
      a. Threaded straight type: Same material and finish as the conduit with which they are used on.
      b. Threadless type: Gland compression or self-threading type, concrete tight.
   6. Unions: Threaded galvanized steel or zinc plated malleable iron.
   7. Conduit bodies (ells and tees):
      a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
      b. Standard and mogul size.
      c. Cover:
         1) Clip-on type with stainless steel screws.
         2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free aluminum.
   8. Conduit bodies (round):
      a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
      b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron or cast copper free aluminum.
   9. Sealing fittings:
      a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
      b. Standard and mogul size.
      c. With or without drain and breather.
      d. Fiber and sealing compound: UL listed for use with the sealing fitting.
   10. Service entrance head:
      a. Malleable iron, galvanized steel or copper free aluminum.
      b. Insulated knockout cover for use with a variety of sizes and number of conductors.
   11. Expansion couplings:
      a. 2 IN nominal straight-line conduit movement in either direction.
      b. Galvanized steel with insulated bushing.
      c. Gasketed for wet locations.
      d. Internally or externally grounded.
   12. Expansion/deflection couplings:
      a. 3/4 IN nominal straight-line conduit movement in either direction.
      b. 30-degree nominal deflection from the normal in all directions.
      c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.

d. Internally or externally grounded.
e. Watertight, raintight and concrete tight.

13. Standards: UL 467, UL 514B, UL 886.

B. Fittings for use with rigid stainless steel conduit.
1. Same as for RGS except 304 or 316 stainless steel.

C. Fittings for use with PVC-RGS:
1. The same material and construction as these fittings listed under paragraph “Fittings for use with RGS:” and coated as defined under paragraph “PVC Coated Rigid Steel Conduit (PVC-RGS):”.

D. Fittings for Use with FLEX-LT:
1. Connector:
a. Straight or angle type.
b. Metal construction, insulated and gasketed.
c. Composed of locknut, grounding ferrule and gland compression nut.
d. Liquid tight.
2. Standards: UL 467, UL 514B.
3. 304 or 316 stainless steel for use with stainless steel conduit systems.

E. Fittings for Use with Rigid Nonmetallic PVC Conduit:
1. Coupling, adapters and conduit bodies:
a. Same material, thickness, and construction as the conduits with which they are used.
b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.

F. Weather and Corrosion Protection Tape:
1. PVC based tape, 10 mils thick.
2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
3. Used with appropriate pipe primer.

2.7 ALL RACEWAY AND FITTINGS

A. Mark Products:
1. Identify the nominal trade size on the product.
2. Stamp with the name or trademark of the manufacturer.

2.8 OUTLET BOXES

A. Metallic Outlet Boxes:
1. Hot-dip galvanized steel.
2. Conduit knockouts and grounding pigtail.
3. Styles:
a. 2 IN x 3 IN rectangle.
b. 4 IN square.
c. 4 IN octagon.
d. Masonry/tile.
4. Accessories:
a. Flat blank cover plates.
b. Barriers.
c. Extension, plaster or tile rings.
d. Box supporting brackets in stud walls.
e. Adjustable bar hangers.
5. Standards: NEMA/ANSI OS 1, UL 514A.

B. Cast Outlet Boxes:
   1. Zinc plated cast iron or die-cast copper free aluminum with manufacturers standard finish.
   2. Threaded hubs and grounding screw.
   3. Styles:
      a. "FS" or "FD".
      b. "Bell".
      c. Single or multiple gang and tandem.
      d. "EDS" or "EFS" for hazardous locations.
   4. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.
   5. Standards: UL 514A, UL 886.
   6. 304 or 316 stainless steel for use with stainless steel conduit systems.

C. See Specification Section 26 27 26 for wiring devices, wallplates and coverplates.

2.9 PULL AND JUNCTION BOXES

A. NEMA 4X Rated (metallic):
   1. Body and cover: 14 GA Type 304 or 316 stainless steel.
   2. Seams continuously welded and ground smooth.
   3. No knockouts.
   4. External mounting flanges.
   5. Hinged door and stainless steel screws and clamps.
   6. Door with oil-resistant gasket.

B. NEMA 12 Rated:
   1. Body and cover:
      a. 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
      b. Type 5052 H-32 aluminum, unpainted.
   2. Seams continuously welded and ground smooth.
   3. No knockouts.
   4. External mounting flanges.
   5. Non-hinged cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
   6. Flat door with oil resistant gasket.

C. Miscellaneous Accessories:
   1. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
   2. Split covers when heavier than 25 LBS.
   3. Weldnuts for mounting optional panels and terminal kits.
   4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.

D. Standards: NEMA 250, UL 50.

2.10 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
   1. Material requirements.
      a. Galvanized steel: ASTM A123/A123M or ASTM A153/A153M.
      b. Stainless steel: AISI Type 316 or 304.

B. Single Conduit and Outlet Box Support Fasteners:
   1. Material requirements:
      a. Zinc plated steel.
      b. Stainless steel.

2.11 OPENINGS AND PENETRATIONS IN WALLS AND FLOORS

A. Sleeves, smoke and fire stop fitting through walls and floors:
   1. See Specification Section 01 73 20.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

A. Shall be in accordance with the requirements of:
   1. NFPA 70.
   2. Manufacturer instructions.

B. Size of Raceways:
   1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
   2. Unless specifically indicated otherwise, the minimum raceway size shall be:
      a. Conduit: 3/4 IN.
      b. Wireway: 2-1/2 IN x 2-1/2 IN.

C. Field Bending and Cutting of Conduits:
   1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
   2. Do not reduce the internal diameter of the conduit when making conduit bends.
   3. Degrease threads after threading and apply a zinc rich paint.
   4. Debur interior and exterior after cutting.

D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.

E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.

F. Remove moisture and debris from conduit before wire is pulled into place.
   1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the conduit, to remove obstructions.
   2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
   3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

I. Fill openings in walls, floors, and ceilings and finish flush with surface.
   1. See Specification Section 01 73 20.

3.2 RACEWAY ROUTING

A. Raceways shall be routed in the field unless otherwise indicated.
   1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
   2. Run in straight lines parallel to or at right angles to building lines.
   3. Do not route conduits:
      a. Through areas of high ambient temperature or radiant heat.
      b. In suspended concrete slabs.
   4. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
   5. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.

B. All rigid conduits within a structure shall be installed exposed except as follows:
   1. As indicated on the Drawings.
   2. Concealed above gypsum wall board or acoustical tile suspended ceilings.
   3. Concealed within stud frame, poured concrete, concrete block and brick walls of an architecturally finished area.
   4. May be embedded in floor slabs or buried under floor.

C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 FT:
   1. Between instrumentation and telecommunication: 1 IN.
   2. Between instrumentation and 125 V, 48 V and 24 Vdc, 2 IN.
   3. Between instrumentation and 600 V and less AC power or control: 6 IN.
   4. Between instrumentation and greater than 600 Vac power: 12 IN.
   5. Between telecommunication and 125 V, 48 V and 24 Vdc, 2 IN.
   6. Between telecommunication and 600 V and less AC power or control: 6 IN.
   7. Between telecommunication and greater than 600 Vac power: 12 IN.
   8. Between 125 V, 48 V and 24 Vdc and 600 V and less AC power or control: 2 IN.
   9. Between 125 V, 48 V and 24 Vdc and greater than 600 Vac power: 2 IN.
   10. Between 600 V and less AC and greater than 600 Vac: 2 IN.
   11. Between process, gas, air and water pipes: 6 IN.

D. Conduits shall be installed to eliminate moisture pockets.
   1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.

F. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.

G. Provide all required openings in walls, floors, and ceilings for conduit penetration.
   1. See Specification Section 01 73 20.

3.3 RACEWAY APPLICATIONS

A. Permitted Raceway Types Per Wire or Cable Types:
   1. Power wire or cables: All raceway types.
   2. Control wire or cables: All raceway types.
   3. Instrumentation cables: Metallic raceway except nonmetallic may be used underground.
   4. Motor leads from a VFD: Metallic exposed and non-metalic underground.
   5. Telecommunication cables: All raceway types.

B. Permitted Raceway Types Per Area Designations:
   1. Dry areas:
      a. RGS.
   2. Wet areas, outdoors and corrosive areas:
      a. Fiberglass.
      b. Stainless steel.
      c. PVC-GRS.

C. Permitted Raceway Types Per Routing Locations:
   1. Embedded in poured concrete walls and floors and beneath floor slab-on-grade:
      a. PVC-40.
      b. Fiberglass, stainless steel, or PVC-GRS when emerging from concrete floor and for at least 6 IN above concrete.
   2. Concrete encased ductbanks:
      a. PVC-40.
      b. 90 degree elbows for transitions to above grade and for 6 IN above grade:

1) Fiberglass.
2) Stainless steel.

c. PVC-GRS.

D. PVC coated flexible conduits shall be install as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.
1. The maximum length shall not exceed:
a. 6 FT to light fixtures.
b. 3 FT to motors.
c. 2 FT to all other equipment.

E. NEMA 4X Rated Wireway:
1. Surface mounted in areas designated as wet, outdoor and or corrosive.

F. NEMA 12 Rated Wireway:
1. Surface mounted in areas designated as dry in architecturally and non-architecturally finished areas.

G. Underground Conduit: See Specification Section 26 05 43.

3.4 CONDUIT FITTINGS AND ACCESSORIES

A. Conduit Seals:
1. Where called out.
2. Filler plug and drain shall be accessible.
3. Pour the conduit seals in a two-step process.
a. Pour the seal and leave cover off.
b. After seal is dry, inspect for proper sealng, install cover and mark (for example, paint or permanent marker) as complete.

B. Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.
1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.

C. Install Expansion Fittings:
1. Where conduits are exposed to the sun and conduit run is greater than 200 FT.
2. Elsewhere as identified on the Drawings.

D. Install Expansion/Deflection Fittings:
1. Where conduits enter a structure.
a. Except electrical manholes and handholes.
b. Except where the ductbank is tied to the structure with rebar.
2. Where conduits span structural expansions joints.
3. Elsewhere as identified on the Drawings.

E. Threaded connections shall be made wrench-tight.

F. Conduit joints shall be watertight:
1. Where subjected to possible submersion.
2. In areas classified as wet.
3. Underground.

G. Terminate Conduits:
1. In metallic outlet boxes:
a. Rigid conduits:
1) Conduit hub and locknut.
2) Insulated bushing and two (2) locknuts.
3) Use grounding type locknut or bushing when required by NFPA 70.
2. In NEMA 1 rated enclosures:
a. RGS:

1) Conduit hub and locknut.
2) Insulated bushing and two (2) locknuts.
3) Use grounding type locknut or bushing when required by NFPA 70.

3. In NEMA 12 rated enclosures:
   a. Watertight, insulated and gasketed hub and locknut.
   b. Use grounding type locknut or bushing when required by NFPA 70.
4. In NEMA 4 and NEMA 4X rated enclosures:
   a. Watertight, insulated and gasketed hub and locknut.
5. When stubbed up through the floor into floor mount equipment:
   a. With an insulated grounding bushing on metallic conduits.
   b. With end bells on nonmetallic conduits.

H. Threadless couplings shall only be used to join new conduit to existing conduit when the existing conduit end is not threaded and it is not practical or possible to cut threads on the existing conduit with a pipe threader.

3.5 CONDUIT SUPPORT

A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
   1. Dry areas:
      a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit clamps.
   2. Wet, outdoor and corrosive areas:
      a. Stainless steel system consisting of: Stainless steel channels, fittings and conduit clamps with stainless steel nuts and hardware.
   3. Conduit type shall be compatible with the support system material.
      a. Galvanized steel system may be used with RGS.
      b. Stainless steel system may be used with RGS, stainless steel, fiberglass and PVC-GRS.

B. Permitted single conduit support fasteners per area designations and conduit types:
   1. Architecturally finished areas:
      a. Material: Zinc plated steel, or steel protected with zinc phosphate and oil finish.
      b. Types of fasteners: Spring type hangers and clips, straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
      c. Provide anti-rattle conduit supports when conduits are routed through metal studs.
   2. Dry areas:
      a. Material: Zinc plated steel, stainless steel and malleable iron.
      b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
   3. Wet, outdoor and corrosive areas:
      a. Stainless steel.
      b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
   4. Conduit type shall be compatible with the support fastener material.
      a. Zinc plated steel, steel protected with zinc phosphate and oil finish and malleable iron fasteners may be used with RGS.
      b. Stainless steel system may be used with RGS, stainless steel, fiberglass and PVC-GRS.

C. Conduit Support General Requirements:
   1. Maximum spacing between conduit supports per NFPA 70.
   2. Support conduit from the building structure.
   3. Do not support conduit from process, gas, air or water piping; or from other conduits.
   4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 LBS.
      a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.

b. Conduit hangers:
1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
c. Do not use suspended ceiling support systems to support raceways.
d. Hangers in metal roof decks:
1) Utilize fender washers.
2) Not extend above top of ribs.
3) Not interfere with vapor barrier, insulation, or roofing.
5. Conduit support system fasteners:
a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
b. Do not use concrete nails and powder-driven fasteners.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

A. General:
1. Install products in accordance with manufacturer's instructions.
2. See Specification Section 26 05 00 and the Drawings for area classifications.
3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.

B. Outlet Boxes:
1. Permitted uses of metallic outlet boxes, dry areas only:
a. Housing of wiring devices:
1) Recessed in all stud framed walls and ceilings.
2) Recessed in poured concrete, concrete block and brick walls of architecturally finished areas and exterior building walls.
b. Pull or junction box:
1) Above gypsum wall board or acoustical tile ceilings.
2) Above 10 FT in an architecturally finished area where there is no ceiling.
2. Permitted uses of cast outlet boxes: All areas.
3. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 26 05 00.
4. Set device outlet boxes plumb and vertical to the floor.
5. Outlet boxes recessed in walls:
a. Install with appropriate stud wall support brackets or adjustable bar hangers so that they are flush with the face of the wall.
b. Locate in ungrouted cell of concrete block with bottom edge of box flush with bottom edge of block and flush with the face of the block.
6. Place barriers between switches in boxes with 277 V switches on opposite phases.
7. Back-to-back are not permitted.
8. Outlet box material shall match conduit system material.

C. Pull and Junction Boxes:
1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
a. Make covers of boxes accessible.
2. Permitted uses of NEMA 4X metallic enclosure:
a. Pull or junction box surface mounted in areas designated as wet, outdoor and/or corrosive.
3. Permitted uses of NEMA 12 enclosure:
a. Pull or junction box surface mounted in areas designated as dry.

END OF SECTION

SECTION 26 05 43
ELECTRICAL: EXTERIOR UNDERGROUND

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Handholes.
      b. Underground conduits and ductbanks.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. HB, Standard Specifications for Highway Bridges.
   2. ASTM International (ASTM):
      a. A536, Standard Specification for Ductile Iron Castings.
   3. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   4. Society of Cable Telecommunications Engineers (SCTE):
      a. 77, Specification for Underground Enclosure Integrity.

1.3 DEFINITIONS

A. Concrete encased ductbank: An individual (single) or multiple conduit(s), arranged in one or more planes, encased in a common concrete envelope.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Prefabricated composite handholes:
      a. Quazite Composolite.
      b. Armorcast Products Company.
      c. Synertech.
      d. Or approved equal.
   2. Precast handholes:
      a. Utility Vault Co.
      b. Oldcastle Precast, Inc.
      c. Lister Industries.
      d. Or approved equal.
   3. Handhole and ductbank accessories:
      a. Neenah.
      b. Unistrut.
      c. Condux International, Inc.

d. Underground Devices, Inc.
e. Or approved equal.

2.2 HANDHOLES

A. Prefabricated Composite Material Handholes:
1. Handhole body and cover: Fiberglass reinforced polymer concrete conforming to all test provisions of SCTE 77.
2. Minimum load ratings: SCTE 77 Tier 8.
3. Open bottom.
4. Stackable design as required for specified depth.
5. Cover:
a. Engraved legend of "ELECTRIC" or "COMMUNICATIONS".
b. Non-gasketed bolt down with stainless steel penta head bolts.
c. Lay-in non-bolt down, when cover is over 100 LBS.
d. One or multiple sections so the maximum weight of a section is 125 LBS.
6. Cover lifting hook: 24 IN minimum in length.

B. Precast Handholes:
1. Fiberglass reinforced polymer concrete or steel reinforced cement concrete structures:
2. AASHTO live load rating: H-20 for full deliberate vehicle traffic.
3. Mating edges: Tongue and groove type.
4. Open bottom.
5. Cover extension rings as required.

2.3 UNDERGROUND CONDUIT AND ACCESSORIES

A. Concrete: Comply with Division 03 Specifications, 3,000 psi minimum.

B. Conduit: See Specification Section 26 05 33.

C. Duct Spacers/Supports:
1. High density polyethylene or high impact polystyrene.
2. Interlocking.
3. Provide 2 IN minimum spacing between conduits.
4. Accessories, as required:
a. Hold down bars.
b. Ductbank strapping.

PART 3 - EXECUTION

3.1 GENERAL

A. Drawings indicate the intended location of handholes and routing of ductbanks.
1. Field conditions may affect actual routing.

B. Handhole Locations:
1. Approximately where shown on the Drawings.
2. As required for pulling distances.
3. As required to keep pulling tensions under allowable cable tensions.
4. As required for number of bends in ductbank routing.
5. Shall not be installed in a swale or ditch.
6. Determine the exact locations after careful consideration has been given to the location of other utilities, grading, and paving.
7. Locations are to be approved by the Owner prior to excavation and placement or construction of handholes.

C. Install products in accordance with manufacturer's instructions.

D. Install handholes in conduit runs where indicated or as required to facilitate pulling of wires or making connections.

E. Comply with Specification Section 31 23 33 for trenching, backfilling and compacting.

3.2 HANDHOLES

A. Prefabricated Composite Material Handholes:
   1. For use in areas subjected to occasional non-deliberate vehicular traffic.
   2. Place handhole on a foundation of compacted 1/4 to 1/2 IN crushed rock or gravel a minimum of 8 IN thick and 6 IN larger than handholes footprint on all sides.
   3. Provide concrete encasement ring around handhole per manufacturers installation instructions (minimum of 10 IN wide x 12 IN deep).
   4. Install so that the surrounding grade is 1 IN lower than the top of the handhole.
   5. Size: As indicated on the Drawings or as required for the number and size of conduits.
   6. Provide cable rails and pulling eyes as needed.

B. Precast Handholes:
   1. For use in vehicular and non-vehicular traffic areas.
   2. Construction:
      a. Grout or seal all joints, per manufacturer's instructions.
   3. Place handhole on a foundation of compacted 1/4 to 1/2 IN crushed rock or gravel a minimum of 8 IN thick and 6 IN larger than handhole footprint on all sides.
   4. Install so that the top of cover is 1 IN above finished grade.
      a. Where existing grades are higher than finished grades, install sufficient number of courses of segmented concrete block between top of handhole and manhole to temporarily elevate cover to existing grade level.
   5. After installation is complete, backfill and compact soil around handholes.
   6. Handhole size:
      a. As indicated on the Drawings or as required for the number and size of conduits entering or as indicated on the Drawings.
      b. Minimum floor dimension of 18 IN x 24 IN and minimum depth of 2 FT.

3.3 UNDERGROUND CONDUITS

A. General Installation Requirements:
   1. Ductbank type : Non reinforced concrete encased.
   2. Do not place concrete until conduits have been observed by the Owner.
   3. Ductbanks shall be sloped a minimum of 4 IN per 100 FT or as detailed on the Drawings.
      a. Low points shall be at handholes.
   4. During construction and after conduit installation is complete, plug the ends of all conduits.
   5. Provide conduit supports and spacers.
      a. Place supports and spacers for rigid nonmetallic conduit on maximum centers as indicated for the following trade sizes:
         1) 1 IN and less: 3 FT.
         2) 1-1/4 to 3 IN: 5 FT.
         3) 3-1/2 to 6 IN: 7 FT.
      b. Place supports and spacers for rigid steel conduit on maximum centers as indicated for the following trade sizes:
         1) 1 IN and less: 10 FT.
         2) 1-1/4 to 2-1/2 IN: 14 FT.
         3) 3 IN and larger: 20 FT.
      c. Securely anchor conduits to supports and spacers to prevent movement during placement of concrete or soil.
   6. Stagger conduit joints at intervals of 6 IN vertically.
   7. Make conduit joints watertight and in accordance with manufacturer's recommendations.
   8. Accomplish changes in direction of runs exceeding a total of 15 degrees by long sweep bends having a minimum radius of 25 FT.

a. Sweep bends may be made up of one or more curved or straight sections or combinations thereof.

9. Furnish manufactured bends at end of runs.
    a. Minimum radius of 18 IN for conduits less than 3 IN trade size and 36 IN for conduits 3 IN trade size and larger.
10. Field cuts requiring tapers shall be made with the proper tools and shall match factory tapers.
11. After the conduit run has been completed:
    a. Prove joint integrity and test for out-of-round duct by pulling a test mandrel through each conduit.
        1) Test mandrel:
            a) Length: Not less than 12 IN
            b) Diameter: Approximately 1/4 IN less than the inside diameter of the conduit.
    b. Clean the conduit by pulling a heavy duty wire brush mandrel followed by a rubber duct swab through each conduit.
12. Pneumatic rodding may be used to draw in lead wire.
    a. Install a heavy nylon cord free of kinks and splices in all unused new ducts.
    b. Extend cord 3 FT beyond ends of conduit.
13. Transition from rigid nonmetallic conduit to rigid metallic conduit, per Specification Section 26 05 33, prior to entering a structure or going above ground.
    a. Except rigid nonmetallic conduit may be extended directly to handholes and pad mounted equipment where the conduit is concealed within the enclosure.
    b. Terminate rigid PVC conduits with end bells.
14. Place traceable warning tape in trench directly over ductbanks and 12 IN below grade in accordance with Specification Section 10 14 00.
15. Placement of conduits stubbing into handholes shall be located to allow for proper bending radiuses of the cables.

B. Concrete Encased Ductbank:
1. Ductbank system consists of conduits completely encased in minimum 2 IN of concrete and with separations between different cabling types as required in Specification Section 26 05 33 or as detailed on the Drawings.
2. Install so that top of concrete encased duct, at any point:
    a. Is not less than 24 IN below grade.
    b. Is below pavement sub-grading.
3. All underground duct banks and conduits shall be concrete encased.

END OF SECTION

SECTION 26 05 48
SEISMIC BRACING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The design and installation of seismic bracing and anchorage required for electrical equipment, conduit, cable tray, and bus ducts.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A307, Standard Specification Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
      c. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.3 SYSTEM DESCRIPTION

A. Contractor is responsible for design and installation of seismic bracing and anchorage systems.

B. Description of Systems:
   1. Transverse and longitudinal bracing for seismic forces on suspended electrical systems including conduit, cable tray, bus duct, and equipment.
   2. Anchorage of floor and roof mounted electrical equipment.

C. Seismic Design Requirements:
   1. Seismic design criteria: Provide bracing and anchoring for equipment, conduit, cable tray, bust duct, designed, constructed, and installed to resist stresses produced by lateral forces.

D. Design and install seismic anchorage and bracing for all floor or roof mounted equipment weighing 400 LBS or more and all suspended or wall mounted equipment weighing 20 LBS or more.

E. The following components are exempt from the requirements of this Specification Section:
   1. Electrical components in structures assigned to Seismic Design Category C provided that the importance factor (I_P) is equal to 1.0.
   2. Electrical components in Seismic Design Categories D, E, and F where I_P = 1.0 and flexible connections between the components and associated ductwork, piping, and conduit are provided and that are mounted at 4 FT (1.22 m) or less above a floor level and weigh 400 LBS (1780 N)or less.
   3. Electrical components in Seismic Design Categories D, E, and F weighing 20 LBS (95 N) or less where I_P = 1.0 and flexible connections between the components and conduit are provided, or for distribution systems, weighing 5 LBS/FT (7 N/m) or less.

F. Seismic forces shall be presumed to act through the center of mass of the equipment in a direction that will produce the largest single anchor force.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Seismic control devices.
   3. Fabrication and/or layout drawings:

a. Layout and mounting detail drawings showing system and proposed brace locations for all systems including pre-engineered systems.
b. The specific detail for each type of brace or anchor must be referenced on a plan that identifies the required location.
    1) Supplying a book of details without referencing the proper detail to a specific location on a plan is not acceptable.
c. Structural calculations for required lateral force level for each component.
d. All submittals, including pre-approved systems, shall be signed and sealed by a licensed engineer, licensed in the state in which the project is located.

1.5 PROJECT CONDITIONS

A. Seismic Loads: See structural general drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
    1. Pre-engineered suspended bracing systems:
        a. International Seismic Application Technology (ISAT) “Engineered Seismic Bracing of Suspended Utilities”.
        b. Unistrut.
        c. Tolco.
        d. B-Line.
        e. Or approved equal.
    2. Custom engineered systems designed using specified criteria and common building materials.

2.2 EQUIPMENT ANCHORS AND SUPPORTS

A. Drilled-in-place concrete anchors shall have an approved ICBO Evaluation Services Report.

B. Cast-in-place anchors shall be stainless steel 316L or 304L.

C. Anchors permanently exposed to weather or corrosive environments shall be stainless steel.

D. Structural steel for supports: Stainless steel.

E. Cold formed metal and connection material: Unistrut or approved equal (stainless steel).

F. Any details provided are based on assumed equipment and arrangement.
    1. Contractor shall be responsible for design and acquiring approval for support and anchorage of equipment and arrangement which varies from equipment and arrangement assumed in detail provided.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Every run which requires bracing shall have a minimum of two (2) transverse braces and one (1) longitudinal brace.
    1. A "run" is defined as suspended pipe, conduit, cable tray, bus ductor trapeze rack having a minimum 5 FT straight run length.

B. Brace spacing shall not exceed the maximum allowable brace spacing as engineered by the manufacturer or custom bracing designer.

C. Bracing may be omitted from conduit, cable tray and bus duct runs less than 5 FT in length.

D. Bracing may be omitted from conduit, cable tray and bus duct runs where rod hung supports of less than 12 IN. (305mm) in length are required.

E. All unbraced suspended utility systems having 2 IN conduit and larger or systems weighing more then 5 LBS/FT shall be installed with a minimum 6IN clearance to suspended ceiling vertical hanger wires.

F. The conduit, cable tray, or bus duct shall be installed such that the lateral motion of the members will not cause damaging impact with other systems or structural members or loss of vertical support.

G. A longitudinal brace at a 90 degree change in direction may act as a transverse brace if it is located within 2 FT of the change in direction.

H. A transverse brace may act as a longitudinal brace if it is located within 2 FT of a change in direction and if the brace arm and anchorage have been sized to meet or exceed the requirements of the longitudinal brace.

I. When bracing equipment or a utility system that is suspended from an overhead deck, brace back to the overhead deck or to the supporting structure supporting the deck.
   1. Do not brace to another element of the structure which may respond differently during a seismic event.

J. Obtain approval from the Structural Engineer prior to attaching any brace elements to structural steel or wood framing.

K. When utilizing cable bracing, tension the cable to remove slack without inducing uplift of the suspended element.
   1. Tension seismic bracing system prior to system start-up and adjust if necessary after equipment start-up.

L. As a general rule, do not mix rigid bracing with cable bracing in the same run.
   1. However, once bracing has transitioned a 90 degree change in run direction, the bracing may switch from rigid to cable or vice versa if required due to a significant change in overhead deck elevation or to provide an implementable bracing scheme in a congested area.

M. Install brace members at an angle of 45 degrees from horizontal within a tolerance of plus 2 1/2 degrees or minus 45 degrees provided the brace length is accounted for in design.
   1. Brace angle may be increased to 60 degrees provided the brace spacing is reduced to 1/2 that required for a 45 degree brace.

N. Seismic bracing may not pass through a building separation joint.
   1. Utility systems that pass through a separation joint must be seismically restrained no greater than 5 FT from the point of connection.
   2. Any hardware designed to accommodate seismic movement across the span of the separation joint shall be installed per manufacturer's installation and listing instructions.

O. With approval of the Structural Engineer, utility systems that are suspended from the overhead deck may be braced to load bearing concrete or CMU (concrete masonry) walls provided that the walls and the overhead decks will respond similarly during a seismic event.

P. Each layer of a multiple layer trapeze rack shall be braced individually based on the weight of the individual layer.

Q. Conduit, cable tray, or bus duct constructed of non ductile material (plastic or fiberglass), shall have brace spacing reduced to 1/2 of the spacing allowed for ductile materials.

R. Where brace elements are through-bolted, the mounting hole in the element is to be no more than 1/16 IN in diameter larger then the bolt or threaded rod.

S. Seismic braces shall directly brace the system and not the hanger.

3.2 SUSPENDED ELECTRICAL SYSTEMS

A. Install seismic bracing for all conduit 2-1/2 IN trade size or greater.

B. All trapeze assemblies supporting conduits, cable trays or bus ducts shall be braced considering the total weight of the elements on the trapeze.
   1. For the purposes of calculating weight, all conduits are to be treated as full.

C. Brace all trapeze racks which support conduit 2-1/2 IN trade size or larger.
   1. Brace all other conduit rack, cable tray or bus duct trapezes having a minimum weight in excess of 10 LBS/LF.
   2. Include a minimum 10 percent additional capacity for future additions.

D. Seismic bracing may be omitted from cable trays, conduit and bus ducts suspended by rod hung supports 12 IN or less in length form the top of the element to the bottom of the structural attachment of the hanger provided lateral motion will not cause damaging impacts to other systems or loss of system vertical support.

E. All vertical risers involving conduit 2-1/2 IN in diameter or larger shall include lateral restraint at maximum 30 FT intervals and at the top and bottom of the riser.

3.3 FLOOR OR ROOF MOUNTED EQUIMENT

A. Provide one (1) anchor on each leg or corner.
   1. Support with a minimum of three (3) 3/8 IN DIA anchors.

B. Friction shall be neglected when designing anchors for shear.

C. Vertical seismic forces, when required, shall be presumed to act concurrently with horizontal seismic forces.

END OF SECTION

SECTION 26 08 13
ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Basic requirements for acceptance testing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 400.3, Guide for Partial Discharge Testing of Power Cable Systems in a Field Environment.
   2. InterNational Electrical Testing Association (NETA):
      a. ATS, Standard for Acceptance Testing Specifications for Electric Power Equipment and Systems.
   3. Nationally Recognized Testing Laboratory (NRTL).
   4. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
      a. 455-78-B, Optical Fibres - PART 1-40: Measurement Methods and Test Procedures - Attenuation.

B. Qualifications:
   1. Testing firm qualifications: See Specification Section 01 61 03.
   2. Field personnel:
      a. See Specification Section 01 61 03.
      b. As an alternative, supervising technician may be certified by the equipment manufacturer.
   3. Analysis personnel:
      a. See Specification Section 01 61 03
         As an alternative, supervising technician may be certified by the equipment manufacturer.

C. Phasing Diagram:
   1. Coordinate with Utility Company for phase rotations and Phase A, B and C markings.
      a. Create a phasing diagram showing the coordinated phase rotations with generators and motors through the transformers.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 01 61 03 for electrical equipment and connection testing plan submittal requirements.

B. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Prior to energizing equipment:
      a. Coordinated phasing diagram.
      b. Copies of wire insulation testing.
   3. Within two (2) weeks after successful completion of Demonstration Period (Commissioning Period):
      a. Single report containing information including:

1) Summary of Project.
2) Information from pre-energization testing.
3) See testing and monitoring reporting requirements in Specification Section 01 61 03.

PART 2 - PRODUCTS

2.1 FACTORY QUALITY CONTROL

A. Provide Electrical equipment with all factory tests required by the applicable industry standards or NRTL.

B. Factory testing will not be accepted in lieu of field acceptance testing requirements specified in this Specification Section and Specification Section 01 61 03.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. General:
   1. See Specification Section 01 61 03.
   2. Complete electrical testing in three (3) phases:
      a. Pre-energization testing phase.
      b. Equipment energized with no load.
      c. Equipment energized under load.
   3. Perform testing in accordance with this Specification Section and NETA ATS.
   4. Provide field setting and programming of all adjustable protective devices and meters to settings as determined by the approved coordination study.

B. Equipment Monitoring and Testing Plan: See Specification Section 01 61 03.

C. Instruments Used in Equipment and Connections Quality Control Testing: See Specification Section 01 61 03.

D. Testing and Monitoring Program Documentation: See Specification Section 01 61 03.

E. Electrical Equipment and Connections Testing Program:
   1. See Specification Section 01 61 03.
   2. See individual Division 26 Specification Sections for equipment specific testing requirements.
   3. Test all electrical equipment.
      a. Perform all required NETA testing.
      b. Perform all required NETA testing plus the optional testing identified with each specific type of equipment in Article 3.2 of this Specification Section.

3.2 SPECIFIC EQUIPMENT TESTING REQUIREMENTS

A. Switchboards:
   1. Perform inspections and tests per NETA ATS 7.1.
   2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
   3. Set all configurable settings for breakers and ATS.

B. Cable - Low Voltage:
   1. Perform inspections and tests per NETA ATS 7.3.2.
   2. Contractor may perform testing using a megger.

C. Low Voltage Molded Case Circuit Breakers:
   1. Perform inspections and tests per NETA ATS 7.6.1.1.
   2. Components:

a. Test all components per applicable paragraphs of this Specification Section and NETA ATS.
b. Thermal magnetic breakers: Visual and mechanical inspection per NETA ATS only.
c. Solid state trip type: Visual and mechanical inspection and electrical tests per NETA ATS.

3. Record as-left settings.

D. Power Monitor:
1. Perform inspections and tests per NETA ATS 7.11.
2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.
3. Set all configurable settings.

E. Grounding:
1. Perform inspections and tests per NETA ATS 7.13.
2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.

F. Motors:
1. Perform inspections and tests per NETA ATS 7.15.
2. See Specification Section 01 61 03.

G. Motor Controllers:
1. Perform inspections and tests per NETA ATS 7.16.
2. Components: Test all components per applicable paragraphs of this Specification Section and NETA ATS.

H. Control System Functional Test:
1. Perform test upon completion of equipment acceptance tests.
2. The test is to prove the correct interaction of all sensing, processing and action devices.
3. Develop a test plan and parameters for the purpose of evaluating the performance of the system.
4. Perform the following tests:
a. Verify the correct operation of all interlock safety devices for fail-safe functions in addition to design function.
b. Verify the correct operation of all sensing devices, alarms and indicating devices.

END OF SECTION

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SECTION 26 09 13
ELECTRICAL METERING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Digital metering equipment.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
      a. C12.20, For Electricity Meter - 0.2 and 0.5 Accuracy Classes.
   3. Underwriters Laboratories, Inc. (UL):
      a. 508, Standard for Safety Industrial Control Equipment.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Provide submittal data for all products specified in PART 2 of this Specification:
      b. See Section 26 05 00 for additional requirements.
   3. Fabrication and/or layout drawings.
      a. Electrical wiring/connection diagrams.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
   2. Content of Operation and Maintenance Manual:
      a. Data sheet of the meters electrical parameters, configuration and characteristics including a complete model number and associated equipment connected too.
      b. Operating instructions of the meter(s) supplied.
      c. Operating instructions of the Power Management software.
      d. Maintenance instructions.
      e. As-constructed electrical wiring/connection diagrams.
      f. Acceptance testing data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Allen-Bradley.
   2. Eaton.
   3. Electro Industries.
   4. General Electric Company.
   5. Power Measurement.
   6. Square D Company.

7. Siemens.
8. Or approved equal.

2.2 DIGITAL METERING DEVICES

A. General:
1. Direct reading metered or calculated values.
2. Microprocessor based.
3. Integral LED or LCD display.
4. Current and potential transformers as required.
5. Integral fusing.
6. Operating temperature: 0 DegF to 150 DegF.
7. Standards:
a. NEMA/ANSI C12.20.
b. UL 508.

B. Type 'B' Midrange Meter:
1. Display the following minimum electrical parameters (accuracy):
a. RMS current per phase (+0.3 percent full scale).
b. RMS voltage line-to-line and line-to-neutral (+0.3 percent full scale).
c. Real power (W): 3 PH total (+0.6 percent full scale).
d. Apparent power (VA): 3 PH total (+0.6 percent full scale).
e. Reactive power (VAR): 3 PH total (+0.6 percent full scale).
f. Power factor (+1.0 percent).
g. Frequency (+0.17 percent).
h. Percent current total harmonic distortion (31st).
i. Percent voltage total harmonic distortion (31st).
2. Data logging:
a. 128 KB.
b. Selectable for parameters listed above for display.
c. Software for configuration, retrieval, and trending.
3. Communication ports and protocols: Ethernet TCP/IP.
4. Supply voltage: 120 Vac.

2.3 ACCESSORIES

A. Provide required connection blocks and CT’s specifically for the application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.
1. Provide all equipment as necessary to provide a complete and functioning system.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: See Section 26 08 13.

3.3 TRAINING

A. A qualified factory-trained manufacturer's representative shall provide the Owner with 2 HRS of on-site training in the operation and maintenance of the metering system and its components.

END OF SECTION

SECTION 26 09 16
CONTROL EQUIPMENT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Operator control devices (selector switches, pushbuttons, indicator lights, etc.).
   2. Control devices (timers, relays, contactors, etc.).
   3. Industrial Control Panels.
   4. Operator Control Stations.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. ICS 2, Industrial Control and System Controllers, Contactors and Overload Relays Rated 600 Volts.
   2. Underwriters Laboratories, Inc. (UL):
      a. 508, Standard for Safety Industrial Control Equipment.
      b. 508A, Standard for Safety Industrial Control Panels.

1.3 SYSTEM DESCRIPTION

A. This Specification specifies components used within other equipment as referenced in other technical specifications.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification:
         1) When components are used within equipment specified in another Section, submittal data for components specified herein shall be included with the submittal for the equipment the components are used in.
      b. Industrial Control Panel bill of material.
      c. Control Station bill of material.
      d. See Specification Section 26 05 00 for additional requirements.
   3. Fabrication and/or layout drawings.
      a. Industrial Control Panel:
         1) Interior and exterior layout.
         2) Wiring/connection diagrams.
         3) Short circuit rating.
         4) Copy of the UL 508A label.
      b. Operator Control Station:
         1) Interior (if applicable) and exterior layout.
         2) Wiring/connection diagrams.
      c. Associate Industrial Control Panel and Operator Control Stations with associated equipment name and tagging.

B. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Functional Test Plan.

C. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of submittal process.
   2. Content of Operation and Maintenance Manual:
      a. Product technical data of components used within Industrial Control Panels and Operator Control Stations.
      b. As-constructed wiring/connection diagrams for Industrial Control Panels and Operator Control Stations.
      c. Functional Test Report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pilot devices, relays, contactors, and termination equipment:
      a. Allen-Bradley.
      b. ATC Diversified Electronics.
      c. Automatic Switch Company (ASCO).
      d. Eaton.
      e. General Electric Company.
      f. Idec.
      g. Phoenix Contact.
      h. Potter & Brumsfield.
      i. Schneider Electric.
      j. Siemens.
      k. Time Mark.
      l. Or approved equal.
   2. Enclosures:
      a. Hoffman Engineering Co.
      b. Wiegmann.
      c. Eaton B-Line.
      d. Adalet.
      e. Stahlin.
      f. Or approved equal.

2.2 PILOT DEVICES

A. General Requirements:
   1. Standards: NEMA ICS 2, UL 508.
   2. Heavy-duty NEMA 4/13 watertight/oiltight.
   3. Heavy-duty NEMA 4/4X corrosion resistant.
   4. Heavy-duty factory sealed, explosion-proof and dust ignition-proof (Class I and II).
   5. Mounting hole: 30.5 mm.
   6. Contact blocks: 10 amp, NEMA A600 rated, number as required to fulfill functions shown or specified.
   7. Legend plate marked as indicated on Drawings or specified.

B. Selector Switches:
   1. Two, three- or four-position rotary switch as required to fulfill functions shown or specified.
   2. Maintained contact type.
   3. Knob or lever type operators.

C. Pushbuttons:
   1. Non-illuminated type:
      a. Protective boot.
      b. Momentary contact.

c. Standard flush and mushroom operators.
d. Green colored buttons for START or ON and red color for STOP or OFF.
e. Emergency stop pushbuttons: Mushroom head operator and maintained contact.

2. Illuminating type:
a. Protective boot.
b. Momentary contact.
c. Standard flush operator.
d. Serves as both pushbutton control and indicating light.
e. Green colored lenses: START or ON.
f. Red colored lense: STOP or OFF.
g. LED-type full voltage light unit with lens and panel gasket.

D. Indicating Lights:
1. Allowing replacement of bulb without removal from control panel.
2. Lamp: LED, 120 V or 24 V as required.
3. Full voltage type.
4. Push-to-test indicating lights.
5. Glass lens.
6. Color code lights as follows:
a. Green: ON or running; valve open.
b. Amber: Standby; auto mode; ready.
c. Red: OFF or stopped; valve closed; alarm.

2.3 RELAYS

A. General Requirements:
1. Standards: NEMA ICS 2, UL 508.

B. Control Relays:
1. General purpose (ice cube) type:
a. Plug-in housing.
b. Clear polycarbonate dust cover with clip fastener.
c. Coil voltage: 120 Vac or as required.
d. Contacts:
1) 10 amp continuous.
2) Silver cadmium oxide.
3) Minimum of 3 SPDT contacts.
e. Sockets: DIN rail mounted.
f. Internal neon or LED indicator is lit when coil is energized.
g. Manual operator switch.
2. Industrial type:
a. Coil voltage: 120 Vac or as required.
b. Contacts:
1) 10 amp, NEMA A600 rated.
2) Double break, silver alloy.
3) Convertible from normally open to normally closed or vice versa, without removing any wiring.
4) Expandable from 2 poles to 12 poles.
c. Provide contacts for all required control plus two spares.

C. Time Delay Relays:
1. General purpose type:
a. Timing modes: On and Off delay, interval, one shot and repeat cycle.
b. Plug-in housing.
c. Polycarbonate dust cover with clip fastener.
d. Coil voltage: 120 Vac or as required.
e. Contacts:
1) 10 amp continuous.

2) Silver cadmium oxide.
3) Two normally open and two normally closed DPDT contacts.

f. Sockets: DIN rail mounted.
g. External timing adjustment knob.
h. Timing ranges: 0.05 seconds to 16.65 HRS.
i. Repeat accuracy: +1 percent.

2. Solid State industrial type:
a. Timing modes: On and Off delay and repeat cycle.
b. Industrial housing.
c. Coil voltage: 120 Vac or as required.
d. Contacts:
1) 5 amp, NEMA B150 rated.
2) Silver alloy.
3) Convertible On Delay and Off Delay contacts.
4) One normally open and one normally closed timed contacts.
5) One normally open and one normally closed instantaneous contacts.

e. Furnish with "on" and "timing out" indicators.
f. External timing adjustment knob.
g. Timing ranges: 0.05 seconds to 10 HRS.
h. Repeat accuracy: +1 percent.

3. Mechanical industrial type:
a. Timing modes: On and Off delay.
b. Coil voltage: 120 Vac or as required.
c. Contacts:
1) 10 amp, NEMA A600 rated.
2) Double break, silver alloy.
3) Convertible On Delay and Off Delay contacts.
4) Convertible normally open and normally closed timed contacts.
5) Convertible normally open instantaneous contacts.

d. External timing adjustment knob.
e. Timing ranges: 0.2 - 60 sec or 5 - 180 sec.
f. Repeat accuracy: Greater than +10 percent.

2.4 CONTACTORS

A. General Requirements:
1. Standards: NEMA ICS 2, UL 508.

B. Lighting and Remote Control Switches:
1. Electrically operated, electrically held.
2. Coil voltage: 120 Vac or as required.
3. Contacts: Totally enclosed, double-break silver-cadmium-oxide.
4. Rated for ballasted lighting, tungsten and general use loads.
5. Number of poles, continuous ampere rating and voltage, as indicated on Drawings or as specified.
6. Auxiliary control relays, as indicated on Drawings or as specified.
7. Auxiliary contacts, as indicated on Drawings or as specified.

C. Definite Purpose:
1. Coil voltage: 120 Vac or as required.
2. Contacts: Totally enclosed, double-break silver-cadmium-oxide.
3. Resistive load and horsepower rated.
4. Number of poles, continuous ampere rating and voltage, as indicated on Drawings or as specified.
5. Auxiliary contacts, as indicated on Drawings or as specified.

2.5 MISCELLANEOUS DEVICES

A. Run Time Meters:
   1. Six-digit wheels including a 1/10 digit.
   2. Non-reset type.
   3. Time range in hours.
   4. Automatic recycle at zero.
   5. Accuracy: 1 percent.
   6. Sealed against dirt and moisture.
   7. Tamperproof.

2.6 TERMINATION EQUIPMENT

A. General Requirements:
   1. Modular type with screw compression clamp.
   2. Screws: Stainless steel.
   3. Current bar: Nickel-plated copper alloy.
   4. Thermoplastic insulation rated for -40 to +90 DegC.
   5. Wire insertion area: Funnel-shaped to guide all conductor strands into terminal.
   6. End sections and end stops at each end of terminal strip.
   7. Machine-printed terminal markers on both sides of block.
   8. Spacing: 6 mm.
   9. Wire size: 22-12 AWG.
   10. Rated voltage: 600 V.
   11. DIN rail mounting.

B. Standard-type block:
   1. Rated current: 30 A.
   2. Color: Gray body.

C. Bladed-type disconnect block:
   1. Terminal block with knife blade disconnect which connects or isolated the two sides of the block.
   2. Rated current: 10 A.
   3. Color:
      a. Panel control voltage leaves enclosure - normal: Gray body, orange switch.
      b. Foreign voltage entering enclosure: Orange body, orange switch.

D. Grounded-type block:
   1. Electrically grounded to mounting rail.
   2. Terminal ground wires and analog cable shields.
   3. Color: Green and yellow body.

E. Fuse Holders:
   1. Blocks can be ganged for multi-pole operation.
   2. Spacing: 9.1 mm.
   3. Wire size: 30-12 AWG.
   4. Rated voltage: 300 V.
   5. Rated current: 12 A.
   6. Fuse size: 1/4 x 1-1/4.
   7. Blown fuse indication.
   8. DIN rail mounting.

2.7 ENCLOSURES

A. Industrial Control Panels:
   1. NEMA 4X rated:
      a. Body and cover: 14 GA Type 304 or 316 stainless steel.
      b. Seams continuously welded and ground smooth.
      c. No knockouts.

d. External mounting flanges.
e. Hinged door and stainless steel screws and clamps.
f. Door with oil-resistant gasket.

2. NEMA 12 enclosure:
   a. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
   b. No knockouts.
   c. External mounting flanges.
   d. Non-hinged stainless steel cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
   e. Flat door with oil resistant gasket.
3. Control panel miscellaneous accessories:
   a. Back plane mounting panels: Steel with white enamel finish or Type 304 stainless steel.
   b. Interiors shall be white or light gray in color.
   c. Wire management duct:
      1) Bodies: PVC with side holes.
      2) Cover: PVC snap-on.
      3) Size as required.
   d. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
   e. Split covers when heavier than 25 LBS.
   f. Floor stand kits made of same material as the enclosure.
   g. Weldnuts for mounting optional panels and terminal kits.
   h. Ground bonding jumper from door, across hinge, to enclosure body.
4. Standards: NEMA 250, UL 508.

B. Operator Control Stations:
1. NEMA 4/13 rated:
   a. Die cast aluminum body with manufacturers standard finish.
   b. Gasketed die cast aluminum cover with manufacturers standard finish.
   c. Number of device mounting holes as required.
2. NEMA 4X rated:
   a. Type 304 or 316 stainless steel body.
   b. Gasketed Type 304 or 316 stainless steel cover.
   c. Number of device mounting holes as required.

2.8 FABRICATION

A. Supplier of Industrial Control Panels shall build control panel under the provisions of UL 508A.
1. Entire assembly shall be affixed with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.

B. Control Panels:
1. Size as required to mount the equipment.
2. Permitted uses of NEMA 4X enclosure:
   a. Surface mounted in areas designated as wet, outdoors and/or corrosive.
3. Permitted uses of NEMA 12 enclosure:
   a. Surface mounted in areas designated as dry.

C. Operator Control Stations:
1. Permitted uses of NEMA 4/13 enclosure:
   a. Use in areas designated as dry.

2. Permitted uses of NEMA 4X enclosure:
    a. Use in areas designated as wet, outdoors and/or corrosive.

3.2 FIELD QUALITY CONTROL

A. See Section 26 05 00.

B. Industrial Control Panel(s) and Operator Control Station Functional Test:
1. The test is to prove the correct interaction of all sensing, processing and action devices.
2. Develop a test plan and parameters for the purpose of evaluating the performance of the system.
    a. Plan shall have witness signature lines for the contractor and owner and submitted when system pass the test.
3. Perform the following tests:
    a. Verify functionality of all control states.
    b. Verify the correct operation of all interlock safety devices for fail-safe functions
    c. Verify the correct operation of all sensing devices, alarms and indicating devices.

3.3 TRAINING

A. A qualified supplier representative shall provide the Owner with on-site training in the operation and maintenance of the Industrial Control Panel(s) and its components.

END OF SECTION

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SECTION 26 24 13
SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Low voltage switchboards.
   2. Service/metering panel.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. PB 2, Deadfront Distribution Switchboards.
   2. Underwriters Laboratories, Inc. (UL):
      a. 891, Standard for Safety Dead-Front Switchboards.
   3. PG&E Requirements.

B. Verify the space required for the switchboard is equal to or less than the space allocated.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
   3. See Specification Section 26 05 00 for additional requirements.
   4. Fabrication and/or layout drawings:
      a. Switchboard layout with alphanumeric designation, protective devices size and type, as indicated in the one-line diagram or switchboard schedule.
      b. Front elevation and plan drawing of the assembly.
      c. Three-line or single line and schematic diagrams.
      d. Conduit space locations within the assembly.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.
   2. Fabrication and/or layout drawings updated with as-build conditions

C. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Eaton.
   2. General Electric Company.
   3. Square D Company.

4. Siemens.
5. Or approved equal.

2.2 SWITCHBOARDS

A. Ratings:
1. Voltage, number of phases, number of wires, and main bus current rating as indicated on the Drawings.
2. Assembly short circuit current and interrupting device rating as indicated on the Drawings.
3. When low voltage power circuit breakers are utilized, the switchboard shall have a 30 cycle withstand rating corresponding to the breaker rating.
4. Service Entrance Equipment rated when indicated on the Drawings.
5. 100 percent rated when 100 percent rated breakers are installed.

B. Construction:
1. Standards: NEMA PB 2, UL 891.
2. Completely enclosed, dead-front, self-supporting metal structure.
3. Vertical panel sections bolted together.
4. Frames bolted together to support and house bus, cables and other equipment.
5. Frames and insulating blocks to support and brace main buses for short circuit stresses up to ratings indicated on the Drawings.
6. All sections rear aligned.
7. Devices front removable and load connections front accessible for mounting switchboard against a wall.
8. Interior and exterior steel surfaces cleaned and painted with rust inhibiting primer and manufacturers standard paint.

C. Buses:
1. Material: Tin-plated aluminum or silver-plated copper.
2. Main horizontal bus:
   a. Fully rated with all three (3) phases arranged in the same vertical plane.
   b. Sufficient size to limit temperature rise to 65 DegC over average air temperature outside the enclosure of 40 DegC.
3. Neutral bus: Fully rated.
4. Ground bus: 1/4 x 2 IN copper, continuous over length of switchboard and solidly grounded to each vertical section structure.
5. Bus joints connected using through bolts and conical spring-type washers for maximum conductivity.

D. Overcurrent and Short Circuit Protective Devices:
1. Feeder overcurrent protective devices:
   a. Group mounted molded case circuit breaker.
2. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.
3. Factory installed.
4. Means to padlock all main and feeder devices in the open position.

E. Surge Protective Device: Integrally mounted, see Specification Section 26 43 13.

F. Accessories:
1. Voltage and arc flash warning labels.

G. Additional requirements for service/metering panel:
1. Construction to be NEMA 3R outdoor, powder coated steel.
2. Consist of UG pull, metering and service circuit breaker sections.
3. UG pull and metering sections to be in full compliance with PG&E standards.
   a. Separate barriered off sections with hinged sealble doors.
   b. Buswork with provisions for required current and potential transformers and meter mounting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install switchboards in accordance with manufacturer's instructions.

B. Arrange switchboard as shown on the Drawings.

C. Indoor Locations: NEMA 1 powder coated steel enclosure.

D. Outdoor locations: NEMA 3R powder coated steel enclosure.

E. Install on concrete housekeeping pad, align front of switchboard with top edge of pad chamfer and securely fasten to pad.

F. Miscellaneous:
   1. Provide circuit protective devices and other associated equipment as indicated on the Drawings.
   2. All control wiring shall be neatly laced and have flexibility at hinge locations.

3.2 FIELD QUALITY CONTROL

A. Test the ground fault protection system as indicated in Specification Section 26 28 00.

END OF SECTION

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SECTION 26 24 19
MOTOR CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Motor control center modifications.
   2. Separately mounted motor starters (including those supplied with equipment).
   3. Manual motor starters.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. International Electrotechnical Commission (IEC).
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volt Maximum).
      b. ICS 2, Controllers, Contactors and Overload Relays Rated 600 V.
      c. ICS 3, Medium-Voltage Controllers Rated 2001 to 7200 V AC.
   3. Underwriters Laboratories, Inc. (UL):
      a. 508, Standard for Industrial Control Equipment.
      b. 845, Motor Control Centers.

B. Miscellaneous:
   1. Verify motor horsepower loads, other equipment loads, and controls from approved shop drawings and notify Engineer of any discrepancies.
   2. Verify the required instrumentation and control wiring for a complete system and notify Engineer of any discrepancies.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 26 05 00 for additional requirements.
   3. Fabrication and/or layout drawings:
      a. Motor control center:
         1) Elevation drawing with overall dimensions.
         2) Starter and component schedule.
         3) Identification of units and their location in the MCC.
         4) Location of incoming line terminals.
         5) Mounting dimensions.
         6) Available conduit entrance areas.
         7) Nameplate schedule.
         8) Assembly ratings (amps, volts, short circuit, etc.).
         9) Unit ladder logic wiring for each unit depicting electrical interlocking and wiring between units (NEMA ICS 3 Class II) and identification of terminals where field devices or remote control signals are to be terminated (NEMA ICS 3 Class II-S) as indicated on the Drawings and/or loop descriptions.
      b. Separately mounted combination starters:
         1) Unit ladder logic wiring for each unit depicting electrical wiring and identification of terminals where field devices or remote control signals are to be terminated as indicated on the Drawings and/or loop descriptions.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.
      c. Fabrication and/or layout drawings updated with as-built conditions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Shall match existing motor control center and be suitable for mounting into existing Westinghouse 5-star MCC's.

2.2 MOTOR CONTROL CENTERS

A. General:
   1. There are no new MCC's and the following provisions are applicable as appropriate.

B. Ratings:
   1. 600 V class, 3 PH, 60 Hz with operating voltage and number of wires as indicated on the Drawings.
   2. Assembly short circuit current and interrupting device rating as indicated on the Drawings.
   3. Service Entrance Equipment rated when indicated on the Drawings.

C. Construction:
   1. Standards: UL 845.
   2. Totally enclosed, dead front, free standing assemblies, bolted together to form a single assembly.
   3. Fabricate of not less than 14 GA steel with 16 GA steel doors in standardized units.
   4. Nominal size per section: 20 IN wide, 20 or 21 IN deep, and 90 IN high.
   5. Enclosure:
      a. NEMA 1 gasketed.
   6. Horizontal wireways:
      a. At the top, isolated from the main bus
      b. At the bottom.
      c. Easily accessible.
      d. Full length of the MCC.
   7. Vertical wireway:
      a. Located in each MCC section that accepts plug-in units.
      b. Connect to top and bottom wireways.
      c. Isolated from the unit interiors.
      d. Accessible through a separate hinged door.
      e. Cable tie supports to hold wiring in place.
   8. Unit doors:
      a. Formed round corners and rolled edges.
      b. Minimum of two (2) heavy-duty hinges or continuous piano hinge.
      c. Held closed by means of captive fasteners.
      d. Fabricate to be a part of the structure and not part of the starter.
   9. Unit cubicles:
      a. Draw-out type for motor starters through NEMA Size 5.
      b. Guide rails for supporting and aligning starters.
      c. Operating handle:
         1) With the unit stabs engaged and door closed the handle mechanism allows complete ON/OFF control of the unit disconnect and clear indication of the disconnect status.
         2) Circuit breaker and MCP operators includes a separate TRIPPED position.

3) Mechanical interlock to prevent the opening of the door when the disconnect is in the ON position with a defeater mechanism.
4) Mechanical interlock to prevent the placement of the disconnect in the ON position with the door open with a defeater mechanism.
5) Non-defeatable interlock to prevent the installation or removal of a unit unless the disconnect is in the OFF position.
6) Padlockable in the OFF position.

d. Control panel:
1) Provide control devices (selector switch, indicating devices, etc.) as indicated on the Drawings per Specification Section 26 09 16.

e. Control power:
1) Control power transformer:
a) 120 V secondary.
b) Fused on primary and secondary side.
c) Sized for 140 percent of required load.

f. Minimum of one (1) full size space unit (12 IN) for any combination magnetic motor starter or starter without overload relay.
g. One-half full size space unit (6 IN) for circuit breakers 100 A and less.
h. Effectively baffled to isolate any ionized gases which may occur within unit starter.

10. Externally mounted overload relay pushbutton.
11. Assemblies effectively ventilated to allow relocation of starters and other components:
a. Within the assembly and with the same load.
b. Without having to compensate for changes in location.
12. Finish: Rust inhibited primer and manufacturer's standard paint inside and out.
13. Provide ample unrestricted space for conduit entry from the bottom.
14. Wiring: NEMA ICS 3 Class II, Type B-D.

D. Buses:
1. Material: Tin-plated copper.
2. Main horizontal bus:
a. 600 A unless otherwise indicated on the Drawings.
b. Extend the full-length of the MCC with provisions for splicing additional sections to either end.
3. Vertical buses:
a. 300 A minimum.
b. Securely bolted to the horizontal main bus with joint easily accessible for maintenance.
c. Completely isolated and insulated by means of a barrier.
d. Extended full length of vertical section to distribute incoming power to each circuit breaker and starter in structure.
1) Starters NEMA Size 5 and larger and certain other components may be cable connected to the main bus with the approval of the Engineer.
e. Extend Vertical bus to spaces provided for future equipment.
4. Ground bus:
a. Extend the full-length of the MCC with provisions for splicing additional sections to either end.
b. 300 A tin-plated copper.
c. Solidly grounded to each structure.
d. Locate near bottom of structure.
e. Provide for lug connection of equipment ground wires.

E. Overcurrent and Short Circuit Protective Devices:
1. Main device:
a. Molded case circuit breaker.
2. Feeder devices:
a. Molded case circuit breaker.
3. Motor protection with full voltage starters:
a. Motor circuit protector.

4. Motor protection with reduced voltage starters or VFDs:
    a. Molded case circuit breaker.
5. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.
6. Factory installed.

F. Motor Starters: See requirements within this Specification Section.

G. Surge Protective Device: Integrally mounted, see Specification Section 26 43 13.

2.3 SEPARATELY MOUNTED COMBINATION STARTERS

A. Standards:
1. NEMA 250, NEMA ICS 2.
2. UL 508.

B. Enclosure:
1. NEMA 4X rated:
    a. Body and cover: Type 304 or 316 stainless steel.
    b. No knockouts, external mounting flanges, hinged and gasketed door.
2. NEMA 12 rated:
    a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.
    b. No knockouts, external mounting flanges, hinged and gasketed door.

C. Operating Handle:
1. With the door closed the handle mechanism allows complete ON/OFF control of the unit disconnect and clear indication of the disconnect status.
2. Circuit breaker and MCP operators includes a separate TRIPPED position.
3. Mechanical interlock to prevent to prevent the opening of the door when the disconnect is in the ON position with a defeater mechanism for use by authorized personnel.
4. Mechanical interlock to prevent the placement of the disconnect in the ON position with the door open with a defeater mechanism for use by authorized personnel.
5. Padlockable in the OFF position.

D. External mounted overload relay pushbutton.

E. Control Devices:
1. Provide control devices as indicated on the Drawings per Specification Section 26 09 16.
2. Devices will be accessible with the door closed.

F. Control Power Transformer:
1. 120V secondary.
2. Fused on primary and secondary side.
3. Sized for 140 percent of required load.

G. Fault Current Withstand Rating: Equal to the rating of the electrical gear from which it is fed.

H. Motor Starters: See requirements within this Specification Section.

I. Disconnect Switch, Overcurrent and Short Circuit Protective Devices:
1. Motor circuit protector or circuit breaker as applicable for motor controller.
2. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.
3. Factory installed.

2.4 MOTOR STARTERS

A. Standards:
1. NEMA ICS 2.
2. UL 508.

B. Full Voltage Non-Reversing (FVNR) Magnetic Starters:
   1. NEMA full size rated contactor.
      a. NEMA half sizes and IEC contactors are not permitted.
   2. Double-break silver alloy contacts.
   3. Overload relays:
      a. Ambient insensitive, adjustable solid state type with phase loss protection, phase imbalance protection and manual reset.
   4. Interlock and auxiliary contacts, wired to terminal blocks:
      a. Holding circuit contact, normally open.
      b. Overload alarm contact, normally open.
      c. Normally open auxiliary contact, for remote run status.
      d. Additional field replaceable auxiliary contacts as required per the Sequence of Operation.
      e. Two (2) additional normally open spare field replaceable auxiliary contacts.

C. Reduced voltage soft starter:
   1. Rated for high inertia load.
   2. Adjustable start ramp.
   3. Built in full speed bypass contactor with overload protection.

2.5 MANUAL MOTOR STARTERS

A. Standards:
   1. NEMA 250, NEMA ICS 2.
   2. UL 508.

B. Quick-make, quick-break toggle mechanism that is lockable in the OFF position.

C. Types:
   1. Horsepower rated, for ON/OFF control.
   2. Horsepower rated, for ON/OFF control and thermal overload protection.
      a. Switch to clearly indicate ON, OFF, and TRIPPED position.

D. Voltage and current ratings and number of poles as required for the connected motor.

E. Enclosures:
   1. NEMA 4X rated:
      a. Type 304 or 316 stainless steel.
      b. No knockouts, external mounting flanges.
   2. NEMA 12 rated:
      a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.
      b. No knockouts, external mounting flanges.

2.6 LABELS

A. Voltage and arch flash.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated on the Drawings and in accordance with manufacturer's recommendations and instructions.

B. Mounting height for surface mounted equipment: See Specification Section 26 05 00.

C. Overload Heaters:
   1. Size for actual motor full load current of the connected motor.
   2. For motors with power factor correction capacitors, size to compensate for the capacitors effect on load current.

D. Combination and Manual Starter Enclosures:
   1. Permitted uses of NEMA 4X enclosure:
      a. Surface mounted in areas designated as wet, outdoor and/or corrosive.
   2. Permitted uses of NEMA 12 enclosure:
      a. Surface mounted in areas designated as dry.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: See Specification Section 26 08 13.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Wall switches.
      b. Receptacles.
      c. Device wallplates and coverplates.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. WD 1, General Color Requirements for Wiring Devices.
      c. WD 6, Wiring Devices - Dimensional Requirements.
   2. Underwriters Laboratories, Inc. (UL):
      a. 20, General-Use Snap Switches.
      b. 498, Standard for Attachment Plugs and Receptacles.
      c. 514A, Metallic Outlet Boxes.
      d. 943, Ground-Fault Circuit-Interrupters.
      e. 1010, Standard for Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.
      f. 1310, Standard for Class 2 Power Units.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Wall switches and receptacles:
      a. Bryant Electric.
      b. Cooper Wiring Devices by Eaton.
      c. Hubbell Incorporated Wiring Device-Kellems.
      d. Leviton Manufacturing Company.
      e. Legrand/Pass & Seymour.
      f. Or approved equal.

2.2 WALL SWITCHES

A. Basic requirements:
   1. Industrial heavy duty Specification Grade.
   2. Quiet action, snap switch.

3. Self grounding with grounding terminal.
4. Back and side wired.
5. Solid silver cadmium oxide contacts.
6. Rugged thermoplastic and/or nylon housing and one-piece switch arm.
7. Ratings: 20 A, 120/277 Vac.
8. Switch handle type: Toggle.
9. Switch handle color: Ivory.
10. Types as indicated on the Drawings:
    a. Single-pole.
    b. Double-pole.
    c. 3-way.
    d. 4-way.
    e. Momentary contact.
11. Standards: UL 20, UL 514A, NEMA WD 1, NEMA WD 6.

B. Dry Non-architecturally Finished Area specific requirements:
1. Coverplate:
    a. 302 or 304 brushed finish stainless steel.
    b. Single or multiple gang as required.

C. Wet or Damp Non-architecturally Finished or Exterior Area specific requirements:
1. Coverplate:
    a. Cast aluminum, gasketed, stainless steel hardware, natural, lacquer, or factory painted finish.
    b. Operator type:
        1) Front mouted lever type handle to operate snap switch.
    c. Wet location rated.
    d. Single or multiple gang as required.

D. Corrosive Dry Area specific requirements:
1. Corrosion resistant nickel plated metal parts.
2. Coverplate for use on metallic outlet boxes:
    a. Cast aluminum, stainless steel hardware, natural, lacquer, or factory painted finish.
    b. Single or multiple gang as required.
3. Coverplate for use on non-metallic outlet boxes:
    a. High impact thermoplastic, stainless steel screws.
        1) Front mounted lever to operate snap switch.
    b. Single or multiple gang as required.

E. Corrosive Wet Area specific requirements:
1. Corrosion resistant nickel plated metal parts.
2. Coverplate for use on metallic outlet boxes:
    a. Cast aluminum, gasketed, stainless steel hardware, natural, lacquer, or factory painted finish.
    b. Operator type:
        1) Front mounted lever to operate snap switch.
    c. Wet location rated.
    d. Single or multiple gang as required.
3. Coverplate for use on non-metallic outlet boxes:
    a. High impact thermoplastic, gasketed, stainless steel screws.
        1) Front mounted lever to operate snap switch.
        2) Spring type door to cover snap switch.
    b. Wet location rated.
    c. Single or multiple gang as required.

2.3 RECEPTACLES

A. Basic requirements unless modified in specific requirements paragraph of receptacles and per designated areas:

1. Industrial heavy duty Specification Grade, GFCI type only.
2. Straight blade.
3. Brass triple wipe line contacts.
4. One-piece grounding system with double wipe brass grounding contacts and self grounding strap with grounding terminal.
5. Back and side wired.
6. Rating: 20 A, 125 Vac.
7. High impact nylon body.
8. Receptacle body color:
    a. Normal power: Ivory.
9. Duplex.
10. Configuration: NEMA 5-20R.
11. Standards: UL 498, UL 514A, NEMA WD 1, NEMA WD 6.

B. Receptacle type specific requirements:
1. Ground Fault Circuit Interrupter (GFCI):
    a. Heavy duty specification Grade.
    b. Class A protection.
    c. Feed through type.
    d. Test and reset buttons.
    e. Self-testing.
    f. Visual indicator light.
    g. Weather-resistant when located in damp or wet areas as indicated on the Drawings.
        1) Identification: Letters “WR” on face of receptacle.
    h. Additional standards: UL 943.

C. Architecturally Finished Areas specific requirements:
1. Wallplate:
    a. 302 or 304 brushed finish stainless steel.
    b. Single or multiple gang as required.

D. Dry Non-architecturally Finished Areas specific requirements:
1. Coverplate for use on surface mounted outlet boxes:
    a. 302 or 304 brushed finish stainless steel.
    b. Single or multiple gang as required.
2. Wallplate for use on recessed outlet boxes:
    a. 302 or 304 brushed finish stainless steel.
    b. Single or multiple gang as required.

E. Wet and Outdoor Areas:
1. Coverplate:
    a. Extra-duty rated, weatherproof (NEMA 4X) while in use, gasketed, stainless steel, 3.2 IN minimum depth for #12 AWG cord, Calbrite S6000 FVCS or approved equal..

F. Special Purpose Receptacles:
1. NEMA configuration as indicated on the Drawings.
2. Coverplate: See requirements per area designations herein.

2.4 MISCELLANEOUS WIRING DEVICES

A. Manual Motor Starters: Horsepower rated with or without thermal overloads, see Specification Section 26 24 19.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Mount devices where indicated on the Drawings and as scheduled in Specification Section 26 05 00.

C. See Specification Section 26 05 33 for device outlet box requirements.

D. Where more than one (1) receptacle is installed in a room, they shall be symmetrically arranged.

E. Provide blank plates for empty outlets.

F. Only one GFCI outlet required per outlet circuit. Mark regular outlets on circuit “GFCI Protected”.

END OF SECTION

SECTION 26 28 00
OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Low voltage circuit breakers.
   2. Coordinated Power system Protection Study.
   3. Arc Flash Study.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C37.13, Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures.
      b. C37.16, Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations.
      c. C37.17, Trip Devices for AC and General Purpose DC Low Voltage Power Circuit Breakers.
   2. National Electrical Manufacturers Association (NEMA):
      a. AB 1, Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures. (Equivalent to UL 489)
   3. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   4. Underwriters Laboratories, Inc. (UL):
      a. 489, Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 26 05 00 for additional requirements.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

C. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Reports:
      a. As-left condition of all circuit breakers that have adjustable settings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

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

a. Eaton.
b. General Electric Company.
c. Square D Company.
d. Siemens.
e. Or approved equal.

2.2 CIRCUIT BREAKERS

A. Molded Case Type:
1. General:
a. Standards: NEMA AB 1, UL 489.
b. Unit construction.
c. Over-center, toggle handle operated.
d. Quick-make, quick-break, independent of toggle handle operation.
e. Manual and automatic operation.
f. All poles open and close simultaneously.
g. Three (3) position handle: On, off and tripped.
h. Molded-in ON and OFF markings on breaker cover.
i. One-, two- or three-pole as indicated on the Drawings.
j. Current and interrupting ratings as indicated on the Drawings.
k. Bolt on type.
2. Thermal magnetic type:
a. Inverse time overload and instantaneous short circuit protection by means of a thermal magnetic element.
b. Frame size 150 amp and below:
1) Non-interchangeable, non-adjustable thermal magnetic trip units.
c. Frame sizes 225 to 400 amp (trip settings less than 400A):
1) Interchangeable and adjustable instantaneous thermal magnetic trip units.
3. Solid state trip type:
a. Inverse time overload, instantaneous short circuit and ground fault protection by means of a solid state trip element, associated current monitors and flux shunt trip mechanism.
b. Frame size 400 amp to 1200 amp (trip settings between 400 and 1200A):
1) Standard rating.
2) Interchangeable current sensor or rating plug.
3) Adjustable long time pick-up setting.
a) Adjustable from 50 to 100 percent of the current sensor or rating plug.
4) Adjustable short time pick-up setting.
5) Adjustable instantaneous pick-up.
6) Fixed ground fault pick-up, when indicated on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Current and interrupting ratings as indicated on the Drawings.

B. Series rated systems not acceptable.

C. Devices shall be ambient temperature compensated.

D. Circuit Breakers:
1. Molded case circuit breakers shall incorporate the following, unless indicated otherwise on the Drawings:
a. Frame sizes 400 amp and less with trip setting less than 400A shall be thermal magnetic type for feeder breakers.
b. Service breaker frame sizes 400 amp and larger shall be solid state trip type.
c. Motor circuit protectors sized for the connected motor.

3.2 FIELD QUALITY CONTROL

A. Coordinated Power System Protection:
   1. A study shall be prepared to demonstrate that the equipment and system constructed within the scope of these Contract Documents, meet the specified requirements for equipment ratings, coordination, and protection.
   2. The studies shall be performed in accordance with IEEE 242, IEEE399, and PG&E requirements.
   3. Computer generated studies shall include the information about the software: name of the developer and software package and version number.
   4. System short circuit study report:
      a. The study shall begin at the PG&E main 12 kV service point and extend to and including each breaker or disconnect for each 480 Volt switchboard and MCC feeder.
         1) A balanced three-phase fault, bolted line-to-line fault and line-to-ground fault study shall be performed.
      b. A one-line diagram shall be prepared to show the electrical system buses, transformers, and all sources of fault current including generators and motors.
      c. Manufacturer's data for the actual proposed equipment shall be utilized (e.g., transformer impedance).
      d. The available utility fault current shall be coordinated with the power utility company (PG&E).
      e. Input data shall be shown in tabular form in the report and/or on the one-line diagram.
         1) Input data shall include but is not limited to:
            a) Utility fault current or mVA and X/R ratio.
            b) Bus voltages.
            c) Conductor sizes and type of conduit.
            d) Generator and motor sizes and contributions.
            e) Transformer sizes and impedances.
      f. Available fault current at each bus shall be shown in tabular form in the report and/or on the one-line diagram.
      g. Perform studies for both normal power and emergency / standby power scenarios.
   5. System protective coordination study report:
      a. The study shall begin at the PG&E main 12 kV service point and include the 480 volt service switchboard main breaker.
      b. The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified for the protection of equipment and conductors from damage from overloads and fault conditions and that downstream protective devices shall clear prior to upstream devices.
         1) Where necessary an appropriate compromise shall be made between system protection, service continuity and arc flash intensity.
      c. A one-line diagram shall be prepared to show the electrical system buses, transformers and protective devices.
      d. Manufacturer's data for the actual proposed protective devices shall be utilized.
      e. Summarize the coordination study, conclusion, and recommendations.
         1) As a minimum, include the following:
            a) The manufacturer's information used to prepare the study.
            b) Assumptions made during the study.
            c) Recommended taps and settings of all adjustable devices in tabulated form.
            d) Composite coordination time-current curves on log-log paper showing:
               (1) That the settings for each protective device will provide protection and selectivity.
               (2) Identify each curve.
               (3) Cable and equipment damage points.
               (4) Circuit interrupting device operating and interrupting times.
               (5) One-line sketch of the part of the system being investigated.

(6) Include as many curves as possible on a graph while maintaining readability.

e) Position time-current curves for each device to provide for maximum selectivity to minimize system disturbances during fault clearing.

f) Advise the Engineer of potential coordination problems discovered during the study and include recommendations to resolve the problem.

g) Submit the report for approval 90 days prior to equipment energization. This report is subject to review and approval by PG&E.

B. System Arc Flash Report:
   1. The report shall begin at the PG&E 12 kV main service point and include the 480 Volt switchboards and MCC's.
   2. The report shall include the following at a minimum:
      a. Arcing fault clearing time.
      b. Arc flash protection, prohibited, restricted and limited approach boundaries per NFPA 70E.
      c. Individual arching current contributions.
   3. The report shall assign incident energy level based on NFPA 70E.
   4. Arc flash labels shall be provided and affixed to all equipment required to be labeled by NEC showing hazard category and PPE requirements.
   5. Report and electronic file shall be submitted.

C. Adjustable Circuit Breakers:
   1. Set all circuit breaker adjustable taps as defined on the Drawings, except adjust motor circuit protectors per the motor nameplate and NFPA 70 requirements.

D. Ground Fault Protection System:
   1. Single source system:
      a. Main breaker using the residual sensing method system.
      b. Main and feeder breakers: Utilize four (4) individual current sensors; the phase sensors are integral to the circuit breaker and the neutral sensor is external to the circuit breaker.

E. Testing:
   1. Acceptance testing: See Specification Section 26 08 13.

F. Adjustable Circuit Breakers:
   1. Set all circuit breaker adjustable taps as defined on the Drawings, except adjust motor circuit protectors per the motor nameplate and NFPA 70 requirements.

END OF SECTION

SECTION 26 28 16
SAFETY SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Safety switches.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. KS 1, Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
   2. Underwriters Laboratories, Inc. (UL):
      a. 98, Enclosed and Dead-Front Switches.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. Provide a Summary Table or use Exhibit A that associates the safety switch features with connected equipment tag number. Exhibit A indicates minimum data required.
      c. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following safety switch manufacturers are acceptable:
   1. Eaton
   2. General Electric Company.
   3. Square D Company.
   4. Siemens.
   5. Or approved equal.

2.2 SAFETY SWITCHES

A. General:
   1. Non-fusible or fusible as indicated on the Drawings.
   2. Suitable for service entrance when required.
   3. NEMA Type HD heavy-duty construction.
   4. Switch blades will be fully visible in the OFF position with the enclosure door open.
   5. Quick-make/quick-break operating mechanism.
   6. Deionizating arc chutes.
   7. Manufacture double-break rotary action shaft and switchblade as one (1) common component.
   8. Clear line shields to prevent accidental contact with line terminals.
   9. Operating handle:
      a. Red and easily recognizable.

b. Padlockable in the OFF position
c. Interlocked to prevent door from opening when the switch is in the ON position with a defeater mechanism.

B. Ratings:
1. Horsepower rated of connected motor.
2. Voltage and amperage: As indicated on the Drawings.
3. Short circuit withstand:
a. Non-fused: 10,000A.
b. Fused: 200,000A.

C. Accessories, when indicated in PART 3 of this Specification Section or on the Drawings:
1. Neutral kits.
2. Ground lug kits.
3. Auxiliary contact kits:
a. Opens before main switch.P
b. Rated 10A at 125/250 Vac.
c. One (1) N.O. and one (1) N.C. contact.

D. Enclosures:
1. NEMA 4X rated (metallic):
a. Body and cover: Type 304 or 316 stainless steel.
b. No knockouts, external mounting flanges, hinged and gasketed door.
2. NEMA 12 rated:
a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
b. No knockouts, external mounting flanges, hinged and gasketed door.

E. Overcurrent and short circuit protective devices:
1. Fuses.
2. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.

F. Standards: NEMA KS 1, UL 98.

G. Voltage and arc flash warning labels.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's instructions and recommendations.

B. Install switches adjacent to the equipment they are intended to serve unless otherwise indicated on the Drawings. Provide nameplate on each switch indicating drive served by switch.

C. Provide auxiliary contact kit on local safety switches for motors being controlled by a variable frequency drive.
1. The VFD is to be disabled when the switch is in the open position.

D. Permitted uses of NEMA 4X metallic enclosure:
1. Surface mounted in areas designated as wet, outdoor and/or corrosive.

E. Permitted uses of NEMA 12 enclosure:
1. Surface mounted in areas designated as dry.

END OF SECTION

SECTION 26 28 17
SEPARATELY MOUNTED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Separately mounted circuit breakers.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. Underwriters Laboratories, Inc. (UL):
      a. 489, Standard for Safety Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. Provide a table that associates equipment model number with equipment tag number.
      c. See Specification Section 26 05 00 for additional requirements.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Eaton.
   2. General Electric Company.
   3. Square D Company.
   4. Siemens.
   5. Or approved equal.

2.2 COMPONENTS

A. NEMA 4X rated:
   1. Body and cover: Type 304 or 316 stainless steel.
   2. No knockouts, external mounting flanges, hinged and gasketed door.
   3. Front operating handle padlockable in the OFF position and interlocked to prevent door from opening when the breaker is ON.
   4. Suitable for service entrance.

B. NEMA 12 rated:
   1. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.

2. No knockouts, external mounting flanges, hinged and gasketed door.
3. Front operating handle padlockable in the OFF position and interlocked to prevent door from opening when the breaker is ON.
4. Suitable for service entrance.

C. Standards: UL 489.

D. Overcurrent and short circuit protective devices:
1. Molded case circuit breaker.
2. See Section 26 28 00 for overcurrent and short circuit protective device requirements.
3. Factory installed.

E. Voltage and arc flash warning labels.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.

B. Permitted uses of NEMA 4X enclosure:
1. Surface mounted in areas designated as wet, outdoor and/or corrosive.

C. Permitted uses of NEMA 12 enclosure:
1. Surface mounted in areas designated as dry.

END OF SECTION

SECTION 26 29 23
VARIABLE FREQUENCY DRIVES - LOW VOLTAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Variable frequency drives (VFDs) for operation of inverter duty motors.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI).
   2. ETL Testing Laboratories (ETL).
   3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 399, Recommended Practice for Industrial and Commercial Power Systems Analysis.
      b. 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
      c. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
   4. National Electrical Manufacturer's Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. MG 1, Motors and Generators.
   5. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC):
         1) Article 430, Motors Motor Circuits, and Controllers..
   6. Occupational Safety and Health Administration (OSHA).
   7. Underwriters Laboratory, Inc. (UL):
      a. 508, Standard for Industrial Control Equipment.
      b. 508A, Standard for Industrial Control Panels.

B. Qualifications:
   1. Provide drives that are listed and labeled by UL, ETL, or other Nationally Recognized Testing Laboratory (NRTL) as defined by OSHA regulations, or that have been inspected and subsequent field-labeled by such NRTL.
   2. Where listed drives and other components are installed in a common enclosure, the assembly shall be listed and labeled per UL 508 and UL 508A or equivalent NRTL standard.
      a. Entire assembly shall be affixed with a UL 508A label "Listed Enclosed Industrial Control Panel" or equivalent NRTL label prior to shipment to the jobsite.
   3. VFD Supplier shall maintain an authorized service organization within 300 miles of the Project Site.

C. Coordination:
   1. VFD shall be supplied complete with all required control components.
      a. Provide control as indicated:
         1) On the electrical drawings.
         2) As specified in this Specification Section.
         3) As specified in the process control system loop descriptions.
            a) See Specification Section 40 90 05.
      b. VFD manufacturer shall review the application and provide, at no additional cost to the Owner, the hardware and software necessary to allow the VFD to control the driven equipment motor over its required operating range.
         1) These may include, but are not limited to, analog and digital interface modules, communication interface modules, switches, lights and other devices.

c. Coordinate control devices with devices furnished with driven equipment such as vibration switches, thermal sensors, leak detectors, etc.

2. Verify plan dimensions with equipment space requirements as indicated on the Drawings.
   a. Equipment which exceeds the allotted maximum dimensions may not be acceptable.
   b. Equipment which reduces clear work space below the minimums established by the NFPA 70 will not be acceptable.

1.3 DEFINITIONS

A. Variable Torque (VT):
   1. Defines a load characteristic in which the torque delivered from the motor to the load is reduced as speed is reduced below full rated.
   2. This type of load permits the VFD and the motor to operate at reduced output current at reduced speed.

B. Constant Torque (CT):
   1. Defines a load characteristic in which the torque delivered from the motor to the load remains constant as speed is varied.
   2. This type of load requires the VFD to be able to continuously deliver rated output current over the entire speed range.

C. Inverter Duty Motor: An AC induction motor complying with all requirements of NEMA MG 1 Part 31 for definite-purpose inverter-fed motors.

D. Standard Motor: An AC induction motor that fails to comply with one or more requirements of NEMA MG 1 Part 31.

E. Low Voltage: 600 VAC or less.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Provide a schedule for each VFD including the following information:
      a. Equipment Tag Number.
      b. VFD Complete Catalog Number.
      c. VFD Amp Frame Size.
      d. Variable or Constant Torque Rating Basis.
      e. Rated Input Current.
      f. Rated Continuous Output Current.
      g. Rated Short Circuit Current.
      h. VFD Maximum Motor Lead Length.
      i. Motor Manufacturer.
      j. Motor Frame Size.
      k. Motor Full Load Amps.
      l. Motor Service Factor.
      m. As installed motor Lead Length.
      n. Altitude rating.
   3. Product technical data:
      a. Complete electrical ratings and performance specifications confirming compliance with specified ratings and performance.
      b. Maximum rate of heat rejection from VFD and all related components and associated cooling requirements.
      c. Manufacturer’s installation instructions.
      d. Manufacturer’s programming and operating instructions.
      e. See Specification Section 26 05 00 for additional requirements.
   4. Fabrication and/or layout drawings:
      a. Top, front and side exterior views, with details showing maximum overall dimensions of enclosure, mounting provisions and conduit/cable entry provisions.

b. Identify minimum clearances from other VFDs or electrical equipment required for proper cooling at top, bottom, side and back of enclosure.
c. Three-line diagrams showing AC schematic of VFD, input, output and bypass devices including device ratings.
d. Interior layout drawings showing location of all components within enclosure, field wiring terminal boards, and power and grounding connections.
e. Field wiring diagrams showing locations and sizes of all electrical connections, ground terminations, and requirements for shielded wire usage or any other special installation considerations.
f. Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70, include any required calculations.

5. Certifications:
   a. Submit with Shop Drawings:
      1) Identification and location of closest authorized service organization.
   b. Submit prior to shipment:
      1) Certified factory test reports confirming compliance with specified requirements.
   c. Submit after installation:
      1) Certified field service reports showing:
         a) Each VFD is operational.
         b) Each VFD and its driven equipment motor are compatible.
         c) Each VFD responds correctly to the input control signals.
         d) Critical frequencies of the drive system and that the VFD has been set to lockout these frequencies.
         e) Measured harmonic levels per Harmonic Protection Requirements Article.
         f) Measured motor terminal peak voltages per Motor Protection Requirements Article.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
   2. Approved copy of VFD schedule per Submittals Article.
   3. Manufacturer’s instruction manuals.
   4. Troubleshooting procedures with a cross-reference between symptoms and corrective recommendations.
   5. Connection data to permit removal and installation of recommended smallest field-replaceable parts.
   6. Recommended spare parts list.
   7. Commissioning sheets showing “as-left” values of all user-programmable or adjustable drive parameters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Allen Bradley Power Flex.
   2. Square D.
   3. Eaton.
   4. Or approved equal.

2.2 GENERAL

A. VFDs shall consist of a rectifier-DC bus-inverter combination producing a sine-coded pulse-width-modulated (PWM) output voltage waveform.

B. VFDs shall constitute a complete combination motor controller per NFPA 70, Article 430 and shall provide the following per the requirements of that article without the addition of any external components or devices.
   1. Motor control.
   2. Motor overload protection.
   3. Motor and motor branch circuit short circuit and ground fault protection.
   4. Motor and controller disconnecting means.

C. It is the intent of this Specification that VFDs shall be an "engineered" or "configured" drive package in which the VFD chassis, all input, output and bypass power devices, VFD accessories, ancillary switches, contactors, relays, and related control devices are selected, furnished, factory-assembled and -tested by the VFD manufacturer in a single enclosure requiring only connection of the power supply circuit, motor branch circuit, and external control wiring in the field.

2.3 PERFORMANCE AND DESIGN REQUIREMENTS

A. Application:
   1. VFD(s) shall be of sufficient capacity and shall provide a quality of output waveform for stepless motor control from 10 to 100 PCT of base speed of the driven equipment.
   2. VFDs shall be compatible with:
      a. Inverter duty induction motors.
   3. VFDs shall be suitable for Constant Torque (CT) or Variable Torque (VT) applications.
      a. VFD manufacturer shall coordinate with the manufacturer of the driven equipment to identify CT and VT applications.
   4. VFDs shall be designed to operate successfully under the following site conditions:
      a. Ambient:
         1) Temperature: 0-40 DEGC.
         2) 95 PCT non-condensing relative humidity.
      b. Elevation: 300 FT above MSL.
      c. Power supply characteristics:
         1) 480Vac, 3 PH, 60 Hz, 3 wire, (±10 PCT).
         2) Effectively grounded.

B. Ratings and Performance Specifications:
   1. Voltage rating:
      a. Nominal: as shown on drawings.
      b. Range for continuous full load operation: ±10 PCT of nominal.
      c. Voltage imbalance tolerance for full load operation: 3 PCT minimum.
   2. Current ratings:
      a. Continuous:
         1) Equal to or greater than the motor nameplate full load.
      b. Short-term overload:
         1) VT: 110 PCT for 1 minute.
         2) CT: 150 PCT for 1 minute.
         3) Permissible for 1 minute every 10 minutes continuously.
      c. Short circuit:
         1) VFD shall have a rating not less than indicated on the Drawings for the MCC, switchboard or panelboard the VFD is supplied from.
         2) Where specified short circuit rating indicates additional input impedance is required to protect semiconductors, provide input AC line reactors, whether required to meet harmonic performance specifications or not.
   3. Efficiency:
      a. 97 PCT, minimum, at full speed and full load.
      b. 93 PCT, minimum at 1/2 speed and full load.
   4. Displacement power factor:
      a. 95 PCT, minimum from 50 PCT to 100 PCT speed and load.
   5. Efficiency and power factor criteria apply from the input terminals to the output terminals of the VFD alone, excluding losses of input and output power circuit accessories.

6. Frequency drift:
    a. +0.5 PCT of set frequency.
7. Speed regulation (motor dependent): 3 PCT.
8. Speed range: 10:1.
9. Control type:
    a. Volts/Hertz ratio; constant over the entire operating range of the VFD except:
        1) When operating under voltage boost.
        2) At frequencies over 60 Hz.

C. Operational Features:
1. Insensitive to input phase sequence.
2. Continued operation with momentary voltage dips of 25 PCT of rated voltage, or single phase condition: 4 SEC, minimum.
3. Controls power loss ride-through: 500 MSEC, minimum.
4. Electronic reversing.
5. DC injection braking.
6. Anti-windmilling: Synchronization of VFD starting frequency with spinning or coasting load, forward or reverse.
7. Critical frequency band lockout:
    a. Minimum of three settings.
    b. Adjustable bandwidth, 1 - 5 Hz.
8. Capable of operating without the motor connected for start-up and troubleshooting.

D. The VFD shall be provided with the following minimum user-programmable parameters:
1. Carrier frequency.
2. Independent maximum and minimum speeds for forward and reverse operation.
3. Start frequency and hold time.
4. Independent linear acceleration and deceleration time.
5. Preset “jog” speed.
6. Three critical frequency bands.
7. One preset speed selectable by logic input.
8. Volts/Hertz ratio.
9. Voltage boost, magnitude and frequency range.
10. Process controller gain, offset and bias.
11. Current limit.
12. Overcurrent pickup.
13. Overcurrent delay.
14. Ground fault pickup.
15. DC injection level and time.

E. The VFD shall be designed such that the power circuit components are fully protected from line side disturbances and load side faults:
1. General:
    a. Shutdown conditions associated with supply circuit conditions which can be corrected external to the VFD-motor system shall be provided with automatic reset, with shutdown cause logged in memory:
        1) Input under voltage.
        2) Input over voltage.
        3) Input under frequency.
        4) Input over frequency.
        5) Input Phase loss.
        6) DC Bus under voltage.
    b. Shutdown conditions which indicate overload or fault within the VFD, the output circuit, or the motor shall require local manual reset at the VFD, requiring operator intervention.
        1) Over temperature.
        2) Blown fuse.

3) Component failure.
4) Overload.
5) Short circuit.
6) Ground fault.
7) DC Bus over voltage.
8) External safety input (e.g., motor thermal protection).
9) Logic fault.

c. When automatic shutdown occurs, VFD shall restart upon restoration of power.
d. VFD shall hold cause of trip data for a minimum of four shutdowns in memory.
1) Data to be accessible through the keypad, local communication link and remotely.

2. Input protection:
a. Input circuit breaker or current-limiting fuses with externally operable disconnect.
1) Fault current interrupting rating equal to or greater than the specified withstand rating of the VFD.
2) Handle padlockable in the OFF position.
b. Provide full protection for semiconductors integral to the VFD; units requiring current-limiting fuses or circuit breakers in the supply circuit are not acceptable.
c. Incoming line transient suppression.
1) 6000V peak per IEEE C62.41.
2) Phase-to-phase and phase-to-ground protection.
d. Sustained over voltage trip.

3. Internal protection:
a. Surge suppression and power device snubbers.
b. Power devices rated at 2.5 times line voltage.
c. Instantaneous over current trip.
d. DC bus over voltage trip.
e. Power device over temperature trip.
f. Control logic circuit malfunction trip.

4. Output protection:
a. Inverse-time overload trip:
1) UL Class 10 characteristic.
b. Over voltage trip.
c. Over frequency trip.
d. Short circuit trip.
1) Line to line and line to ground.
e. Ground fault trip.

2.4 OPERATOR AND REMOTE CONTROL INTERFACE

A. Drive controls shall be microprocessor-based with on-board human machine interface and both local and remote digital communications capability.
1. All monitoring and control functions, other than those shutdowns specified to be manual reset only, shall be available both locally and remotely.

B. Control circuits shall be 120 VAC or 24 VAC or 24 VDC.
1. 120 VAC supplied by CPT in the VFD.
a. CPT shall have minimum additional capacity of 60 VA greater than that required by control devices.
b. CPT shall have two fuses on the primary side and one fuse on the secondary side.
c. CPT shall have surge protection on the primary side independent of any other surge protection in the VFD.
2. 24 VDC supplied by Class 2 power supply in the VFD.
a. Power supply shall have minimum additional capacity of 33 PCT greater than that required by control devices.
b. Provide two current-limiting fuses on the AC supply to the power supply.
c. Power supply shall have surge protection on the primary side independent of any other surge protection in the VFD.

C. Operator Interface:
   1. Door mounted sealed keypad, membrane type with LED or LCD display.
      a. Messages shall be in English and engineering units.
      b. Drive operating parameters shall be programmable.
      c. Menu driven.
      d. Password security.
      e. Display fault and diagnostic data.
      f. Operating parameters, fault and diagnostic data maintained in non-volatile memory with historic log of fault and diagnostic data.
      g. Gold plated plug-in contacts.
   2. Provide indication and control interface, integral in the keypad, as required in the sequence of operation and Drawings.
      a. Minimum indications:
         1) Run.
         2) Stop.
         3) Ready.
         4) Alarm.
         5) Fault.
         6) Local control.
         7) Remote control.
         8) Control source local.
         9) Control source remote.
         10) Speed indication.
      b. Minimum control functions:
         1) Local/Remote switch.
         2) Stop button.
         3) Start button.
         4) Reset button.
         5) Speed control buttons.
   3. Diagnostic indicators located externally on the face of the drive shall show the type of fault responsible for drive warning, shutdown or failure.
      a. On occurrence of more than one condition, each shall be recorded or indicated by the diagnostics.

D. Remote Control Interface:
   1. Ethernet IP communications port:
      a. Capability to:
         1) Start-Stop VFD.
         2) Control VFD Speed.
         3) Access fault and diagnostic data.
   2. Isolated Analog and discrete inputs:
      a. Speed reference (setpoint) signal 4-20 mA DC.
      b. Isolated process PID controller with user-programmable setpoint, gain, rate, reset and span for accepting a remote 4-20 mA DC process variable signal.
      c. VFD start/stop command.
   3. Isolated Analog and discrete outputs:
      a. 4-20 mA DC output for remote speed indication, as a function of frequency, calibrated 0 to 100 PCT.
      b. Drive FAULT contacts.
      c. Drive RUNNING contacts.
      d. Drive in REMOTE mode status contact.
   4. Contacts:
      a. Contacts shall be rated 2 A inductive at 120 VAC.
      b. All contacts shall be wired to field wiring terminal boards.
   5. Drive shutdown on external fault input:

a. Provide isolated input for dry contact from external motor or system safety devices to cause immediate shutdown of VFD.
b. Safety shutdown to be operable in all operating modes of drive, including local operation from keypad.

6. Network communications capability:
   a. Provide VFD with communication card, protocol and required programming for digital communication of all VFD program and operational parameters via:
      1) Ethernet IP.

2.5 HARMONIC PROTECTION REQUIREMENTS

A. All VFDs shall be capable of satisfactory operation from a source having voltage distortion and notch characteristics identified as acceptable for a “dedicated system” in IEEE 519 Table 10.2.

B. The Engineer has performed preliminary calculations based on typical VFD data which indicate that the minimum mitigation measures required to meet the specified harmonic criteria are one of the following topologies:
   1. 6-pulse rectifier topology with input and output line reactors, minimum impedance 5 PCT on drive kVA base.

2.6 MOTOR PROTECTION REQUIREMENTS

A. The VFD shall produce a quality of output waveform adequate to allow the motor to produce rated torque at rated RPM continuously without exceeding the temperature rise given in NEMA MG 1 Table 31-2.

B. Provide motor overload, short circuit and ground fault protection integral to drive electronics.

2.7 EQUIPMENT CONSTRUCTION

A. Fabrication and Assembly:
   1. Each VFD system shall be factory-assembled in an enclosure for remote mounting, and shall utilize interchangeable plug-in printed circuit boards and power conversion components wherever possible.
      a. Factory assembly shall be performed by the VFD manufacturer or authorized agent.
      b. Systems fabricated or assembled in whole or in part by parties other than the VFD manufacturer or authorized agent will not be acceptable.
   2. Reactors shall be mounted within or in an ancillary enclosure adjacent to the drive enclosure.
   3. Cooling fans, as required, shall be provided to run when drive is running.
   4. Enclosures for separately mounted VFD's:
      a. NEMA Type 12.

B. Wiring:
   1. The wiring in the VFD shall be neatly installed in wire ways or with wire ties where wire ways are not practical.
      a. Where wire ties are used, the wire bundles are to be held at the back panel with a screw-mounted wire tie mounting base.
      b. Bases with a self-sticking back will not be allowed.
   2. All plug-in contacts shall be gold-plated.
   3. Provide terminal boards for all field wiring and inter-unit connections, including analog signals.
      a. Provide terminals for shield continuity where required.
   4. Terminal blocks shall be complete with marking strip, covers and pressure connectors.
      a. Non-brittle, interlocking, track-mounted type.
      b. Screw terminals will not be allowed.
      c. A terminal for each conductor of external circuits plus one ground for each shielded cable.
      d. For free-standing panels, 8 IN of clearance shall be provided between terminals and the panel base for conduit and wiring space.

e. Not less than 25 PCT spare terminals shall be provided.
f. Terminals shall be labeled to agree with identification indicated on the suppliers submittal drawings.
g. Individually fuse each control loop or system and all fuses or circuit breakers shall be clearly labeled and located for easy maintenance.

5. All grounding wires shall be attached to the enclosure sheet metal with a ring tongue terminal.
   a. The surface of the sheet metal shall be prepared to assure good conductivity and corrosion protection.
6. Wiring shall not be kinked or spliced and shall have markings on both ends or be color coded.
   a. Markings or color code shall match the manufacturer's drawings.
7. With the exception of electronic circuits, all interconnecting wiring and wiring to terminals for external connection shall be stranded copper, type MTW or SIS, insulated for not less than 600 V, with a moisture-resistant and flame-retardant covering rated for not less than 90 DegC.

C. Nameplates:
1. All devices mounted on the face of the drive shall be provided with a suitable nameplate as specified in Specification Section 10 14 00 fastened with stainless steel screws.
2. Push buttons, selector switches, and pilot lights shall have the device manufacturer's standard legend plate.
3. Relays, terminals and special devices inside the control enclosure shall have permanent markings to match identification used on manufacturer's wiring diagrams.

D. Painting: Enclosure, after being phosphate washed, shall be thoroughly cleaned and given at least one (1) coat of rust-inhibiting primer on all inner surfaces prior to fabrication.

2.8 COMPONENTS AND ACCESSORIES

A. Provide input and output reactors for all VFD’s:
1. Impedance: 5 PCT.
2. Continuous current: Not less than drive rating.
3. Current overload: 150 PCT for 1 minute.
4. Insulation temperature rating: 180 DEGC.
5. Copper windings.
6. Saturation current rating: 3.5 to 5 times rated current.
7. Hi-potential rating: 2500 VAC line to ground and line to line, for 1 minute.
8. Noise reduction features:
   a. Epoxy over cast coil.
   b. Extra dips and bakes of varnish over continuous wound coil.

2.9 SOURCE QUALITY CONTROL

A. Factory Tests:
1. Conduct all standard tests in accordance with NEMA and ANSI standards to ensure conformance to Specification requirements.

2.10 MAINTENANCE MATERIALS

A. Provide manufacturer's recommended renewable spare parts (e.g., power and control fuses).

B. Spare parts utilized during pre-start-up or start-up and demonstration testing shall be immediately restocked, at no cost to the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and as indicated on the Drawings.

B. Provide separately mounted VFD enclosure with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
   1. Determine the SCCR rating as indicated on the Drawings.

C. Verify the installed motor nameplate electrical requirements do not exceed the VFD capacity.

D. Provide services of manufacturer's representative to perform start-up services.

3.2 START UP

A. Pre-start-up Services:
   1. Shall be completed a minimum of 30 days prior to the start-up and demonstration period described in Specification Section 01 75 00.
   2. Shall consist of:
      a. Physical and electrical installation check.
      b. Final adjustments and calibration of drive parameters.
      c. VFD operation from simulated input signals.
   3. Shall be complete when VFD(s) are fully operational.

B. Start-up and Demonstration Services:
   1. Supervise start-up of all units including recheck of settings made during the pre-start-up tests.
      a. Perform all work in the presence of the Owner's designated representatives.
   2. Setup all VFDs with carrier frequency at minimum value consistent with proper operation; inform Owner of carrier frequencies set in excess of 5 kHz and reason for setting.
   3. Simulate operation of the VFD and its associated control and instrumentation system in both the manual and automatic modes.
      a. Ensure compatibility of VFD with associated control and instrumentation signals.
   4. Simulate VFD failures and demonstrate troubleshooting aids.

C. Instruct Owner's designated personnel:
   1. Minimum of 2 HRS at the jobsite.
   2. Include both field and classroom instruction.
   3. Instructions shall include proper operation and maintenance procedures including, but not limited to:
      a. Troubleshooting.
      b. Repair and replacement.
      c. Parts inventory.
      d. Maintenance records.

3.3 SCHEDULES

A. Some motors may have full load amps (FLA) greater than that listed in NFPA 70.
   1. The following table is an estimate for the FLA of the motors based on preliminary Shop Drawings. Contractor to verify.

EQUIPMENT TAG	HP	RPM	ESTIMATED FLA	TYPE VFD
Raw Water Transfer Pump	50	1770	65	Variable Torque

END OF SECTION

SECTION 26 43 13
LOW VOLTAGE SURGE PROTECTION DEVICES (SPD)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Type 1 SPD - High exposure locations (switchgear, switchboard, panelboard or motor control center), integrally mounted.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
      b. C62.41.1, Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits.
      c. C62.41.2, Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
      d. C62.45, Recommended Practice on Surge Testing For Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
   2. Military Standard:
      a. MIL-STD-220B, Method of Insertion-Loss Measurement.
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. LS 1, Low Voltage Surge Protective Devices.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   5. Underwriters Laboratories, Inc. (UL):
      a. 1283, Standard for Electromagnetic Interference Filters.
      b. 1449, Standard for Safety Transient Voltage Surge Suppressors.

B. Qualifications:
   1. Provide devices from a manufacturer who has been regularly engaged in the development, design, testing, listing and manufacturing of SPDs of the types and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
      a. Upon request, suppliers or manufacturers shall provide a list of not less than three (3) customer references showing satisfactory operation.

1.3 DEFINITIONS

A. Clamping Voltage:
   1. The applied surge shall be induced at the 90 degree phase angle of the applied system frequency voltage.
   2. The voltage measured at the end of the 6 IN output leads of the SPD and from the zero voltage reference to the peak of the surge.

B. Let-Through Voltage:
   1. The applied surge shall be induced at the 90 degree phase angle of the applied system frequency voltage.
   2. The voltage measured at the end of the 6 IN output leads of the SPD and from the system peak voltage to the peak of the surge.

C. Maximum Continuous Operating Voltage (MCOV): The maximum steady state voltage at which the SPD device can operate and meet its specification within its rated temperature.

D. Maximum Surge Current:
   1. The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10 percent deviation of clamping voltage at a specified surge current.
   2. Listed by mode, since number and type of components in any SPD may very by mode.

E. MCC: Motor Control Center.

F. Protection Modes: This parameter identifies the modes for which the SPD has directly connected protection elements, i.e., line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), neutral-to-ground (N-G).

G. Surge Current per Phase:
   1. The per phase rating is the total surge current capacity connected to a given phase conductor.
      a. For example, a wye system surge current per phase would equal L-N plus L-G; a delta system surge current per phase would equal L-L plus L-G.
      b. The N-G mode is not included in the per phase calculation.

H. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a 480/277 V system the L-L peak voltage is 679V and the L-N peak voltage is 392 V).

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Manufacturer's qualifications.
      b. Standard catalog cut sheet.
      c. Electrical and mechanical drawing showing unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
      d. Testing procedures and testing equipment data.
      e. Create a Product Data Sheet for each different model number of SPD provided (i.e., Model XYZ with disconnect and Model XYZ without disconnect, each require a Product Data Sheet).
         1) Data in the Product Data Sheet heading:
            a) SPD Type Number per PART 2 of the Specification.
            b) Manufacturer’s Name.
            c) Product model number.
         2) Data in the Product Data Sheet body:
            a) Column one: Specified value/feature of every paragraph of PART 2 of the Specification.
            b) Column two: Manufacturer’s certified value confirming the product meets the specified value/feature.
            c) Name of the nationally recognized testing laboratory that preformed the tests.
            d) Warranty information.
         3) Data in the Product Data Sheet closing:
            a) Signature of the manufacturer’s official (printed and signed).
            b) Title of the official.
         4) Date of signature.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of submittal process.
      b. The content of the Operation and Maintenance Manuals.
   2. Warranty.

1.5 WARRANTY

A. Minimum of a five (5) year Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Standards: IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45, NEMA LS 1, MIL-STD 220B, UL 1283, UL 1449.

2.2 TYPE 1 SPD

A. Product:
   1. Integrally mounted in switchboards.
   2. Hybrid solid-state high performance suppression system.
      a. Do not use a suppression system with gas tubes, spark gaps or other components which might short or crowbar the line resulting in interruption of normal power flow to connected loads.
   3. Do not connect multiple SPD modules in series to achieve the specified performance.
   4. Designed for parallel connection.
   5. Field connection: Use mechanical or compression lugs for each phase, neutral and ground that will accept bus bar or #10 through #1/0 conductors.
   6. Device monitor:
      a. Long-life, solid state, externally visible indicators and Form C dry contact(s) that monitors the on-line status of each mode of the units suppression filter system and power loss in any of the phases.
      b. A fuse status only monitor system is not acceptable.

B. Operating Voltage: The nominal unit operating voltage and configuration as indicated on Drawings.

C. Modes of Protection: All modes.
   1. Three phase (delta): L-L, L-G.
   2. Three phase (wye): L-N, L-L, L-G and N-G.
   3. Single phase (2 pole): L-L, L-N, L-G and N-G.
   4. Single phase: L-N, L-G and N-G.

D. Maximum Continuous Operating Voltage: Less than 130 percent of system peak voltage.

E. Operating Frequency: 45 to 65 Hz.

F. Short Circuit Rating: Equal to or greater than rating of equipment SPD is connected to.

G. Maximum Surge Current: 240,000 A per phase, 120,000 A per mode minimum.

H. Minimum Repetitive Surge Current Capacity: 4000 IEEE C High waveform impulses with no degradation greater than 10 percent deviation of the clamping voltage.

I. SPD Protection:
   1. Integral unit level and/or component level overcurrent fuses and sustained overvoltage thermal cutout device.
   2. An IEEE C High waveforms shall not cause the fuse to open and render the SPD inoperable.

J. Maximum Clamping Voltages: Dynamic test at the 90 degree phase angle including 6 IN lead length and measured from the zero voltage reference:

System Voltage	Test Mode	IEEE C62.41 C High V & I Wave	IEEE C62.41 B Combination Wave	UL 1449
L-L < 250 V	L-L	1470 V	1000 V	800 V
L-N < 150 V	L-N	850 V	600 V	500 V
	L-G	1150 V	800 V	600 V
	N-G	1150 V	800 V	600 V
L-L > 250 V	L-L	2700 V	2000 V	1800 V
L-N > 150 V	L-N	1500 V	1150 V	1000 V
	L-G	2000 V	1550 V	1200 V
	N-G	2000 V	1550 V	1200 V

K. EMI-RFI Noise Rejection: Attenuation greater than 30 dB for frequencies between 100 kHz and 100 MHz.

2.3 SOURCE QUALITY CONTROL

A. SPD approvals and ratings shall be obtained by manufacturers from nationally recognized testing laboratories.

B. The SPD are to be tested as a complete SPD system including:
   1. Integral unit level and/or component level fusing.
   2. Neutral and ground shall not be bonded during testing.
   3. 6 IN lead lengths.
   4. Integral disconnect switch when provided.

C. The “as installed” SPD system including the manufacturers recommended circuit breaker, the SPD is connected to, will not open when tested with a IEEE C3 combination waveform.

D. Tests to be performed in accordance with IEEE C62.45:
   1. Clamping voltage performance testing using IEEE C62.41 Category waveforms.
   2. Single pulse surge current capacity test.
   3. Repetitive surge current capacity testing.
   4. Spectrum analysis for EMI-RFI noise rejection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Type 1 SPD:
   1. Connected in parallel to the equipment.
   2. Install in dedicated electrical equipment compartment, bucket or panelboard box at the factory before shipment.
   3. Provide leads that are as short and straight as possible.
   4. Maximum lead length: 12 IN.
   5. Minimum lead size: #2 stranded AWG or bus bar.
   6. Connect leads to the equipment to be protected by one (1) of the following means:
      a. Through a circuit breaker or molded case switch mounted in the equipment.
      b. Use manufacturer recommended circuit breaker size.
      c. Circuit breaker or switch to be operable from the equipment exterior or from behind a hinged door.

END OF SECTION

SECTION 26 50 00
INTERIOR AND EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Interior building and exterior building mounted luminaires.
      b. Exterior and site luminaires.
      c. LEDs.
      d. Drivers.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI):
      a. C78.377, Specification for the Chromaticity of Solid State Lighting Products.
   2. Federal Communications Commission (FCC):
      a. Code of Federal Regulations (CFR), 47 CFR 18, Industrial, Scientific and Medical Equipment.
   3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   4. Illuminating Engineering Society of North America (IESNA):
      a. LM-79, Electrical and Photometric Measurements of Solid-State Lighting Products.
      b. LM-80, Measuring Lumen Maintenance of LED Light Sources.
   5. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000Volts Maximum).
   6. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
      a. SSL 1, Electronic Drivers for LED Devices, Arrays and Systems.
   7. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
      b. 101, Life Safety Code.
   8. Underwriters Laboratories, Inc. (UL):
      a. 248-4, Low-Voltage Fuses - Part 4: Class CC Fuses.
      b. 924, Standard for Emergency Lighting and Power Equipment.
      c. 1012, Power Units Other Than Class 2.
      d. 1598, Luminaires.
      e. 8750, Light Emitting Diode (LED) Equipment for Use in Lighting Products.
   9. United States Department of Energy (USDOE):
      a. EPAct, the National Energy Policy Act.

1.3 DEFINITIONS

A. Useful Life for LED luminaire light sources:
   1. The operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions.
   2. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in IES LM-80.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. Identify luminaire by Luminaire Schedule designation.
      c. Luminaire data sheet:
         1) Name of manufacturer.
         2) Complete order information (catalog number).
         3) Description of construction and optics.
         4) Total input wattage.
         5) Luminous efficacy (lumens/Watt).
         6) Photometric performance data including candlepower distribution and coefficient of utilization (CU) table.
         7) Dimensional size.
         8) Weight.
         9) Effective Projected Areas (EPA) for pole mounted luminaires.
      d. Solid state Luminaire additional data:
         1) Voltage.
         2) Initial and IES L70 lumens.
         3) Luminous efficacy (lumens/Watt).
         4) Correlated Color Temperature (CCT).
         5) Color Rendering Index (CRI).
         6) Total Harmonic Distortion (THD).
         7) Lamp life.
         8) Driver manufacturer and model number.
         9) Driver life.
         10) Driver type (0-10V, constant voltage, constant current).
         11) Dimming range and control device compatibility.
         12) Remote driver: Maximum wire length to luminaire.
         13) Emergency battery driver:
            a) Compatibility with lighting module.
            b) Lumen output of lighting module in emergency operation.
            c) Battery life.
            d) Description of testing.
            e) Ambient operating temperature.
         14) Toxicity Characteristic Leaching Procedure (TCLP) compliance.
         15) Warranty information.
      e. Luminaire lamp data sheet:
         1) Name of manufacturer.
         2) Complete order information (catalog number).
         3) Wattage.
         4) Initial and mean lumens.
         5) Luminous efficacy (lumens/Watt).
         6) Correlated Color Temperature (CCT).
         7) Color Rendering Index (CRI).
         8) Lamp life.
         9) Base configuration.
         10) Toxicity Characteristic Leaching Procedure (TCLP) compliance.
         11) Warranty information.
      f. See Specification Section 26 05 00 for additional requirements.
   3. Test Reports:
      a. IES LM-79 Test Report for Solid-State Luminaire.

b. IES LM-80 Test Report Solid-State Light Source.
4. Certifications: Solid-state Luminaire Useful Life Certificate.

B. Operation and Maintenance Manuals:
1. See Specification Section 01 33 04 for requirements for:
a. The mechanics and administration of the submittal process.
2. The content of Operation and Maintenance Manuals.
a. Submittal data for each component covered by warranty.
b. Warranty.

1.5 WARRANTY

A. Minimum of a five (5) year Warranty from date of manufacture against failure for solid-state luminaire including LED arrays, LED drivers and integral control devices. The solid-state product is considered defective if more than 15 percent of the individual light emitting diodes fail to illuminate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Luminaires: Per Luminaire Schedule or approved equal.

2.2 GENERAL REQUIREMENTS

A. All Luminaires and Electrical Components:
1. UL labeled.
2. Luminaires complete.

B. Provide all recessed luminaires with gaskets of rubber, fiberglass, or equivalent material to prevent light leaks around flush trim.
1. Provide recessed luminaires with trim gaskets cemented in proper position.

C. Provide standard plaster frame for all recessed luminaires installed in plaster walls or ceilings.
1. Design, finish and fabricate material to preclude possibility of rust stain in plaster.

D. Coordinate luminaire mounting where recessed into building canopies prior to Submitting Shop Drawings. Confirm clearances and luminaire flange compatibility with construction.

E. Electrical components of recessed luminaires shall be accessible and removable through luminaire without having to remove luminaire from ceiling.

F. No live parts normally exposed to contact.

G. When intended for use in wet areas: Mark luminaire "Suitable for wet locations."

H. When intended for use in damp areas: Mark luminaire "Suitable for damp locations" or "Suitable for wet locations."

2.3 LUMINAIRES

A. Standards:
1. UL 1598.
2. NEMA LE 4 for recessed locations.

B. Fasteners:
1. As indicated in the Luminaire Schedule and the following:
a. Aluminum or steel luminaires: Cadmium-plated or an equivalent.
b. Stainless steel luminaires: Stainless steel.
c. Bronze luminaires: Bronze or stainless steel.

d. Non-metallic luminaires: Stainless steel.
e. Outdoor or wet area luminaires: Stainless steel.

C. Finishes:
1. As indicated in the Luminaire Schedule and the following:
a. Painted surfaces:
1) Manufacturer's standard metal pretreatment and baked or air-dried, light-stabilized enamel finish; acrylic, alkyd, epoxy, polyester or polyurethane.
2) White finishes shall have minimum 85 percent reflectance.
b. Unpainted surfaces:
1) Interior: Clear anodic coating, satin finish.
2) Exterior: Clear anodic coating.

D. Lens/Louver Frames:
1. As indicated in the Luminaire Schedule and the following:
a. Extruded aluminum with mitered corners.
b. Hinging or other normal motion shall not cause lens or louver to drop out.
c. No light leak between frame and housing.

E. Lenses:
1. As Indicated in the Luminaire Schedule and the Following:
a. 100 percent virgin, UV stabilized acrylic.
b. Luminaires with directional lenses shall include a lens orientation device to ensure that lens installation provides light distribution as designed.
c. No light leaks between the lens and the luminaire.

F. Reflectors:
1. As Indicated in the Luminaire Schedule.

G. Gaskets:
1. As Indicated in the Luminaire Schedule and the Following:
a. Gaskets at face plates or frames of recessed luminaires which serve as ceiling trim and which allow interior access.
b. Moisture seal gaskets at exterior locations and in other designated wet areas.
c. Secure frames to luminaire bodies with screws or other means, to result in tight installation, without light leaks.

H. Wiring:
1. Factory-wired to be compatible with the project electrical and controls systems.

I. Mounting Accessories:
1. Provide appropriate mounting accessories for each luminaire, compatible with various structural conditions encountered.
2. All luminaires with adjustable beam angles shall have a locking device to ensure that the beam distribution is not effected during relamping or cleaning.
3. Recessed Luminaires:
a. Plaster Frames: Provide frames for luminaires installed in gypsum board and concealed suspension system ceiling tile. Make frames of non-ferrous metal or suitably rustproof after fabrication.
b. Baffles and Gaskets: As required to prevent light leakage.
c. Flanged luminaires are required in all ceiling systems except exposed grid lay-in panel type.
4. Luminaire Suspension Material:
a. Unfinished Spaces:
1) 1/2 IN minimum diameter swivel stem, unless otherwise noted.
2) Safety chain on high bay type.

2.4 EMERGENCY LIGHTING UNITS

A. Standards:

1. UL 924.
2. NFPA 101.

B. Emergency Lighting Units: As indicated in the Luminaire Schedule.
1. Battery type: As indicated in the Luminaire Schedule.
2. Consist of battery, charger and electronic circuitry.
3. Solid state charging indicator light to monitor the charger and battery.
4. Single-pole test switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate Luminaire Types with Ceiling Construction:
1. Provide mounting hardware for the ceiling system in which the luminaire is to be installed.

B. Provide mounting brackets and/or structural mounting support for wall-mounted luminaires.
1. Do not support luminaire from conduit system.
2. When luminaire is supported from outlet boxes, install per NFPA 70.
3. Supports for luminaire mounted on exterior walls shall not be attached to exterior face of the wall.

C. Support surface mounted luminaires from the building structure and not from the ceiling suspension system.
1. Luminaires up to 4 FT wide and 4 FT long: A minimum of four supporting points, one at each corner.
2. Luminaires 8 FT long: A minimum of five support points, one at center of luminaire and one at each corner.
3. Luminaires smaller than 2 FT in length: A minimum of two supporting points.

D. Provide pendant luminaires with swivel hangers which will allow luminaire to swing in any direction but will not permit stem to rotate.
1. Provide hangers with enclosure rating (NEMA 1 or 4) equal to enclosure requirements of area in which they are installed.
2. Swivel hangers for luminaires in mechanical equipment areas: Shock absorbing type.
3. Secure low and high bay luminaires with safety chain or safety aircraft cable to the building structure.
a. Chain or cable to prevent luminaire from falling more than 3 IN before the luminaire is caught by the chain or cable.

E. Pendant Mounted:
1. Not in continuous rows:
a. Supported by conduit or by approved chains or cable:
b. Hardwired to ceiling mounted junction box.
2. In continuous rows:
a. Supported rigidly with conduit and fasten luminaire to each other or mount on continuous metal channel per Specification Section 26 05 00.
b. Hardwired to ceiling mounted junction box.
c. Provide reflector alignment clips.

F. Provide access panels for recessed luminaires that require access for maintenance when such access is not provided for in design of luminaire.

G. Mount luminaire at heights indicated in Specification Section 26 05 00 or per Luminaire Schedule or as indicted on the Drawings.

H. Install exterior luminaires so that water can not enter or accumulate in the wiring compartment.

I. Ground luminaire and ballasts.

3.2 LIGHTING CONTROL

A. As shown on Drawings.

3.3 ADJUST AND CLEAN

A. See Specification Section 01 74 13.

B. Aim all emergency lighting units, so that, the path of egress is illuminated.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Site clearing, tree protection, stripping topsoil and demolition.

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing trees and other vegetation to remain against damage.
   1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
   2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
   3. Provide temporary protection as required.

B. Repair or replace trees and vegetation damaged by construction operations.
   1. Repair to be performed by a qualified tree surgeon/licensed arborist.
   2. Remove trees which cannot be repaired and restored to full-growth status.
   3. Replace with new trees of minimum 4 IN caliper or as required by local tree ordinance.

C. Owner will obtain authority for removal and alteration work on adjoining property, as applicable.

3.2 SITE CLEARING

A. Topsoil Removal:
   1. Strip topsoil to depths encountered, 6” minimum.
      a. Remove heavy growths of grass before stripping.
      b. Stop topsoil stripping sufficient distance from such trees to prevent damage to main root system.
      c. Separate from underlying subsoil or objectionable material.
   2. Do not strip topsoil in wooded areas where no change in grade occurs.
   3. Borrow topsoil: Reasonably free of subsoil, objects over 2 IN DIA, weeds and roots.

B. Clearing and Grubbing:
   1. Clear from within limits of construction all trees not marked to remain.
      a. Include shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, structures and debris.
   2. Grub (remove) from within limits of construction all stumps, roots, root mats, logs and debris encountered.

C. Disposal of Waste Materials:
   1. Do not burn combustible materials on site.
   2. Remove all waste materials from site.
   3. Do not bury organic matter on site.

END OF SECTION

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SECTION 31 23 00
EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Earthwork - excavation, backfilling, grading, compaction, disposal of waste and surplus materials, placing crushed stone, construction of berms, sheeting, bracing, dewatering and other Earthwork related work.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C33, Standard Specification for Concrete Aggregates.
      b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).
      c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3(2,700 kN-m/m)).
      d. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
      e. D3786, Standard Test Method for Bursting Strength of Textile Fabrics--Diaphragm Bursting Strength Tester Method.
      f. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
      g. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
      h. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
   2. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR Part 1926.650, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

1.3 DEFINITIONS

A. Excavation:
   1. Consists of removal of material encountered to subgrade elevations required or indicated.
   2. Includes excavation of soils; pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; boulders; and rock.

B. Foundations: Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.

C. Non-Structural Fill/Backfill: Soil materials placed and compacted to achieve finish grade elevations that do NOT support foundations, slabs, paving, or other flatwork.

D. Engineer: Independent geotechnical specialist providing field quality control for the project.

E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

F. Subgrade: The earth or soil layer immediately below foundation bearing elevation, subbase material, fill material, backfill material, or topsoil materials.

G. Unauthorized Excavation:
   1. Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer.

a. Unauthorized excavation, as well as remedial work directed by Engineer shall be at Contractor's expense.

2. Unsuitable Soil Materials: Soil materials encountered at or below subgrade elevation of insufficient character to support construction as determined by the Engineer.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's installation instructions.
3. Certifications.

B. Samples:
1. Submit samples and source of fill and backfill materials proposed for use.
2. Submit samples and source of borrow materials proposed for use.
3. Test reports.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill and Backfill:
1. Selected material approved by Engineer from site excavation or from off site borrow. Meeting the following requirements:
a. Organic content: < 3% by volume.
b. Free of debris and other deleterious materials.
c. Maximum dimension: 4 IN
d. Gradation: > 85% passing 2-1/2 IN sieve
e. Liquid limit: < 40%
f. Maximum plasticity index: 15

B. Granular Fill Under Base Slabs:
1. Drainage material: Conform to ASTM C33, Size No. 67.

C. Geotextile Filter Fabric:
1. Nonwoven type.
2. Equivalent opening size: 50-100 (U.S. Standard Sieve).
3. Permeability coefficient (cm/second): 0.07 minimum, 0.30 maximum.
4. Grab strength: 90 LBS minimum in either direction in accordance with ASTM D4632 requirements.
5. Mullen burst strength: 125 psi minimum in accordance with ASTM D3786 requirements.

PART 3 - EXECUTION

3.1 PROTECTION

A. Erosion Control:
1. See Specification Section 31 25 00.
2. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
3. Conduct work to minimize erosion of site. Remove eroded material washed off site.
a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.

B. Protect existing surface and subsurface features on-site and adjacent to site as follows:
   1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
   2. Protect and maintain bench marks, monuments or other established reference points and property corners.
      a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
   3. Verify location of utilities.
      a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
      b. Secure and examine local utility records for location data.
      c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
         1) If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
         2) Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
         3) Obtain Owner's approval prior to disconnecting any utility service
      d. Repair damages to utility items at own expense.
      e. In case of damage, notify Engineer at once so required protective measures may be taken.
   4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
      a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
      b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
      c. All repairs to be made and paid for by Contractor.
   5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
   6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
   7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

C. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.

D. Dispose of waste materials, legally, off site.
   1. Burning, as a means of waste disposal, is not permitted.

3.2 SITE EXCAVATION AND GRADING

A. The site excavation and grading work includes the offsite disposition of all material:
   1. That exceed quantities required for earthwork on the project.
   2. That the Engineer classifies as unclassified excavation.
   3. That the Engineer classifies as unacceptable.
   4. That the Engineer classifies as potentially contaminated.

B. Excavation and Grading:
   1. Perform as required by the Contract Drawings.
   2. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
      a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
      b. Perform other layout work required.
      c. Replace property corner markers to original location if disturbed or destroyed.

3. Preparation of ground surface for embankments or fills:
    a. Before fill is started, scarify to a minimum depth of 6 IN in all proposed embankment and fill areas.
    b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
4. Protection of finish grade:
    a. During construction, shape and drain embankment and excavations.
    b. Maintain ditches and drains to provide drainage at all times.
    c. Protect graded areas against action of elements prior to acceptance of work.
    d. Reestablish grade where settlement or erosion occurs.

C. Borrow:
1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
2. Include cost of all borrow material in original proposal.
3. Fill material to be approved by Engineer prior to placement.

D. Construct embankments and fills as required by the Contract Drawings:
1. Construct embankments and fills at locations and to lines of grade indicated.
    a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.
    a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of fill or embankment.
    b. Do not place material in layers greater than 8 IN loose thickness.
    c. Place layers horizontally and compact each layer prior to placing additional fill.
3. Compact by sheepsfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
    a. Control moisture for each layer necessary to meet requirements of compaction.

3.3 USE OF EXPLOSIVES

A. Blasting with any type of explosive is prohibited.

3.4 FIELD QUALITY CONTROL

A. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA standards 29 CFR Part 1926.650 Subpart P, and state requirements. Where conflict between OSHA and state regulations exists, the more stringent requirements shall apply.

B. Do not include in bid price the cost of inspection services indicated herein as being performed by the Engineer.

C. Services will include verification and documentation of satisfactory soil materials, sampling and testing of proposed soil materials, and field testing for quality control.
1. Test reports to include the following:
    a. Report and certification of aggregate fill and drainage fill.
    b. Test reports on borrow material.
    c. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
    d. Field reports; in-place soil density tests.
    e. One optimum moisture-maximum density curve for each type of soil encountered.
    f. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.
    g. Other documentation necessary for Engineer to approve earthwork.

D. Moisture density relations, to be established by the Engineer required for all materials to be compacted.

E. Extent of compaction testing will be as necessary to assure compliance with specifications.

F. Give minimum of 24 HR advance notice to Engineer when ready for compaction or subgrade testing and inspection.

G. Should any compaction density test or subgrade inspection fail to meet specification requirements, perform corrective work as necessary, at no additional expense to Owner.

H. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests.

3.5 COMPACTION DENSITY REQUIREMENTS

A. Obtain approval from Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

B. Provide dewatering system necessary to successfully complete compaction and construction requirements.

C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Engineer.

D. Stabilize subgrade with well graded granular materials as directed by Engineer.

E. Assure by results of testing that relative compaction levels comply with the following requirements:

1. Sitework:

LOCATION	RELATIVE COMPACTION
Under Paved Areas, Sidewalks:	95 percent per ASTM D 1557
Unpaved Areas:	90 percent of ASTM D 1557

2. Structures:

LOCATION	COMPACTION DENSITY
Inside of structures under foundations, under equipment support pads, under slabs-on-grade and scarified existing subgrade under fill material	100 percent (CLSM)/95 percent per ASTM D1557
Outside structures next to walls, piers, columns and any other structure exterior member	100 percent (CLSM)/95 percent per ASTM D1557

3. Specific areas:

LOCATION	COMPACTION DENSITY
Outside structures under equipment support foundations	95 percent per ASTM D1557
Granular fill under building floor slabs-on-grade	100 percent (CLSM)

3.6 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. General:
   1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
   2. Obtain fill and backfill material necessary to produce grades required.
      a. Materials and source to be approved by Engineer.
      b. Excavated material approved by Engineer may also be used for fill and backfill.
   3. In the paragraphs of this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation Requirements for Structures:
   1. General:
      a. Do not commence excavation for foundations for structures until Engineer approves:
         1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
         2) Density and moisture content of site area compacted fill material meets requirements of specifications.
         3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
         4) Surcharge or mass fill material has been removed from construction area or portions thereof.
      b. Engineer grants approval to begin excavations.
   2. Dimensions:
      a. Excavate to elevations and dimensions indicated or specified.
      b. Allow additional space as required for construction operations and inspection of foundations.
      c. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
      d. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
   3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
      a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Engineer.
      b. Remove unsuitable subgrade soils located below foundations. The bottom of the overexcavation shall be located outside the exterior limits of foundations around the perimeter of structure the following horizontal distance, whichever is greater:
         1) Distance equal to depth of overexcavation below bottom of foundations.
         2) 5 FT.
         3) As directed by Engineer.
      c. When excavation has reached required subgrade elevations, notify Engineer, who will make an inspection of conditions.
         1) If Engineer determines that bearing materials at required subgrade elevations are unsuitable, provide Subgrade Stabilization as specified herein.
   4. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill.
      a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
      b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6 IN and then compact to density stated in this Specification Section before fill material can be placed thereon.

c. Do not carry excavations lower than shown for foundations except as directed by Engineer.
d. If any part of excavations is carried below required depth without authorization, notify Engineer and correct unauthorized excavation as directed. Corrections may include:
    1) Under soil supported footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
        a) CLSM fill may be used to bring elevations to proper position.
    2) In locations other than those above, including slabs on grade and pile supported foundations, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.
    3) No extra compensation will be made to Contractor for correcting unauthorized excavations.

5. Make excavations large enough for working space, forms, dampproofing, waterproofing, and inspection.
6. Notify Engineer as soon as excavation is completed in order that subgrades may be inspected.
    a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under equipment support pads, and under retaining wall footings has been inspected and approved by the Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.
    b. Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.
    c. Place fill material, foundations, retaining wall footings, floor slabs-on-grade, and equipment support pads as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.
    d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.
7. Dewatering:
    a. Groundwater will be encountered during excavation. Install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
    b. Groundwater shall be maintained at least 3 FT below the bottom of any excavation.
    c. Before beginning excavation, determine where groundwater is likely to be encountered during excavation.
    d. Employ dewatering specialist for selecting and operating dewatering system.
    e. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
    f. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
        1) Install groundwater monitoring wells as necessary.
    g. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Subgrade stabilization:
    a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Engineer.
    b. Provide compaction density of replacement material as stated in this Specification Section.

c. Loose, wet, or soft materials, when approved by Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.
e. Remove and replace frozen materials as directed by Engineer.
f. Method of stabilization shall be performed as directed by Engineer.
g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Engineer.

9. Do not place floor slabs-on-grade including equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence slab construction.
   a. Do not place building floor slabs-on-grade including equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40 DegF before structure is completed and heated to a temperature of at least 50 DegF.
10. Protection of structures:
    a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
    b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.
11. Shoring:
    a. Shore, sheet pile, slope, or brace excavations as required to prevent them from collapsing.
    b. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.
    c. Construct shoring that is required retain water as part of the dewatering system, using non-permeable details such as interlock sealant for sheet piles.
12. Drainage:
    a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
    b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.
    c. Provide pumping required to keep excavated spaces clear of water during construction.
    d. Should any water be encountered in the excavation, notify Engineer and Engineer.
    e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.
13. Frost protection:
    a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
    b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.
    c. Protect excavation from frost if placing of concrete or fill is delayed.
    d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.
    e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 DegF.

C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs, Floor Slabs, Equipment Support Pads and Piping:
   1. General:
      a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Engineer and scarified to a depth of 6 IN and compacted to density specified herein.

b. Surface may be stepped by at not more than 12 IN per step or may be sloped at not more than 2 percent.
c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Engineer as being free of undesirable material and compacted to specified density.

2. Obtain approval of fill and backfill material and source from Engineer prior to placing the material.
3. Granular fill under floor slabs-on-grade: Where required in the Drawings, place all floor slabs-on-grade on a minimum of 6 IN of granular fill unless otherwise indicated.
4. Fill and backfill placement:
   a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Engineer.
   b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
   c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
   d. Use hand operated equipment for filling and backfilling within 5 FT of walls and less than 3 FT above pipes
      1) Compaction equipment exceeding 3000 LBS dead weight shall not be used within 5 FT of the wall as a minimum
      2) Contractor is responsible for method of compaction so as not to damage wall.
   e. Use hand operated equipment for filling and backfilling next to walls.
   f. Do not place fill and backfill when the temperature is less than 40 DegF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
   g. Use vibratory equipment to compact granular material; do not use water.
5. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content. Provide structural fill material as required to fill the specified overexcavation to bottom of foundation.

D. Filling and Backfilling Outside of Structures.
1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
2. Provide material as approved by Engineer for filling and backfilling outside of structures.
3. Fill and backfill placement:
   a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Engineer.
   b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
   c. Compact material with equipment of proper type and size to obtain density specified.
   d. Use hand operated equipment for filling and backfilling within 5 FT of walls and less than 3 FT above pipes
      1) Compaction equipment exceeding 3000 LBS dead weight shall not be used within 5 FT of the wall as a minimum
      2) Contractor is responsible for method of compaction so as not to damage wall.
   e. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
   f. Do not place fill or backfill material when temperature is less than 40 DegF and when subgrade to receive material is frozen, wet, loose, or soft.
   g. Use vibratory equipment for compacting granular material; do not use water.
4. Backfilling against walls:
   a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.
   b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, dampproofing and waterproofing have been completed.

c. Do not place fills against walls until floor slabs at top, bottom, and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.
d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.

E. Backfilling Outside of Structures Under Piping or Paving:
1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Specification Section.
2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.
3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Specification Sections for the Project.

END OF SECTION

SECTION 31 23 33
TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation, trenching, backfilling and compacting for all underground utilities.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 FT-LBF/FT^3 (600 kN-M/M^3)).
      b. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
      c. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

A. Excavation: All excavation will be defined as unclassified.

B. CLSM: Controlled Low Strength Material.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   2. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
   3. Submit sieve analysis reports on all granular materials.
   4. Excavation Support System:
      a. Submit prior to the installation of excavation support system the following:
         1) Supporting calculations sealed by a Professional Engineer licensed in the State where the project is located.
         2) Detail drawings sealed by a Professional Engineer licensed in the State where the project is located, showing type and location of support system.

B. Informational Submittals:
   1. Trench shield (trench box) certification if employed:
      a. Specific to Project conditions.
      b. Re-certified if members become distressed.
      c. Certification by registered professional structural engineer, registered in the state where the Project is located.
      d. Engineer is not responsible to, and will not, review and approve.

1.5 SITE CONDITIONS

A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
   1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.

B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.

D. Verify location of existing underground utilities.

1.6 REGULATORY REQUIREMENTS

A. Regulatory requirements that govern the work of this Section include the following governing codes:
   1. California Code of Regulations, Title 8, Chapter 4, Subchapter 4 – Construction Safety Orders, and Subchapter 19 – Trench Construction Safety Orders.
   2. California Code of Regulations, Title 24, Part 2, California Building Code, Chapter 33 and Appendix Chapter 22, and Structural Chapters 18 and 18A.
      a. Evacuations shall be defined or classified as being in excess of 12 feet in depth below grade, and, as such, shall comply fully with the requirements of Sections 3301.2, 3301.2a, and 3301.03 of the California Building Code.
      b. Contrary to certain provisions of the California Building Code, Sections 3301.2 and 3301.2a, extensions of foundations, if any, regardless of depth, shall be at the expense of the Contractor, and the Contractor shall make provisions for such expense.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Material:
   1. As approved by Engineer.
      a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
      b. Moisture content at time of placement: ±3% of optimum moisture content as specified in accordance with ASTM D698.

B. Bedding Material:
   1. Granular materials:
      a. Must consist of sand:
         1) Free of clay or organic material
         2) Suitable for the purpose intended
         3) Complying with the gradation requirements shown in the following table:

Sieve size	Percentage passing
No. 4	90–100
No. 200	0–5

C. CLSM and Embedment Material:
   1. Flowable fill:
      a. Description: Flowable fill shall be a mixture of cement, fly ash, fine sand, water, and air having a consistency which will flow under a very low head.
      b. Material characteristics:
         1) The approximate quantities of each component per cubic yard of mixed material shall be as follows:
            a) Cement (Type I or II): 50 LBS.
            b) Fly ash: 200 LBS.
            c) Fine sand: 2,700 LBS.
            d) Water: 420 LBS.
            e) Air content: 10%.
         2) Actual quantities shall be adjusted to provide a yield of 1 cubic yard with the materials used.
         3) Approximate compressive strength should be 85 to 175 PSI.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Owner.

B. Excavation for Appurtenances:
   1. 12 IN (minimum) clear distance between outer surface and embankment.

C. Groundwater Dewatering:
   1. Groundwater is expected to be encountered during excavation. Install a dewatering system to prevent softening and disturbance of subgrade to allow subgrade stabilization, pipe, bedding and backfill material to be placed in the dry, and to maintain a stable trench wall or side slope.
   2. Groundwater shall be drawn down and maintained at least 3 FT below the bottom of any trench excavation prior to excavation.
   3. Employ dewatering specialist for selecting and operating dewatering system.
   4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
   5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
   6. Install groundwater monitoring wells as necessary.
   7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
   8. Cost of groundwater dewatering shall be included in the lineal foot unit price of the pipe installation.

D. Trench Excavation:
   1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
      a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
         1) Stabilize excavation to prevent undermining of existing utility [and yard piping].
   2. Open trench outside buildings, units, and structures:
      a. No more than 300 LF.
      b. Field adjust limitations as weather conditions dictate.
   3. Any trench or portion of trench, which is opened and remains idle for [seven] calendar days, or longer, as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
      a. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.
   4. Observe following trenching criteria:
      a. Trench size:
         1) Excavate width to accommodate free working space.
         2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

OVERALL DIAMETER OF UTILITY SERVICE	EXCESS DIMENSION
33 IN and less	18 IN
more than 33 IN	24 IN

         3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.

4) Keep trenches free of surface water runoff.
   a) Include cost in Bid.
   b) No separate payment for surface water runoff pumping will be made.

E. Trenching for Electrical Installations:
   1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification Section.
   2. Modify for electrical installations as follows:
      a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN but not more than 30 IN wide.
      b. Any length of trench may be opened in exterior locations for trenches which are 12 IN wide or less.
      c. Do not over excavate trench.
      d. Cut trenches for electrical runs with minimum 30 IN cover, unless otherwise specified or shown on Drawings.
      e. See Division 26 for additional requirements.

F. Flowable Fill:
   1. Flowable fill shall be:
      a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.
      b. Placed in 4 FT maximum lifts to the elevations indicated.
         1) Allow 12 HR set-up time before placing next lift or as approved by the Engineer.
         2) Place flowable fill lifts in such a manner as to prevent flotation of the pipe.
   2. Flowable fill shall not be placed on frozen ground.
   3. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
   4. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 DEGF and rising.
   5. At the time of placement, flowable fill must have a temperature of at least 40 DEGF.
   6. Mixing and placing shall stop when the air temperature is 38 DEGF or less and falling.
   7. Each filling stage shall be as continuous an operation as is practicable.
   8. Prevent traffic contact with flowable fill for at least 24 HRS after placement or until flowable fill is hard enough to prevent rutting by construction equipment.
   9. Flowable fill shall not be placed until water has been controlled or groundwater level has been lowered in conformance with the requirements of the preceding Groundwater Dewatering paragraph in PART 3 of this Specification Section.

G. Shoring:
   1. Shore, slope, or brace excavations as required to prevent them from collapsing.
   2. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.
   3. Construct shoring that is required to retain water as part of the dewatering system, using non-permeable details such as interlock sealant for sheet piles.

3.2 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Over-Excavation:
   1. Backfill and compact to 90% of maximum dry density per ASTM D698.
   2. Backfill with granular bedding material as option.

B. Rock Excavation:
   1. Excavate minimum of 6 IN below bottom exterior surface of the pipe or conduit.
   2. Backfill to grade with suitable earth or granular material.
   3. Form bell holes in trench bottom.

C. Subgrade Stabilization:
   1. Stabilize the subgrade when directed by the Owner.
   2. Observe the following requirements when unstable trench bottom materials are encountered.

a. Notify Owner when unstable materials are encountered.
   1) Define by drawing station locations and limits.
b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
   1) Replace with subgrade stabilization with no additional compensation.

3.3 BACKFILLING METHODS

A. Do not backfill until tests to be performed on system show system is in full compliance with specified requirements.

B. Carefully Compacted Backfill:
   1. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 IN above top of pipe or conduit.
   2. Comply with the following:
      a. Place backfill in lifts not exceeding 8 IN (loose thickness).
      b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
      c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
      d. Compact each lift to specified requirements.

C. Common Trench Backfill:
   1. Perform in accordance with the following:
      a. Place backfill in lift thicknesses capable of being compacted to densities specified.
      b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
      c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.

D. Water flushing for consolidation is not permitted.

E. Backfilling for Electrical Installations:
   1. Observe the preceding Carefully Compacted Backfill paragraph or Common Trench Backfill paragraph in PART 3 of this Specification Section or when approved by the Engineer.
   2. Modify for electrical installation as follows:
      a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.4 COMPACTION

A. General:
   1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
   2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. Compaction Requirements:
   1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.
      a. Bedding and Embedment material:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	75% relative density by ASTM D4253 and ASTM D4254

b. Carefully compacted backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All applicable areas	Cohesive soils	95% of maximum dry density by ASTM D698
	Cohesionless soils	75% relative density by ASTM D4253 and ASTM D4254

c. Common trench backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
Under pavements	Cohesive soils	95% of maximum dry density by ASTM D698
	Cohesionless soils	75% of relative density by ASTM D4253 and ASTM D4254

3.5 FIELD QUALITY CONTROL

A. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA Standards, and state requirements. Where conflict between OSHA and state regulations exists, the more stringent requirements shall apply.

B. Testing:
1. Perform in-place moisture-density tests as directed by the Owner.
2. Perform tests through recognized testing laboratory approved by Owner.
3. Costs of "Passing" tests paid by Owner.
4. Perform additional tests as directed until compaction meets or exceeds requirements.
5. Cost associated with "Failing" tests shall be paid by Contractor.
6. Reference to Engineer in this Specification Section will imply Geotechnical Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
7. Assure Owner has immediate access for testing of all soils related work.
8. Ensure excavations are safe for testing personnel.

END OF SECTION

SECTION 32 12 16
ASPHALTIC CONCRETE VEHICULAR PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Asphaltic concrete vehicular paving.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Federal Specifications (FS):
      a. TT-P-115F, Paint, Traffic (Highway, White and Yellow).
   2. Construction standards: State of California, Department of Transportation, "Caltrans," 2015, as amended to date.

B. Miscellaneous:
   1. Should conflicts arise between standard specifications of government agencies mentioned herein and Contract Documents, Contract Documents shall govern.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Asphalt design mix.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphaltic Concrete: Per Caltrans.
   1. Mix commonly used in City of Fort Bragg.

B. Aggregate Base:
   1. Class II per Caltrans.

C. Line Paint:
   1. Nonreflective.
   2. White.
   3. FS TT-P-115F.

2.2 MIXES

A. Comply with mix design category Type A, per Caltrans.

PART 3 - EXECUTION

3.1 APPLICATION

A. Construct to line, grade and section as shown on Drawings and in accordance with referenced State Specifications.

B. Spread a prime coat uniformly on compacted aggregate base course at rate of 0.05 to 0.10 GAL per square yard in accordance with Section 26 of State Specifications.

C. Install a 3 IN surface course, in accordance with Section 39 of State Specifications

D. Tolerance of Finished Grade: +0.10 FT from required elevations.

E. Line Painting:
   1. Thoroughly clean surfaces which are to receive paint.
   2. Make completely dry before paint is applied.
   3. Do not paint until minimum of five (5) days has elapsed from time surface is completed.
      a. A longer period may be required if directed by Engineer.
   4. Do not apply paint over wet surfaces, during wet or damp weather, or when temperature is below 40 DegF.
   5. Lay out markings and striping in accordance with Drawings.
      a. Width of painted lines: 4 IN.

END OF SECTION

SECTION 33 05 16
PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Precast concrete structures and appurtenant items.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A48/A48M, Standard Specification for Gray Iron Castings.
      b. C150/C150M, Standard Specification for Portland Cement.
      c. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
      d. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
      e. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
      f. D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Fabrication and/or layout drawings:
      a. Include detailed diagrams of precast structures showing typical components and dimensions, reinforcements and other details.
      b. Itemize, on separate schedule, sectional breakdown of each precast structure with all components and refer to drawing identification number or notation.
      c. Indicate knockout elevations for all piping entering each precast structure.

B. Unless approved prior to submittal, submit all products from this Specification Section in one complete submittal package. Include all products and accessories together.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Precast structure rings, covers and frames:
      a. Neenah Foundry and Neenah Enterprises, Inc.
      b. Deeter Foundry.
   2. Black mastic joint compound:
      a. Kalktite 340.
      b. Tufflex.
      c. Plastico.
   3. Premolded joint compound:
      a. RAM-NEK.
      b. Kent Seal.

4. Emulsified fibrated asphalt compound:
    a. Sonneborn Hydrocide 700B.

2.2 PRECAST STRUCTURE COMPONENTS

A. Precast Structure Components:
1. Reinforcement: ASTM C478.
2. Minimum wall thickness: 5 IN.
3. Minimum base thickness: 12 IN.
4. Provide the following components for each precast structure:
    a. Base (precast) with integral bottom section or (cast-in-place).
    b. Precast bottom section(s).
    c. Precast barrel section(s).
    d. Precast eccentric transition section.
    e. Precast adjuster ring(s).
    f. Precast concrete transition section.
    g. Precast flat top with opening for access door.
    h. Circular or rectangular as shown on Drawings.
5. Unless dimensioned or specifically noted on Drawings, provide precast structure section with minimum 48 IN inside dimensions.

B. Nonpressure Type Frames and Cover:
1. Cast iron frame and covers: ASTM A48/A48M, Class 35 (minimum).
2. Use only cast ductile iron of best quality, free from imperfections and blow holes.
3. Furnish frame and cover of heavy-duty construction a minimum total weight of 450 LBS.
4. Machine all horizontal surfaces.
5. Furnish unit with solid nonventilated lid with concealed pickholes.
    a. Letter covers "SEWER" for all collection system precast structures, "DRAIN" for all gravity unit drains returning flow to the headworks, and "STORM" for storm sewer systems.
6. Ensure minimum clear opening of 24 IN DIA.
7. Bolted down removable grating cover:
    a. Metal fabrication per Section 05 50 00.

C. Access Doors:
1. See Section 08 31 00.
2. Sizes as shown on Drawings.
3. Access hatch and access door are equivalent terms.

D. Special Coatings and Joint Treatment:
1. Joints of precast sections:
    a. Black mastic compound: ASTM D4586.
2. Vertical wall surfaces:
    a. Emulsified fibrated asphalt compound meeting ASTM D1227 Type II for all exterior and interior vertical wall surfaces.

PART 3 - EXECUTION

3.1 PRECAST STRUCTURE CONSTRUCTION

A. General:
1. Construct cast-in-place concrete base slabs.
2. Make inverts with a semi-circular bottom conforming to the inside contour of the adjacent sewer sections.
3. On all straight runs, lay pipe through precast structure and cut out top half of pipe.
    a. See detail on Drawings.
    b. If pipes deflect at precast structure, shape as specified in Paragraphs 2 and 4 in this General Paragraph.
4. Shape inverts accurately and steel trowel finish.

a. For changes in direction of the sewer and entering branches into the precast structure, make a circular curve in the precast structure invert using as large a radius as precast structure inside diameter will permit.
b. Pour base slab integral with bottom barrel section.

B. Build each precast structure to dimensions shown on plans and at such elevation that pipe sections built into wall of precast structure will be true extensions of line of pipe.

C. For all horizontal mating surfaces between concrete and concrete or concrete and metal, above established high groundwater elevation shown trowel apply to clean surface black mastic joint compound to a minimum wet thickness of 1/4 IN immediately prior to mating the surfaces.

D. For horizontal joints that fall below established high groundwater elevation shown, install a resilient O-ring type gasket or pre-molded joint compound.

E. Seal all pipe penetrations in precast structure.
1. Form pipe openings smooth and well shaped.
2. After installation, seal cracks with, non shrink grout.
3. After grout cures, wire brush smooth and apply two coats emulsified fibrated asphalt compound to minimum wet thickness of 1/8 IN to ensure complete seal.

F. Set and adjust frame and cover final 6 IN (minimum) to 18 IN (maximum) to match finished pavement or finished grade elevation using precast adjuster rings.

END OF SECTION

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SECTION 33 47 13
GEOMEMBRANE LINER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The work shall consist of furnishing and installing a Linear Low Density Polyethylene (LLDPE) liner and the necessary mechanical attachments as shown in the drawings or as specified herein. Unless otherwise specified, LLDPE liner system shall be constructed in strict accordance to manufacturer's recommendations.
   2. The following basins/ponds shall be lined per this specification:
      a. Raw Water Storage Pond/Basin No.1.
      b. Raw Water Storage Pond/Basin No.2.

A. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 31 23 00 - Earthwork.

1.2 REFERENCES

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. ASTM D638, Standard Test Method for Tensile Properties of Plastics
      b. ASTM D792, Methods for Density and Specific Gravity of Plastics by Displacement
      c. ASTM D1004, Test Method for Initial Tear Resistance of Plastic Film and Sheeting
      d. ASTM D1505, Test Method for Density of Plastics by the Density-Gradient Technique
      e. ASTM D1603, Standard Test Method for Carbon Black in Olefin Plastics
      f. ASTM D4437, Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes
      g. ASTM D4759, Standard Practice for Determining the Specification Conformance of Geosynthetics
      h. ASTM D4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
      i. ASTM D5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembrane Using Notched Constant Tensile Load Test
      j. ASTM D5596, Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
      k. ASTM D5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber
      l. ASTM D5885, Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
      m. ASTM D6392, Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
      n. ASTM D6497, Standard Guide for Mechanical Attachment of Geomembrane to Penetrations or Structures.
      o. ASTM D6693, Determining Tensile Properties of Non-reinforced Polyethylene and Non-reinforced flexible Polypropylene Geomembranes.
   2. American Water Work Association (AWWA):
      a. C652, Disinfection of Water Storage Facilities.
      b. D130, Geomembrane Materials for Potable Water Applications.
   3. NSF:
      a. NSF/ANSI-61, Drinking Water System Components - Health Effects.

B. Quality Assurance:
   1. Manufacturer shall have in place a Manufacturer Quality Control (MQC) program to ensure compliance with material and workmanship specifications.
   2. Manufacturer shall have in place a Manufacturer Quality Assurance (MQA) program for impartial verification of compliance with material and workmanship specifications.
   3. Fabricator shall have in place a project specific Fabrication Quality Control (FQC) program to maintain quality and conformance with project drawings and specifications.
   4. Fabricator shall have in place a Fabricator Quality Assurance (FQA) program for impartial verification of compliance with material and workmanship specifications.
   5. The Owner may conduct independent routine testing and observations to verify the product meets requirements of Project Drawings and Specifications.
   6. Contractor/Installer shall have in place a project specific Construction Quality Control (CQC) program to maintain quality and conformance with project drawings and specifications.
   7. Contractor/Installer shall have in place a Construction Quality Assurance (CQA) program for impartial verification of compliance with material and workmanship specifications.
      a. Contractor’s Quality Assurance Goals:
         1) The basic goals of quality assurance shall be to ensure that the highest standards of workmanship and performance are exercised in the execution of the work; that the work is in complete compliance with the contract documents; and to implement a quality assurance program that will:
            a) Verify and document, through testing, that all liner materials are in accordance with the minimum stated specification requirements;
            b) Verify and document that all materials adjacent to the liner materials are placed in accordance with the Specifications, approved shop drawings, and in such a manner that the integrity of the liner installation is not compromised;
            c) Verify and document, through monitoring, that all liner materials are installed in accordance with the specifications and approved shop drawings;
            d) Record the results of Quality Assurance activities on the project in the form of a Final Report.
      b. Scope of Contractor’s Quality Assurance Plan:
         1) The Contractor shall thoroughly review and comprehend the contract documents. prior to the development of the quality assurance plan. The Contractor's Quality Assurance Plan shall be mutually consistent with the Project Specifications, and the Contractor shall not substitute less stringent requirements for those specified.
         2) The Contractor's Quality Assurance Plan shall state in writing how the following items shall be accomplished and shall include sample forms to be used to document each quality assurance activity. The major heading and subheadings list those tasks, as a minimum, which shall be included in the quality assurance plan. The Contractor shall include any additional pertinent information and topics as appropriate.
            a) Materials:
               (1) Monitor and document the unloading, handling, and on-site storage of fabricated geomembrane panels;
               (2) Label, package, and ship test samples to independent testing laboratory for specification compliance testing.
            b) Heat Seaming:
               (1) Include a list of all equipment, with pertinent technical information, to be used for heat seaming.
               (2) Describe complete heat seaming procedures, including cleaning of material to be seamed, seaming, voltage and temperatures, and equipment dwell and pressure.
               (3) Indicate solvents, solutions and other chemicals to be used, in addition to or in conjunction with heat seaming.

(4) Describe seaming procedures to be used at special locations, such as tee joints (where a factory or field seam is bonded to another layer) and where cap strips and patches are used on seams.
(5) Indicate adverse weather or other conditions which would limit or halt seaming operations.
(6) Describe measures to account for and compensate for temperature and/or humidity changes in ambient air or the membrane material which may affect seam quality.
(7) Describe equipment calibration frequency and procedures.

c) Installation:
(1) Evaluate and document the suitability of weather conditions to insure proper installation.
(2) Monitor and document placement and condition of all geomembrane panels while being placed.
(3) Monitor and document the proper installation of geomembrane panels in accordance with approved shop Drawings.
(4) Monitor and document trial seaming procedure and test results to evaluate seaming personnel and equipment.
(5) Devise seam identification numbering system unique to each seam such that the seam location, seaming crew, equipment used, date and time are properly documented for all seaming activities.
(6) Perform overall visual observations of the entire geomembrane surface to locate, document, and identify all damage and defects.
(7) Monitor and record the repair of all damage and defects and all destructive testing.
(8) Certification that installation means, and methods meet all requirements of the manufacturer and fabricator.

d) Seam Samples:
(1) Monitor and document nondestructive testing of seams.
(2) Select locations for destructive seam samples, if required.
(3) Monitor and document the cutting of test samples and patching of holes created from test sample holes, if required.
(4) Package, label and ship test samples to independent testing laboratory for specification compliance testing;
(5) Interpret all laboratory test results on materials and seams for compliance with specifications.
(6) Distribute laboratory test results, with interpretation, to the ENGINEER.
(7) Monitor and document the repair of all rejected seams.
(8) Monitor and document testing of repaired seams.

c. Requirements:
1) Upon approval of the Contractor's Quality Assurance Plan, the Contractor shall implement and continuously monitor the Quality Assurance Plan, as stated above, through an active and on-going Quality Assurance Program.
2) The Engineer may continuously monitor the Contractor's approved Quality Assurance Program for compliance.
3) The Contractor's assigned quality assurance personnel shall be completely independent from the on-site installation personnel, shall not be assigned any production (installation) responsibilities and shall report directly to an off-site senior management employee.
4) The Quality Assurance Program shall include, but not necessarily be limited to, the following responsibilities on the part of the Contractor's quality assurance personnel:
a) Review of all contract Drawings and specifications for clarity, completeness, and to acquire a thorough knowledge of project materials and construction procedure requirements.

b) Review, revise as deemed necessary, and approve fabricator's Quality Assurance Plan.
c) Continuing review of Contractor's Quality Assurance Plan for thoroughness, adequacy and feasibility.
d) Use special job specific forms or logs for monitoring all activities involved with the Quality Assurance Plan.
e) Maintain logs summarizing all daily activities.
f) Interpret all laboratory test results on material and seams to ensure compliance with Specifications.
g) Distribute laboratory test results, with interpretation as required, to the Engineer.

C. Qualifications:
1. Contractor and fabricator experience:
a. Contractor installing liner: Installed at least 2,000,000 SQFT of specified geomembrane lining.
b. Fabricating manufacturer: Customarily engaged in factory fabricating individual widths of roll stock into large sheets.
c. Provide list of references for Contractor installing liner.
1) Include name, address, and telephone number of person to contact regarding previous installation of liners and square footage of lining installed at each location.

1.3 DEFINITIONS

A. Wherever the word "Manufacturer" occurs in these specifications, it shall mean the company, firm, or corporation, which actually manufactures the flexible membrane products required by the work as specified in these specifications.

B. The word "Fabricator" shall mean the company, firm, or corporation which actually factory seams the liner membrane into large, prefabricated panels in accordance with these specifications.

C. The word "Contractor" or “Installer” shall mean the Contractor responsible for the installation of the reservoir liner and ancillary equipment, and for completion of the work as described in this specification.

D. The word "Owner" shall mean the Owner of the reservoir on which this liner is being installed and the organization contracting for and paying for same.

E. The word "commissioning" (the liner) shall mean that time that the Contractor completes construction and testing of the liner in accordance with the specifications and states the reservoir is ready for service.

F. Inspector:
1. Inspectors are the individuals hired by the installer as part of the contractor/installer CQC. Inspectors are responsible for observing field installation of the geosynthetic materials and providing the Manufacturer, Fabricator, Installer and Owner with verbal and written documentation of the compliance of the installation with this specification and with written procedures manuals prepared by the Manufacturer or Contractor/Installer.

G. Independent Testing Laboratory:
1. The firm hired by the Contractor/Installer as part of its CQC program to perform destructive testing of the geomembrane.
2. Firm shall be acceptable to Engineer and Owner.

H. Independent Testing Laboratory:
1. The firm hired by the Contractor/Installer as part of its CQC program to perform destructive testing of the geomembrane.
2. Firm shall be acceptable to Engineer and Owner.

I. Construction Quality Control (CQC):
   1. Contractor's inside program to ensure compliance with the project drawings and specifications.

J. Construction Quality Assurance (CQA):
   1. Third party verification of quality tool employed by the Contractor for routine observations and testing to confirm product compliance with project drawings and specifications.

K. Fabricator Quality Control (FQC):
   1. Fabricator internal program to ensure compliance with fabricator's material and workmanship specifications.

L. Fabricator Quality Assurance (FQA):
   1. Fabricator program for impartial verification of compliance with fabricator's material and workmanship specifications.

M. Manufacturer Quality Control (MQC):
   1. Manufacturer internal program to ensure compliance with manufacturer's material and workmanship specifications.

N. Manufacturer Quality Assurance (MQA):
   1. Manufacturer program for impartial verification of compliance with manufacturer's material and workmanship specifications.

1.4 SUBMITTALS

A. Product Data:
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation instructions including storage, placement, acceptable methods of repair, acceptable methods of disinfection, and other requirements.

B. Technical data concerning physical and chemical properties of the material. Shop Drawings:
   1. See Standard General Conditions for requirements for the mechanics and administration of the submittal process.
   2. The Engineer's shop drawing review and approval will include materials of construction, general compliance with the specifications and completeness of the drawings for constructability purposes.
   3. Fabrication and Installation layout drawings:
      a. Prior to installation, submit detailed installation plan indicating proposed procedures and sequencing for installing liner, and disinfection of the reservoir.
      b. Submit shop drawings, showing liner panel sheet layout with proposed size, number, position, and sequence of placing of all factory-fabricated sheets and indicating the location of all field joints and the direction of shop joints on each sheet.
   4. Shop drawings shall also show complete details and/or methods for installation of all liner components and accessories included but not necessarily limited to:
      a. Fabrication of factory seams and field seams and seaming procedures.
      b. Anchoring of liner.
      c. Seals at pipe penetrations and around structures included but not limited to piping, valve boxes, overflow structure, and any other existing reservoir elements.
      d. Fabricated miscellaneous liner and metal accessories.

C. Certifications:
   1. Provide independent lab certification that liner meets membrane performance criteria specified herein.
      a. Include factory seam strength certification.
   2. Certification from the manufacturer that all material in contact with potable water is in accordance with the requirements of NSF/ANSI-61 and any regulatory agency having jurisdiction over potable water storage.
   3. Utilize certification forms from this section for certifications below:

a. Certification that materials have been received and accepted in undamaged condition from the shipper.
b. Daily certification that subgrade has been properly prepared and acceptable for the placement of the geomembrane.
c. Daily certification that the geomembrane liner was installed in accordance with these Specifications, with approved shop drawings, and per fabricator's requirements.
d. Daily certification that geomembrane joints were inspected, tested for strength and continuity, and passed all inspections and testing.
    1) All test and inspection data shall be incorporated into this certification.

D. Informational Submittals:
1. See Standard General Conditions for requirements for the mechanics and administration of the submittal process.
2. Operation and maintenance manuals.
3. Safety Data Sheets (SDS) for solvents, caulks and other chemicals proposed to be used.
4. Qualifications as listed in this specification.
5. Fabricator's Quality Assurance Program.
6. Contractor's Quality Assurance Program.
7. Submit calculations supporting the sizing of the sump pumps.
8. Contractor's quality assurance final report at completion of the liner installation and acceptance of all work by the Owner.
9. Testing Protocols:
    a. Submit testing plan for all testing specified including integrity of the installed system.
    b. Liner leak detection testing.
    c. Factory and field seam testing protocol in compliance with ASTM D751.
10. Warranties as specified in this section.
11. Submit a written statement from the reinforced membrane lining manufacturer that the liner has been installed properly and is ready for use by the Owner.
12. Test reports including third party factory seam test results.
13. Resume and any certifications of full-time inspector described in 1.2 C.5.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Unused or stockpiled geomembrane shall be stored in accordance with the manufacturer's recommendations and ASTM D4873.

B. Geomembrane:
1. Handle and store geomembrane in accordance with the manufacturer's recommendations and ASTM D4873.
2. Label each roll with the manufacturers name, type, lot number, roll number, and roll dimensions (length, width, gross weight).
    a. Repair or replace geomembrane or plastic wrapping damaged as a result of storage or handling, as directed.
    b. Do not expose geomembrane to temperatures in excess of 71 DegC (160 DegF) or below 0 DegC (32 DegF).
3. Do not use hooks, tongs or other sharp instruments to handle the geomembrane.
    a. Do not lift rolls by use of cables or chains in contact with the geomembrane.
    b. Do not drag geomembrane along the ground and ensure the ground is free of abrasive or sharp materials or provide a geotextile rub sheet, prior to placing on ground.

1.6 GUARANTEE

A. Fabricator and Contractor shall guarantee the entire work under the contract to be free of defects in materials and workmanship at time of completion and commissioning of the liner. The Owner shall have a period of 2 years following the date of commissioning of the liner to discover and report any such defects. The Contractor shall agree to make, or have made, at the Contractor's expense, any repairs or replacements made necessary by defects in materials or workmanship which become evident within said period. Contractor shall make repairs or replacements promptly upon receipt of written notice from the Owner.

B. Upon commissioning of the liner, a written material weathering guarantee from the Manufacturer of the liner material shall be submitted. The membrane material shall be guaranteed in writing by the membrane Manufacturer on a pro rata basis for a period of 20 years against functional membrane deterioration failure due to exposure to ozone, sunlight, ultraviolet radiation, or other normal weather aging; the first 10 years non-prorated, the second 10 years prorated. Vandalism, physical or chemical abuse, acts of animals, or earthquakes and other unusual acts of Nature are excluded. The guarantee shall be limited to replacement of material only.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Layfield USA Corporation.
      a. Contact: Jan Nichols
      b. Office: (619) 797-1984
      c. jan.nichols@layfieldgroup.com
   2. Colorado Lining International, a Viaflex Company
      a. Contact: Patrick Elliott
      b. Office: (303) 951-5913
      c. pat.elliot@viaflex.com

2.2 MATERIALS

A. Geomembrane:
   1. Geomembrane material:
      a. Type: Linear Low Density Polyethylene.
      b. Surface: Smooth, no striations, gels, pinholes or bubbles.
   2. Minimum Average Thickness (ASTM D 5199):
      a. 1.50 mm (60 mil; 0.060 inches).
   3. Minimum Tensile Properties (ASTM D638 or ASTM D6693): Machine direction and perpendicular to machine direction average values on the basis of five (5) test specimens each direction:
      a. Break Strength: 255 lb/in).
      b. Break Elongation: 1000%.
   4. Minimum Tear Resistance (ASTM D1004): 108 lbs.
   5. Minimum Puncture Resistance (ASTM D4833): 90 lbs.
   6. High Pressure Oxidative Induction Time (ASTM D5885):
      a. Minimum 400 minutes.
   7. Stress Crack Resistance under Constant Load (ASTM D5397):
      a. Minimum 300 hours.
   8. Seam Properties (Shop and Field Seams - ASTM D6392):
      a. Shear Strength: 15.7 kN/m (90lb/in).
      b. Peel Strength: 13.1 kN/m (75lb/in).

B. Geotextile Underlayment:
   1. Non-woven geotextile:
   2.

Properties	**Test Method**	
Weight	ASTM D5261	6 oz/yd^2
Thickness	ASTM D5199	80 Mils
Grab Tensile Strength	ASTM D4632	170 lbs
Grab Tensile Elongation	ASTM D4632	50%
Trapezoidal Tear Strength	ASTM D4533	70 lbs
CBR Puncture Strength	ASTM D6241	450 lbs

Apparent Opening Size	ASTM D4751	80 U.S. Sieve
Permittivity	ASTM D4491	1.5 SEC^{-1}
Permeable	ASTM D4491	0.45 cm/sec
Flow Rate	ASTM D4491	110 $gal/min/ft^2$
UV Resistance	ASTM D4355	80%

2.3 FABRICATOR

A. Geomembrane fabricator shall have at least two years experience in the factory fabrication of geomembrane. The Geomembrane fabricator shall have fabricated at least 500,000 m2 (5,000,000 ft2) of geomembrane during the last two years.

B. Geomembrane fabricator shall be certified by the geomembrane manufacturer and follow manufacturer's fabrication specifications.

2.4 FABRICATION

A. Set Up
   1. Carefully transfer rolls of geomembrane from storage to unwinding rack.
   2. The floor or table must be clean, dry, and free of foreign objects that could damage the liner.
   3. Pull panels to specified length, after double-checking dimensions on the work order.
   4. Ensure seaming equipment is in good repair and functioning properly. Ensure equipment is adjusted to the material.
   5. Follow documented welding procedures.

B. Qualification Seam
   1. A qualification seam will be run prior to any fabrication.
   2. The qualification seam must be run using the same material and equipment that will be used for fabrication.
   3. Machine conditions and operator used for fabrication must be the same as those used for the qualification weld.
   4. Qualification seam must be tested in shear and peel and meet the specified requirements for the material as stated in the materials section.
   5. A qualification seam must be rerun whenever the operator is changed, the equipment adjusted, shift changed, or if the equipment is idle for more than 2 hours.

C. Fabrication Seams
   1. Fabrication seams must meet the specified requirements in peel and shear for the material.
   2. Fabrication seams will be destructively tested in shear and peel according to ASTM D6392.
      a. Test one specimen each in peel and shear on the first and last welded panel, and,
      b. Test one specimen each in peel and shear for every 300 lineal meters (1000 lineal feet) of welding
   3. A record of the seam test results is maintained on the Shop QC report.
   4. The seaming process must be constantly supervised by the equipment operator. 100 % of the fabrication seams must be visually inspected during seaming.

D. Protection from Damage
   1. Protect completed panels from damage
   2. Handle carefully to avoid damaging the liner

E. Packaging
   1. Each panel will be accordion folded in one direction, and rolled or folded in the other direction.
   2. Wrap completed panels in a weather resistant, opaque cover material.
   3. Hold wrapper securely in place using UV resistant tape or other secure method.
   4. Label the packaged liner to clearly show:
      a. Material type
      b. Dimensions
      c. Stock code
      d. Sales order number

e. QC number
f. Panel number
g. Unfolding and deployment directions

2.5 DELIVERY STORAGE AND PROTECTION

A. Shipping
1. Completed panels will be placed on clean, serviceable pallets, free from exposed nails or other obstructions.
2. A layer of geomembrane, geotextile, or wood will be placed on all pallets to protect the panel from damage.
3. Secure panels to the pallet using metal or plastic bands. Use a layer of geomembrane between the packaged liner and the band to prevent damage to the liner as the band is tightened.
4. The packaged liner must not extend beyond the outer edges of the pallet. Use larger pallets or a layer of plywood to extend the pallet edges to match the liner.
5. Carefully handle and place on the truck to avoid damage to the liner.
6. Panels may be stacked not more than two high.

B. Delivery
1. All panels will be inspected for damage on delivery.
2. Use suitable unloading equipment to handle panels. Do not drag, slide, or drop panels during unloading.
3. Place panels in a prepared area away from soft ground, standing water, or other deleterious surfaces.
4. Replace any pallets that may become damaged during shipping or handling.
5. Store liner panels in a secure area protected from extremes of heat or cold.
6. Protect panels from damage prior to use.

2.6 ACCESSORIES

A. Preformed Pipe Boots will be vacuum formed from thicker sheet material manufactured from the same formulation as the geomembrane.

PART 3 - EXECUTION

3.1 INSTALLER

A. The Geomembrane Installer shall have at least three years experience in the installation of the geomembrane. The Geomembrane Installer shall have installed at least 500,000 m^2 (5,000,000 ft^2) geomembrane during the last three years.

B. Geomembrane Installer shall be certified by the geomembrane manufacturer and follow manufacturer's installation specifications.

3.2 PREPARATION

A. Ensure subgrade is compacted and surface finished to not impair installed membrane.

B. Subgrade to provide firm, unyielding surface with no sharp changes or abrupt breaks in grade. A smooth drum rolled surface is preferable.

C. Ensure surfaces to be lined are smooth, free of foreign and organic material, sharp objects, or debris of any kind.

D. If a suitable sub-grade is not available then a cushion layer of 100mm (4 inches) of clean sand and/or and LP8 non woven geotextile shall be placed prior to liner placement.

E. Excavate anchor trench to line, grade, and width indicated on drawings, prior to liner placement. Provide slightly rounded corners in the trench to avoid sharp bends in the geomembrane.

F. Prepare mechanical attachments according to ASTM D6497 Standard Guide for Mechanical Attachment of Geomembrane to Penetrations or Structures.

G. All concrete surfaces to which the liner will attach shall have “smooth trowel” finish. All the corners should have radius to a minimum 25mm (1 inch) as per the drawing.

H. Compaction at pipe penetrations and areas of mechanical attachment will be inspected carefully as these are areas where differential settlement can occur.

I. A certificate of subgrade acceptance will be prepared by the liner installation contractor prior to liner installation.

3.3 INSTALLATION

A. Installation of the geomembrane shall be performed in a logical sequence.

B. Place panels according to the drawings, the panel layout, and the label on each panel.

C. Sufficient thermal slack shall be incorporated during placement to ensure that harmful stresses do not occur in service.

D. Weather Conditions at Time of Installation:
   1. Site welding may proceed at any temperature providing a suitable qualification weld can be prepared at site conditions using the operator, equipment, and materials intended for the project.
   2. Installation of membrane in winds above 20 km/h (12 mph) can proceed only if the installer can demonstrate that the liner will not be at risk of damage.
   3. Do not install membrane during precipitation or in the presence of excessive moisture.
   4. Do not install in weather conditions that may be detrimental to the function of the membrane.

E. Ensure personnel working on geomembrane do not use damaging footwear.

F. Protect completed panels from damage; handle carefully to avoid damaging the liner.

G. Equipment and methods used to unroll liner panels should not damage the prepared subgrade.

H. Ballast used to prevent uplift by wind must not damage the geomembrane. A continuous load is recommended along the edges of panels to eliminate the risk of wind uplift.

I. Qualification Seams
   1. A qualification seam will be run prior to any field seams.
   2. A qualification seam is made with separate pieces of geomembrane using the same material and equipment that will be used for production welding.
   3. Machine conditions, and operator used for welding must be the same as those used for the qualification weld.
   4. Qualification seam must be tested in shear and peel, and meet the specified requirements for the material as stated in the materials section.
   5. A qualification seam must be rerun whenever the operator is changed, the equipment adjusted, or at least every 4 hours.

J. Field Seams
   1. Field seams will be sampled for testing in a way that does not compromise the installed liner
      a. One sample to be tested for every 150m (500 ft) of field seam
      b. Test samples are to be removed from the ends of seams, from the anchor trench, or other location that does not introduce a defect into the liner.
      c. Samples to be approximately 100 mm (4 inches) long to permit testing of one shear and two peel specimens (ASTM D6392).
      d. Test samples immediately after seaming
      e. Record date, location and pass/fail description
   2. Field seams must meet the specified requirements in peel and shear for the material.
   3. A written record will be maintained for all field seam tests.

4. All completed field seams will be 100% non-destructively tested using an air lance test (ASTM D4437 method 7.2).

3.4 TOLERANCES

A. Seam Tests:
   1. Follow the procedure in ASTM D6392
   2. Test three specimens per sampling point, one in shear and two in peel.
      a. All specimens to meet seam strength requirements
   3. Procedures for Destructive Test Failure:
      a. Cut out seam and re-weld; or,
      b. Retrace welding path to 3 m (10 feet) from location of failed test. Take sample for additional test. If passed - cap strip or extrusion weld between failed location and original failed location.

3.5 REPAIR

A. Inspect seams and non-seam areas for defects, holes, blisters, undispersed raw materials.

B. Identify any sign of foreign matter contamination.

C. Repair all through-thickness defects.

D. Defective Seams: Cap strip or replace.

E. Small Holes: Repair by extrusion welding using a bead of extruded material over hole. Patch if hole is larger than 6 mm (1/4 inch).

F. Tears: Patch and seal round sharp ends of tears on slope or stressed area prior to patching.

G. Repair blisters, large cuts and undispersed raw materials with patch.

H. Secure Patches by Extrusion Welding or Hot Air Welding:
   1. Extrusion Welding.
      a. Clean area to be patched.
      b. Tack patch in place with hot air welding or with double sided tape.
      c. Prepare patch area by roughening with a wire brush.
      d. Extrude all the way around patch.
      e. A maximum of two extrusion beads can be laid side-by side on Enviro Liner 4000.
   2. Hot Air Welding
      a. Hand hot air welding is permitted for patching Enviro Liner.
      b. Clean area to be patched.
      c. Hand weld the patch with a hot air gun and suitable roller.

I. Patches: Round or oval, of same geomembrane. Extend minimum 75 mm (3 inches) beyond the edge of the defect.

J. Verification of Repairs: All repairs to be non-destructively tested using
   1. Air Lance Test, ASTM D4437 Method 7.2
   2. Vacuum Box Test ASTM D5641

K. Redo failed repairs and re-test.

L. Keep records of all repairs and the results of repair testing.

3.6 DISINFECTION OF LINER

A. Prior to placing the reservoir into service, the Contractor shall disinfect reservoir per AWWA C652 – 19, *Disinfection of Water Storage Facilities*, Section 4.3 Method 2.

B. Water for disinfection of the reservoir shall be provided by the Owner.

C. Water for subsequent filling of the reservoir will be provided by the Owner. The City will operate all valves in order to fill the reservoir.

D. Following filling of the reservoir, the Contractor shall verify adequate disinfection has occurred by testing per AWWA C652.

3.7 CLEANUP

A. The Contractor shall clean up within the reservoir throughout the course of the work. No dirt, scrap material, trash, tools, or other unwanted materials shall be trapped between the lining.

B. After the work specified herein has been completed, the entire area of work shall be left in a neat and presentable condition, free of all cleared vegetation, rubbish, construction debris and waste, surplus materials, and other objectionable materials. All such removed materials shall be disposed of by Contractor off site and in conformance with all applicable codes, ordinances, and regulations.

3.8 FABRICATION AND FIELD QUALITY CONTROL

A. The Contractor's Quality Assurance / Quality Control testing shall keep pace with the deployment and seaming operations to identify all problems at the earliest possible point in time.

B. Inspector shall not be a part of the installation program and shall not serve as a substitute for performing the duties or certification required of the Fabricator and Installer.
   1. Inspector's responsibilities include, but are not limited to:
      a. Inspection of the material and the handling and field installation of the geomembranes.
         1) Inspection of all welds, repairs and quality control test results.
      b. All exceptions to material or installation shall be documented and furnished to the Owner's representative in writing within 48 HRS of discovery.

C. Trial Seam Testing:
   1. Trial seams shall be made each half-day prior to production seaming.
      a. The location of trial seam shall be in an area proposed for the day's production seaming.
      b. Equipment, methods and personnel shall be the same as proposed for the day's seaming.
   2. Samples shall be tested in accordance with ASTM D413 – 98(2017), *Standard Test Methods for Rubber Property – Adhesion to Flexible Substrate*, and ASTM D751 – 19, *Standard Test Methods for Coated Fabrics* (modified method).

D. Equipment Calibration:
   1. The seaming equipment shall be calibrated in accordance with the Contractor's quality assurance plan; but shall not be less than at the beginning of each shift, every 4 hours, and any significant environmental changes.
   2. Field seam test samples shall be collected and tested in accordance with the provisions stated herein (peel strength, breakaway peel strength, and tensile strength). The field seam calibration verification testing shall be performed by on-site quality control personnel. The Contractor shall submit the daily calibration test results to the Owner as part of the final quality assurance report.
   3. The testing equipment shall be calibrated at least once every 12 months by an independent testing agency certified to conduct such calibration and a label attesting to such calibration shall be affixed to the testing equipment.
   4. No daily field seaming shall be performed until all the calibration samples have been tested and passed.

E. Seam Test Samples:
   1. Factory and field seam samples shall measure not less than 14 IN wide by 60 IN long with the seam parallel to the long direction and down the middle of the sample.
   2. A minimum of 5 test specimens for each of the required tests (peel strength, breakaway peel strength, and tensile strength) shall be taken from each seam test sample.
   3. All test samples shall be provided by the Contractor at their expense.

4. Field and factory seam test samples shall be numbered, dated, and identified as to the personnel making the seam from which the seam test sample is taken, the seaming method being used, and the temperature and weather conditions at the time of seaming. Each seam test sample shall be keyed to its general location on the seam from which it is taken by appropriate notes or markings on a drawing, furnished by the Contractor, for future reference.

F. Seam Testing:
   1. The Contractor shall have tests performed, at their own expense, by a GRI-certified testing laboratory. All testing shall be performed to ensure that the shop seams and field seams meet the following requirements:
      a. Peel Strength Test:
         1) Factory and field seam test samples shall be tested for peel strength in accordance with ASTM D413, Machine Method, Type A.
         2) A minimum of five test specimens shall be tested from each seam test sample.
      b. Breakaway Peel Strength Test:
         1) The breakaway peel strength of a seam in 180 degree peel is the minimum level at which the seam separation is deemed acceptable and that portion of the seam which separates below the stated minimum required breakaway peel strength is not considered part of the seam.
         2) Factory and field seams shall be tested in 180 degree peel by static test in which a weight is suspended from a 1 IN wide seam specimen and held for a minimum of 5 seconds.
         3) For heat seams, a 21 LB weight shall be suspended immediately after the seam has been allowed to cool.
         4) For adhesive seams, a 15 LB weight shall be suspended after 12 days.
         5) The effective seam width shall be determined by measuring the remaining scrim-to-scrim overlap at the conclusion of the breakaway peel strength test.
         6) A minimum of five test specimens shall be tested from each seam test sample.
      c. Tensile Strength Test.
         1) Factory and field seam test specimens shall be 4 IN wide, with a length equal to the specified seam width plus 9 IN.
         2) Factory and field test samples shall be tested in accordance with ASTM D751 (modified method).
         3) A minimum of five test specimens shall be shall be tested from each seam test sample.
   2. A seam shall be deemed acceptable if all the test specimens from each seam test sample location satisfy all of the following requirements:
      a. The effective seam width is equal to or greater than the minimum width specified on the Drawings, as measured at the conclusion of the breakaway peel strength test.
      b. A minimum peel strength equal to or greater than 21 LBS/IN of seam width.
      c. Failure by delamination from the scrim rather than in the plane of the seam.
      d. A minimum seam tensile strength equal to 90 percent of the value specified for the parent material.
   3. Test results not meeting these requirements shall be cause for rejection of the seam from which the test sample was taken.

G. Testing of Factory Seams during Fabrication:
   1. The Contractor shall have the fabricator provide and have tested, by a GRI-certified independent laboratory, samples of factory seams taken from the fabricated panels at the factory.
   2. One seam test sample per 5,000 LF of rollstock-to-rollstock shop seams, or one seam test sample per panel, whichever yields the greater number of seam test samples, is required. Each seam test sample shall be tested for the required tests (peel strength, breakaway peel strength, and tensile strength).

3. The certified test results of specimens from each seam test sample shall be submitted to the testing agency for review and approval prior to installation of panels represented by the respective seam test samples.
4. Patching of sampled seams may be done in the field after installation of the affected panel, at the Contractor's option.

H. Testing of Field Seams during Field Installation:
1. The Contractor shall test samples of field seams taken from field installed fabricated panels.
2. One seam test sample per 500 FT of panel-to-panel field seam shall be tested for the required tests (peel strength, breakaway peel strength, and tensile strength).
3. If any seam test results are not satisfactory, the Owner, at their discretion, may require that additional sampling and testing be performed at the Contractor's expense.
4. Any seam tests that fail shall be marked and repaired to the satisfaction of the Owner and the Fabricator.

I. The testing laboratory and the Contractor shall certify all test results. Five copies of the certified test results shall be submitted to the Owner.

J. Probe and Air-Lance Inspection:
1. Prior to performing air lance inspection, the Contractor shall check all factory seams, field seams, joint cover strips, doublers, and patches with a metal probe (such as a wire 1/16 IN maximum diameter with the point slightly rounded).
2. All factory seams, field seams, joint cover strips, doublers, and patches shall be air-lance tested. Air-lance tests shall be performed in the field by the Contractor in the presence of the Owner during daylight hours. Leak paths or suspect areas revealed by these inspections shall be marked and repaired.
3. The air-lance shall have a 1/8 IN DIA orifice. Pressure at the orifice shall be between 60 and 80 psi. The jet of air shall be directed at the edge of seam or patch to effect the lifting of unbonded edges. The air-lance testing shall be done in a manner so as to allow the Contractor Quality Assurance/Quality Control personnel sufficient time to observe and document any leaks or suspect areas. All defects found during probing shall not be repaired until the defect is tested by air-lancing.
4. Field probing and air-lance tests of factory seams shall be required, even if those seams have previously been air-lance tested in the factory.

END OF SECTION

SECTION 40 05 00
PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Process piping systems.
2. Utility piping systems.
3. Plumbing piping systems.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. American Association of State Highway and Transportation Officials (AASHTO):
   a. M36, Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains (Equivalent ASTM A760).
   b. M190, Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
   c. M252, Standard Specification for Corrugated Polyethylene Drainage Tubing.
   d. M294, Interim Specification for Corrugated Polyethylene Pipe 12 to 24 Inch Diameter.
2. American Iron and Steel Institute (AISI).
3. American Society of Mechanical Engineers (ASME):
   a. B16.3, Malleable Iron Threaded Fittings.
   b. B16.5, Pipe Flanges and Flanged Fittings.
   c. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.
   d. B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.
   e. B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
   f. B36.19, Stainless Steel Pipe.
   g. B40.100, Pressure Gauges and Gauge Attachments.
4. ASTM International (ASTM):
   a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   b. A74, Standard Specification for Cast Iron Soil Pipe and Fittings.
   c. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
   d. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   e. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
   f. A197, Standard Specification for Cupola Malleable Iron.
   g. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
   h. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   i. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
   j. A536, Standard Specification for Ductile Iron Castings.
   k. A760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
   l. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
   m. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
   n. B88, Standard Specification for Seamless Copper Water Tube.

o. C14, Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
p. C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
q. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
r. C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
s. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
t. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
u. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
v. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
w. F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

5. American Water Works Association (AWWA):
   a. C200, Standard for Steel Water Pipe - 6 IN and Larger.
   b. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
   c. C208, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
   d. C606, Standard for Grooved and Shouldered Joints.
   e. C651, Standard for Disinfecting Water Mains.
   f. C800, Standard for Underground Service Line Valves and Fittings.
6. American Water Works Association/American National Standards Institute (AWWA/ANSI):
   a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
   b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   c. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   d. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
   e. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.
7. Chlorine Institute, Inc. (CI):
   a. Pamphlet 6, Piping Systems for Dry Chlorine.
8. California Plumbing Code (CPC).
9. Underwriters Laboratories, Inc. (UL).

B. Coordinate flange dimensions and drillings between piping, valves, and equipment.

1.3 SYSTEM DESCRIPTION

A. Piping Systems Organization and Definition:
   1. Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.
   2. See PIPING SPECIFICATION SCHEDULES in PART 3.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.

c. Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.
    1) Attach technical product data on gaskets, pipe, fittings, and other components.
3. Fabrication and/or Layout Drawings:
    a. Exterior yard piping drawings (minimum scale 1 IN equals 10 FT) with information including:
        1) Dimensions of piping lengths.
        2) Invert or centerline elevations of piping crossings.
        3) Acknowledgement of bury depth requirements.
        4) Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
        5) Acknowledge designated valve or gate tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
        6) Line slopes and vents.
    b. Interior piping drawings (minimum scale 1/8 IN equals 1 FT) with information including:
        1) Dimensions of piping from column lines or wall surfaces.
        2) Invert or Centerline dimensions of piping.
        3) Centerline elevation and size of intersecting ductwork, conduit/conduit racks, or other potential interferences requiring coordination.
        4) Location and type of pipe supports and anchors.
        5) Locations of valves and valve actuator type.
        6) Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.
        7) Acknowledgement of valve, equipment and instrument tag numbers.
        8) Provisions for expansion and contraction.
        9) Line slopes and air release vents.
        10) Rough-in data for plumbing fixtures.
    c. Schedule of interconnections to existing piping and method of connection.

B. Contract Closeout Information:
1. Operation and Maintenance Data:
    a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

C. Informational Submittals:
1. Qualifications of lab performing disinfection analysis on water systems.
2. Test reports:
    a. Copies of pressure test results on all piping systems.
    b. Reports defining results of dielectric testing and corrective action taken.
    c. Disinfection test report.
    d. Notification of time and date of piping pressure tests.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe coating during handling using methods recommended by manufacturer.
1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit.
1. Repair abrasions, scars, and blemishes.
2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

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

1. Insulating unions:
    a. "Dielectric" by Epco.
2. Dielectric flange kit:
    a. PSI.
    b. Maloney.
    c. Central Plastics.
3. Pipe saddles (for gage installation):
    a. Dresser Style 91 (steel and ductile iron systems).
    b. Dresser Style 194 (nonmetallic systems).

2.2 PIPING SPECIFICATION SCHEDULES

A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Specification Section.

2.3 COMPONENTS AND ACCESSORIES

A. Insulating Components:
1. Dielectric flange kits:
    a. Flat faced.
    b. 1/8 IN thick dielectric gasket, phenolic, non-asbestos.
    c. Suitable for 175 psi, 210 DegF.
    d. 1/32 IN wall thickness bolt sleeves.
    e. 1/8 IN thick phenolic insulating washers.
2. Dielectric unions:
    a. Screwed end connections.
    b. Rated at 175 psi, 210 DegF.
    c. Provide dielectric gaskets suitable for continuous operation at union rated temperature and pressure.

B. Reducers:
1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
2. Connection size requirements may change from those shown on Drawings depending on equipment furnished.

C. Protective Coating and Lining:
1. Include pipe, fittings, and appurtenances where coatings, linings, paint, tests and other items are specified.
2. Field paint pipe in accordance with Specification Section 09 91 00.

D. Underground Warning Tape:
1. See Specification Section 10 14 00.

E. Pressure Gages:
1. See Specification Section 01 61 03 and Specification Section 40 91 10.

F. Dry Disconnect Couplings:
1. Adapters:
    a. Male adapters: Size shown on Drawings.
    b. Adapters:
        1) Female NPT end connection for flush applications.
        2) Male NPT end connection for chemical applications.
2. Couplers:
    a. Built-in valve and spring loaded poppet which close automatically when disconnected.
    b. Designed to remain with only one (1) arm locked in closed position.
    c. Construct couplers for chemical and PVC system applications 3 IN and less from polypropylene with stainless steel arms and pins.
        1) Above 3 IN, provide stainless steel units.
    d. Gasket: Compatible with conveyed liquid.

3. Dust caps: For all adapters.

G. Valves:
   1. See schematics and details for definition of manual valves used in each system under 4 IN in size.
   2. See Specification Section 40 05 51.

PART 3 - EXECUTION

3.1 EXTERIOR BURIED PIPING INSTALLATION

A. Unless otherwise shown on the Drawings, provide a minimum of 4 FT and maximum of 8 FT earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.

B. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals specified in Specification Section 01 73 20 and as shown on Drawings.

C. When entering or leaving structures with buried mechanical joint piping, install joint within 2 FT of point where pipe enters or leaves structure.
   1. Install second joint not more than 6 FT nor less than 4 FT from first joint.

D. Install expansion devices as necessary to allow expansion and contraction movement.

E. Laying Pipe In Trench:
   1. Excavate and backfill trench in accordance with Specification Section 31 23 33.
   2. Clean each pipe length thoroughly and inspect for compliance to specifications.
   3. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
   4. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
   5. Except for first two (2) joints, before making final connections of joints, install two (2) full sections of pipe with earth tamped along side of pipe or final with bedding material placed.
   6. Lay pipe in only suitable weather with good trench conditions.
      a. Never lay pipe in water except where approved by Engineer.
   7. Seal open end of line with watertight plug if pipe laying stopped.
   8. Remove water in trench before removal of plug.

F. Lining Up Push-On Joint Piping:
   1. Lay piping on route lines shown on Drawings.
   2. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
   3. Observe maximum deflection values stated in manufacturer's written literature.
   4. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.
   5. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.

G. Anchorage and Blocking:
   1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces in or on buried piping tees, wye branches, plugs, or bends.
   2. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall.
      a. Concrete blocks shall not cover pipe joints.
   3. Provide bearing area of concrete in accordance with drawing detail.

H. Install underground hazard warning tape per Specification Section 10 14 00.

I. Install insulating components where dissimilar metals are joined together.

3.2 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

A. Install piping in vertical and horizontal alignment as shown on Drawings.

B. Alignment of piping smaller than 4 IN may not be shown; however, install according to Drawing intent and with clearance and allowance for:
   1. Expansion and contraction.
   2. Operation and access to equipment, doors, windows, hoists, moving equipment.
   3. Headroom and walking space for working areas and aisles.
   4. System drainage and air removal.

C. Enter and exit through structure walls, floor and ceilings using penetrations and seals specified in Specification Section 01 73 20 and as shown on the Drawings.

D. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.

E. Pipe Support:
   1. Use methods of piping support as shown on Drawings and as required in Specification Section 40 05 07.
   2. Where pipes run parallel and at same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight.
      a. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.
   3. Size pipe supports with consideration to specific gravity of liquid being piped.

F. Locate and size sleeves and castings required for piping system.
   1. Arrange for chases, recesses, inserts or anchors at proper elevation and location.

G. Use reducing fittings throughout piping systems.
   1. Bushings will not be allowed unless specifically approved.

H. Equipment Drainage and Miscellaneous Piping:
   1. Provide drip pans and piping at equipment where condensation may occur.
   2. Hard pipe stuffing box leakage to nearest floor drain.
   3. Avoid piping over electrical components such as motor control centers, panelboards, etc.
      a. If piping must be so routed, utilize 16 GA, 316 stainless steel drip pan under piping and over full length of electrical equipment.
      b. Hard pipe drainage to nearest floor drain.
   4. Collect system condensate at drip pockets, traps and blowoff valves.
   5. Provide drainage for process piping at locations shown on Drawings in accordance with Drawing details.
   6. For applications defined above and for other miscellaneous piping which is not addressed by a specific piping service category in PART 1, provide 304 stainless steel piping and fittings.
      a. Size to handle application with 3/4 IN being minimum size provided.

I. Unions:
   1. Install in position which will permit valve or equipment to be removed without dismantling adjacent piping.
   2. Mechanical type couplings may serve as unions.
   3. Additional flange unions are not required at flanged connections.

J. Install expansion devices as necessary to allow expansion/contraction movement:

K. Provide full face gaskets on all systems.

L. Anchorage and Blocking:
   1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.

M. Equipment Pipe Connections:
   1. Equipment - General:

a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.
b. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.
c. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint.
    1) Provide tightening torque in accordance with manufacturer's recommendations.
d. Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.
e. Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
f. Align, level, and wedge equipment into place during fitting and alignment of connecting piping.
g. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
h. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
    1) Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
    2) Realign as necessary, install flange bolts and make equipment connection.
i. Provide utility connections to equipment shown on Drawings, scheduled or specified.

2. Plumbing and HVAC equipment:
    a. Make piping connections to plumbing and HVAC equipment, including but not limited to installation of fittings, strainers, pressure reducing valves, flow control valves and relief valves provided with or as integral part of equipment.
    b. For each water supply piping connection to equipment, furnish and install union and gate or angle valve.
    c. Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly to building sewer system.
        1) Size trap as required by CPC.

N. Provide insulating components where dissimilar metals are joined together.

O. Instrument Connections:
    1. See drawing details.

3.3 CONNECTIONS WITH EXISTING PIPING

A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered.

B. Perform connections with existing piping at time and under conditions which will least interfere with service to customers affected by such operation.

C. Undertake connections in fashion which will disturb system as little as possible.

D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to adjacent property.

E. Where connections to existing systems necessitate employment of past installation methods not currently part of trade practice, utilize necessary special piping components.

F. Where connection involves potable water systems, provide disinfection methods as prescribed in this Specification Section.

G. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made and tested.

3.4 CATHODIC PROTECTION

A. Isolate, dielectrically, all piping from all other metals including reinforcing bars in concrete slabs, other pipe lines, and miscellaneous metal.

B. Make all connections from wire or cable by Thermit Cadwelding accomplished by operators experienced in this process.

C. Install all cables with a loop and overhead knot around each pipe and slack equal to at least 50 percent of the straight line length.

D. After cadwelding, coat all exposed metallic surfaces with hot applied tape.

3.5 PRESSURE GAGES

A. Provide at locations shown on the Drawings and specified.

B. See Specification Section 01 61 03.

3.6 FIELD QUALITY CONTROL

A. Pipe Testing - General:
   1. Test piping systems as follows:
      a. Test exposed, non-insulated piping systems upon completion of system.
      b. Test exposed, insulated piping systems upon completion of system but prior to application of insulation.
      c. Test concealed interior piping systems prior to concealment and, if system is insulated, prior to application of insulation.
      d. Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated, prior to application of insulation.
   2. Utilize pressures, media and pressure test durations as specified in the PIPING SPECIFICATION SCHEDULES.
   3. Isolate equipment which may be damaged by the specified pressure test conditions.
   4. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.
      a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.
      b. Notify the Engineer 24 HRS prior to each test.
   5. Completely assemble and test new piping systems prior to connection to existing pipe systems.
   6. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.
   7. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

B. Pressure Testing:
   1. Testing medium: Unless otherwise specified in the PIPING SPECIFICATION SCHEDULES, utilize the following test media.
      a. Process and plant air systems:

PIPE LINE SIZE	SPECIFIED TEST PRESSURE	TESTING MEDIUM
2 IN and smaller	75 psi or less	Air or water
2 IN and smaller	Greater than 75 psi	Water
Greater than 2 IN	3 psi or less	Air or water
Greater than 2 IN	Greater than 3 psi	Water

      b. Liquid systems:

PIPE LINE SIZE (DIA)	GRAVITY OR PUMPED	SPECIFIED TEST PRESSURE	TESTING MEDIUM
Up to and including 48 IN	Gravity	25 psig or less	Air or water
Above 48 IN	Gravity	25 psig or less	Water
All sizes	Pumped	250 psig or less	Water

2. Hydrostatic pressure testing methodology:
   a. General:
      1) All joints, including welds, are to be left exposed for examination during the test.
      2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.
      3) Provide temporary restraints for expansion joints for additional pressure load under test.
      4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.
      5) Do not paint or insulate exposed piping until successful performance of pressure test.
3. Air testing methodology:
   a. General:
      1) Assure air is ambient temperature.
   b. Low pressure air testing:
      1) Place plugs in line and inflate to 25 psig.
      2) Check pneumatic plugs for proper sealing.
      3) Introduce low pressure air into sealed line segment until air pressure reaches 4 psig greater than ground water that may be over the pipe.
         a) Use test gage conforming to ASME B40.100 with 0 to 15 psi scale and accuracy of 1 percent of full range.
      4) Allow 2 minutes for air pressure to stabilize.
      5) After stabilization period (3.5 psig minimum pressure in pipe) discontinue air supply to line segment.
      6) Record pressure at beginning and end of test.

C. Dielectric Testing Methods and Criteria:
   1. Provide electrical check between metallic non-ferrous pipe or appurtenances and ferrous elements of construction to assure discontinuity has been maintained.
   2. Wherever electrical contact is demonstrated by such test, locate the point or points of continuity and correct the condition.

3.7 CLEANING, DISINFECTION AND PURGING

A. Cleaning:
   1. Clean interior of piping systems thoroughly before installing.
   2. Maintain pipe in clean condition during installation.
   3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
   4. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.
   5. At completion of work and prior to Final Acceptance, thoroughly clean work installed under these Specifications.
      a. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes.
      b. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.

6. Purge all neat liquid polymer tubing or piping between the neat polymer storage tank or tote and the polymer blending units with mineral oil to remove residual water prior to introducing neat polymer. Following purging, drain as much of the mineral oil out of the system as possible. Dispose of purged fluids and waste mineral oil in accordance with local environmental regulations.

B. Disinfection of Potable Water Systems:
   1. After favorable performance of pressure test and prior to Final Acceptance, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed.
   2. Perform work, including preventative measures during construction, in full compliance with AWWA C651.
   3. Perform disinfection using sodium hypochlorite complying with AWWA B300.
   4. Flush each segment of system to provide flushing velocity of not less than 2.5 FT per second.
   5. Drain flushing water to sanitary sewer.
      a. Do not drain flushing water to receiving stream.
   6. Use continuous feed method of application.
      a. Tag system during disinfection procedure to prevent use.
   7. After required contact period, flush system to remove traces of heavily chlorinated water.
   8. After final flushing and before placing water in service, obtain an independent laboratory approved by the Owner to collect samples and test for bacteriological quality.
      a. Repeat entire disinfection procedures until satisfactory results are obtained.
   9. Secure and deliver to Owner, satisfactory bacteriological reports on samples taken from system.
      a. Ensure sampling and testing procedures are in full compliance to AWWA C651, local water purveyor and applicable requirements of State of California.

3.8 LOCATION OF BURIED OBSTACLES

A. Furnish exact location and description of buried utilities encountered and thrust block placement.

B. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants and related fixed structures.

C. Include such information as location, elevation, coverage, supports and additional pertinent information.

D. Incorporate information on "As-Recorded" Drawings.

3.9 SCHEDULES

PIPE SYSTEM	TAG	SYSTEM
Filter-to-Waste	FTW	7
Backwash Supply	BWS	1
Finish/Final/Filtered Water	FW	1
Raw Water	RW	1
Instrument Air	IA	11
Low Pressure Air	LPA	12
Vent	V	21

A. SPECIFICATION SCHEDULE - SYSTEM 1
   1. General:
      a. Piping symbol and service:
         1) BWS - Backwash Supply.

2) FW - Finish/Final/Filtered Water.
3) RW – Raw Water.

b. Test requirements:
1) Test medium: Water.
2) Pressure: 125 psig.
3) Duration: 6 HRS.

c. Gaskets:
1) Push-on and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.

2. System components:
a. Pipe size 3 IN through 24 IN:
1) Exposed service:
a) Material:
(1) Flanged: Ductile iron, Class 150.
(2) Grooved type joint system: Use pipe thickness per AWWA C606.
b) Reference: AWWA/ANSI C115/A21.15.
c) Lining: Cement.
d) Coating: Paint.
e) Fittings: Either AWWA/ANSI C110/A21.10 ductile or gray iron.
f) Joints:
(1) Flanged or grooved type mechanical coupling (AWWA C606) joints.
(2) With both systems, provide screwed-on flanges at equipment, valves and structure penetrations.
(3) Restrained

b. Pipe size 3 IN through 48 IN:
1) Buried service:
a) Materials: Ductile iron, Class 53.
b) Reference: AWWA/ANSI C151/A21.51.
c) Lining: Cement.
d) Coating: Bituminous.
e) Fittings:
(1) Either AWWA/ANSI C110/A21.10 ductile or gray iron.
(2) Optional: AWWA/ANSI C153/A21.53 ductile iron compact fittings for sizes 3 IN to 16 IN.
f) Joints: Restrained. Flanged at equipment and structure locations.

B. SPECIFICATION SCHEDULE - SYSTEM 7
1. General:
a. Piping symbol and service:
1) FTW – Filter to Waste.

b. Test requirements pressure lines:
1) Test medium: Water.
2) Pressure: 125 psig.
3) Duration: 6 HRS.

c. Test requirements vacuum lines:
1) Test medium: Air.
2) Pressure: -27 IN HG.
3) Duration: 6 HRS.

d. Gaskets and O-rings:
1) Viton.

2. System components:
a. Pipe size 12 IN and smaller:
1) Exposed service:
a) Material: PVC, Type 1, Grade 1, Schedule 80.
b) Reference: ASTM D1785.

c) Lining: None.
d) Coating: Paint.
e) Fittings: Solvent welded socket type complying with ASTM D2467.
f) Joints: Solvent welded with unions at valves, penetrations through structures and equipment connections for pipe 2 IN and less and flanges at those locations for pipe above 2 IN.

2) Buried service:
a) Material: PVC, Type 1, Grade 1, Schedule 40.
b) Reference: ASTM D1785.

C. SPECIFICATION SCHEDULE - SYSTEM 11

1. General:
a. Piping symbol and service:
1) IA - Instrument Air.
b. Test requirements:
1) Test medium: See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.
2) Pressure: 150 psig.
3) Duration: 6 HRS.
c. Gaskets and O-rings:
1) O-ring and flanged joints: Rubber or neoprene, 250 DegF.
2) Grooved coupling joints (steel): AWWA C606, rubber, 250 DegF.

2. System components:
a. Pipe size 3/8 IN to 1 IN for IA:
1) Exposed service:
a) Material: Stainless steel tubing, TP-304L.
b) Reference: ASTM A269.
c) Lining: None.
d) Coating: None.
e) Fittings: Stainless steel 304L, compression type tube fittings.
f) Joints: Compression type couplings, unions at equipment and valves.
b. Pipe size 1 IN to 4 IN:
1) Exposed service:
a) Materials:
(1) Threaded: Steel, Grade B, black, Schedule 40.
(2) Grooved type joint system: Use pipe thickness per AWWA C606.
b) Reference: ASTM A53.
c) Linings: None.
d) Coating: Paint.
e) Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASME B16.3, ASTM A234.
f) Joints:
(1) Retrained.
(2) Threaded or grooved type mechanical coupling (AWWA C606) joints.
(3) With both systems, provide rigid flanges at equipment, valves and structure penetrations above 2 IN and unions at those locations 2 IN and below.
2) Buried service:
a) Materials: Steel, Schedule 40, Grade B, black.
b) Reference: ASTM A53.
c) Lining: None.
d) Coating: Bituminous.
e) Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASME B16.3, ASTM A234.
f) Joints: Threaded.

3. Slope all piping mains approximately 1:100 toward points of drainage.
4. Provide driplegs at low points:
    a. Provide ball type isolation valve.
    b. Route dripleg to nearest wall or column and terminate 4 FT above finished floor.

D. SPECIFICATION SCHEDULE - SYSTEM 12
1. General:
    a. Piping symbol and service:
        1) LPA - Low Pressure Air.
    b. Test requirements:
        1) Test medium: Air.
        2) Pressure: 20 psig.
        3) Duration: 6 HRS.
    c. Gaskets and O-rings:
        1) O-rings and flanged joints: Viton, 300 DegF or Neoprene, 250 DegF.
    d. Temperature:
        1) Normal: 180 DegF.
        2) Maximum: 250 DegF.
2. System components:
    a. All pipe sizes:
        1) Exposed and buried service:
            a) Material: Stainless Steel, Schedule 10S (exposed) and 40S (buried), Grade TP304L .
            b) Reference: ASTM A312.
            c) Lining: None.
            d) Coating: None.
            e) Fittings: Butt weldPied stainless steel meeting ASTM A774.
            f) Joints:
                (1) Butt welded with ASTM A182 stainless steel flanges at equipment and valves.
                (2) Stainless steel harnessed compression sleeve couplings where indicated on Drawings.

E. SPECIFICATION SCHEDULE - SYSTEM 21
1. General:
    a. Piping symbol and service:
        1) V – Vent.
    b. Test requirements:
        1) Test medium: Water.
        2) Pressure: See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.
        3) Duration: 6 HRS.
    c. Gaskets: Rubber, ASTM C564.
2. System components:
    a. Pipe size 1-1/4 IN and larger:
        1) Exposed service.
            a) Material: Cast iron soil pipe.
            b) Reference: ASTM A74, CISPI 301.
            c) Lining: None.
            d) Coating: Paint.
            e) Fittings: ASTM A74.
            f) Joints: No-hub with elastomeric sealing sleeve and stainless steel clamp assembly conforming to CISPI 301.
        2) Buried service (to 5 FT outside of structure):
            a) Material: Cast-iron soil pipe.
            b) Reference: ASTM A74.
            c) Lining: None.

d) Coating: Bituminous.
e) Fittings: ASTM A74.
f) Joints: Hub and spigot.

3. Vent Piping Installation:
   a. Run vent stack parallel to each soil or waste stack to receive branch vents from fixtures.
   b. Originate each vent stack from soil or waste pipe at its base.
   c. Where possible, combine soil, waste or vent stacks before passing through roof so as to minimize roof openings.
   d. Offset pipes running close to exterior walls away from such walls before passing through roof to permit proper flashing.
   e. Provide pipes passing through roofs with cast iron increasers minimum of 12 IN below roof one size larger than pipe but in no case less than 4 IN.
   f. Terminate each vent with approved frostproof jacket.
   g. Carry vent stacks 4 IN and larger full size through roof.
      1) Extend vent stacks at least 12 IN above roofing.
   h. Pipe vents from pressure regulating devices in compliance with local codes.

END OF SECTION

SECTION 40 05 07
PIPE SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe support and anchor systems.
   2. Design of Pipe Support Systems as specified.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B31.1, Power Piping.
      b. B31.3, Process Piping.
   2. ANVIL International (ANVIL).
   3. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A276, Standard Specification for Stainless Steel Bars and Shapes.
      c. [A510, Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.]
      d. A575, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
      e. A576, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
      f. A917, Standard Specification for Steel Sheet, Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface (General Requirements).
      g. A918, Standard Specification for Steel Sheet, Zinc-Nickel Alloy Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
      h. B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   4. American Welding Society (AWS):
      a. D1.1, Structural Welding Code - Steel.
   5. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
      a. SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
      b. SP-69, Pipe Hangers and Supports - Selection and Application.

B. Responsibility:
   1. Design complete support systems for piping 12 IN and smaller.
   2. Provide all labor, materials, equipment and incidentals as shown, specified and required to design, furnish and install the system of hangers, supports, guidance, anchorage and appurtenances.
   3. General piping support details may be indicated on the Drawings in certain locations for pipe 12 IN DIA and smaller.
   4. Incorporate those details with requirements of this Specification Section to provide the piping support system.

C. Each type of pipe hanger or support shall be the product of one manufacturer.

D. Qualifications:
   1. Pipe support designer:
      a. Licensed Professional Engineer registered in the state the project is located in.
      b. Minimum of 5 years experience designing pipe supports for projects of similar size and complexity.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Special Provision 19 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.
      d. Scaled drawings showing location, installation, material, loads and forces, and deflection of all hangers and supports.
      e. Analyze each pipe system for all loads and forces on hangers and supports and their reaction forces to the structure to which they are fastened.
      f. Where Contract Documents indicate contractor is to design pipe support systems, submit detail design calculations and scaled drawings signed by Pipe support designer..
   3. Certifications.
      a. Pipe support designer qualifications

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 MANUFACTURED UNITS

A. Vertical Pipe Supports:
   1. At base of riser.
   2. Lateral movement:
      a. Clamps or brackets:
         1) Stainless steel 316.

B. Pipe Support Saddle:
   1. For pipe located 3 FT or less from floor elevation, except as otherwise indicated on Drawings.
   2. Stainless steel.

C. Pipe Support Risers:
   1. Schedule 40 pipe.
   2. Stainless steel.
   3. Size: As recommended by saddle manufacturer.

D. Pipe Support Base Plate:
   1. 4 IN larger than support.
   2. Collar 3/16 IN thickness, circular in shape, and sleeve type connection to pipe.
   3. Collar fitted over outside of support pipe and extended 2 IN from floor plate.
   4. Collar welded to floor plate.
   5. Edges ground smooth.
   6. Assembly hot-dipped galvanized after fabrication.
   7. Stainless steel.

E. Wall Brackets:
   1. For pipe located near walls and 8 FT or more above floor elevation or as otherwise indicated on the Drawings.
   2. Stainless steel.

F. Pipe Anchors:
   1. For locations shown on the Drawings.

2. 1/4 IN steel plate construction.
3. Stainless steel.
4. Designed to prevent movement of pipe at point of attachment.

2.3 DESIGN REQUIREMENTS

A. Supports capable of supporting the pipe for all service and testing conditions.
   1. Provide 4 to 1 safety factor.

B. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.

C. Design supports and hangers to allow for proper pitch of pipes.

D. Check all physical clearances between piping, support system and structure.
   1. Provide for vertical adjustment after erection.

E. Support vertical pipe runs at base of riser.
   1. Support pipes for lateral movement with clamps or brackets.

F. Pipe Support Spacing:
   1. General:
      a. Factor loads by specific weight of liquid conveyed if specific weight is greater than water.
      b. Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the Drawings.
      c. Provide at least one (1) support for each length of pipe at each change of direction and at each valve.
   2. Steel, stainless steel, ductile iron, support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
1-1/2 and less	5
2 thru 4	10
5 thru 8	15
10 and greater	20

   3. Support each length and every fitting:
      a. Bell and spigot piping:
         1) At least one (1) hanger.
         2) Applied at bell.
      b. Mechanical coupling joints:
         1) Place hanger within 2 FT of each side of fittings to keep pipes in alignment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide piping systems exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition.
   1. Included in this requirement are movements from:
      a. Trap discharge.
      b. Water hammer.
      c. Similar internal forces.

B. Weld Supports:
   1. AWS D1.1.
   2. Weld anchors to pipe in accordance with ASME B31.3.

C. Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.

D. Inspect hangers for:
   1. Design offset.
   2. Adequacy of clearance for piping and supports in the hot and cold positions.
   3. Guides to permit movement without binding.
   4. Adequacy of anchors.

E. Inspect hangers after erection of piping systems and prior to pipe testing and flushing.

F. Anchorage to Concrete- reference Section 03 15 19.

G. Welding:
   1. Welding rods: ASTM and AWS standards.
   2. Integral attachments:
      a. Include welded-on ears, shoes, plates and angle clips.
      b. Ensure material for integral attachments is of good weldable quality.
   3. Preheating, welding and postheat treating: ASME B31.3, Chapter V.

H. Field Painting:
   1. Comply with Specification Section 09 91 00.

END OF SECTION

SECTION 40 05 19
PIPE: DUCTILE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ductile iron piping, fittings, and appurtenances.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
      b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. ASTM International (ASTM):
      a. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
   3. American Water Works Association (AWWA):
      a. C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
      b. C606, Standard for Grooved and Shouldered Joints.
   4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
      a. C105/A21.5, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
      b. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
      c. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
      d. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
      e. C150/A21.50, Standard for Thickness Design of Ductile-Iron Pipe.
      f. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
   5. Society of Automotive Engineers (SAE):
      a. AMS-QQ-P-416, Cadmium Plating - Electro-deposited.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 40 05 00.
   3. Certification of factory hydrostatic testing.
   4. If mechanical coupling system is used, submit piping, fittings, and appurtenant items which will be utilized to meet system requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Flanged adaptors:
      a. Rockwell (Style 912 (cast)).
      b. Dresser (Style 127 (cast)).
   2. Compression sleeve coupling:
      a. Rockwell (Style 431 (cast)).

b. Dresser (Style 153 (cast)).

3. Mechanical coupling:
   a. Victaulic (Style 31).
   b. Tyler.
4. Insulating couplings:
   a. Rockwell (Style 416).
   b. Dresser (Style 39).
5. Reducing couplings:
   a. Rockwell (Style 415).
   b. Dresser (Style 62).
6. Transition coupling:
   a. Rockwell (Style 413).
   b. Dresser (Style 62).
7. Polyethylene encasement tape:
   a. Chase (Chasekote 750).
   b. Kendall (Polyken 900).
   c. 3 M (Scotchrap 50).
8. Restrained joints:
   a. American (Lock Fast) - 12 IN and below.
   b. U.S. Pipe (TR-Flex) - 4 IN to 54 IN.
   c. American (Lock Fast) - Above 12 IN.

2.2 MATERIALS

A. Ductile Iron Pipe:
   1. AWWA/ANSI C115/A21.15.
   2. AWWA/ANSI C150/A21.50.
   3. AWWA/ANSI C151/A21.51.

B. Fittings and Flanges:
   1. AWWA/ANSI C110/A21.10.
   2. AWWA/ANSI C115/A21.15.
   3. Flanges drilled and faced per ASME B16.1 for both 125 and 250 psi applications.

C. Nuts and Bolts:
   1. Buried: 316 stainless steel.
   2. Exposed: 316 stainless steel.
   3. Heads and dimensions per ASME B1.1.
   4. Threaded per ASME B1.1.
   5. Project ends 1/4 to 1/2 IN beyond nuts.

D. Gaskets: See individual piping system requirements in Section 40 05 00.

E. If mechanical coupling system is used, utilize pipe thickness and grade in accordance with AWWA C606.

F. Polyethylene Encasement: See AWWA/ANSI C105/A21.5.

G. See Piping Schedules in Section 40 05 00.

2.3 MANUFACTURED UNITS

A. Couplings:
   1. Flanged adaptors:
      a. Unit consisting of steel or carbon steel body sleeve, flange, followers, Grade 30 rubber gaskets.
      b. Provide units specified in the ACCEPTABLE MANUFACTURERS Article.
      c. Supply flanges meeting standards of adjoining flanges.
      d. The working pressure rating of the entire assembly shall be greater than or equal to the test pressure specified on piping schedule for each respective piping application.
   2. Compression sleeve coupling:

a. Unit consisting of steel sleeve, followers, Grade 30 rubber gaskets.
b. Provide units specified in the ACCEPTABLE MANUFACTURERS Article.
c. Supply flanges meeting standards of adjoining flanges.
d. The working pressure rating of the entire assembly shall be greater than or equal to the test pressure specified on piping schedule for each respective piping application.
e. Provide field coating for buried couplings per AWWA C203.

3. Mechanical couplings:
   a. Use of mechanical couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Section 40 05 00.
   b. Utilize units defined in the ACCEPTABLE MANUFACTURERS Article.

2.4 FABRICATION

A. Furnish and install without outside coatings of bituminous material any exposed pipe scheduled to be painted.

B. Furnish cast parts with lacquer finish compatible with finish coat.

2.5 LININGS AND COATINGS

A. Where specified in piping schedule, provide linings to a minimum thickness of 40 mils.
   1. Polyethylene, "Polybond" by American Pipe.
   2. Polyurethane, "Polythane" by U.S. Pipe.
   3. Ceramic epoxy, "Protecto 401" by U.S. Pipe.
   4. Calcium aluminate, "Sewper Coat" by Griffin Pipe.

2.6 SOURCE QUALITY CONTROL

A. Factory Test:
   1. Subject pipe to hydrostatic test of not less than 500 psi with the pipe under the full test pressure for at least 10 seconds.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Joining Method - Push-On Mechanical (Gland-Type) Joints:
   1. Install in accordance with AWWA/ANSI C111/A21.11.
   2. Assemble mechanical joints carefully according to manufacturer's recommendations.
   3. If effective sealing is not obtained, disassemble, thoroughly clean, and reassemble the joint.
   4. Do not overstress bolts.
   5. Where piping utilizes mechanical joints with tie rods, align joint holes to permit installation of harness bolts.

B. Joining Method - Push-On Joints:
   1. Install in accordance with AWWA/ANSI C151/A21.51.
   2. Assemble push-on joints in accordance with manufacturer's directions.
   3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
      a. Use lubricant that is non-toxic, does not support the growth of bacteria, has no deteriorating effects on the gasket material, and imparts no taste or odor to water in pipe.
   4. Assure the gasket groove is thoroughly clean.
   5. For cold weather installation, warm gasket prior to placement in bell.
   6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.

C. Joining Method - Flanged Joints:
   1. Install in accordance with AWWA/ANSI C115/A21.15.
   2. Extend pipe completely through screwed-on flanged and machine flange face and pipe in single operation.

3. Make flange faces flat and perpendicular to pipe centerline.
4. When bolting flange joints, exercise extreme care to ensure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress, bending or torsional strains to be applied to cast flanges or flanged fittings.
5. Allow one (1) flange free movement in any direction while bolts are being tightened.
6. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
7. Gradually tighten flange bolts uniformly to permit even gasket compression.

D. Joining Method - Mechanical Coupling Joint:
1. Arrange piping so that pipe ends are in full contact.
2. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
3. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.

E. Flange Adaptors 12 IN and Less:
1. Locate and drill holes for anchor studs after pipe is in place and bolted tight.
2. Drill holes not more than 1/8 IN larger than diameter of stud projection.

F. Cutting:
1. Do not damage interior lining material during cutting.
2. Use abrasive wheel cutters or saws.
3. Make square cuts.
4. Bevel and free cut ends of sharp edges after cutting.

G. Support exposed pipe in accordance with Section 40 05 00.

H. Install buried piping in accordance with Section 40 05 00.

I. Install restrained joint systems where specified in Section 40 05 00 under specific piping system.

3.2 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Section 40 05 00.

END OF SECTION

SECTION 40 05 31
PIPE: PLASTIC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic pipe.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. See Specification Section 40 05 00.

B. Referenced Standards:
   1. ASTM International (ASTM):
      a. PVC (polyvinyl chloride) materials:
         1) D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
         2) D1785, Standard Specification for Poly(Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80 and 120.
         3) D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
         4) D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
         5) D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
         6) D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
         7) F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
         8) F679, Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
         9) F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
         10) F949, Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings.
      b. Installation:
         1) D2321, Standard Practice for Underground Installation of Thermosplastic Pipe for Sewers and Other Gravity-Flow Applications.
   2. American Water Works Association (AWWA):
      a. PVC (polyvinyl chloride) materials:
         1) C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN Through 12 IN, for Water Distribution.
         2) C905, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 IN through 48 IN, for Water Transmission and Distribution.
   3. NSF International (NSF).

1.3 SUBMITTALS

A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. See Specification Section 40 05 00.

PART 2 - PRODUCTS

2.1 PVC PRESSURE PIPING (EXPOSED)

A. General:
   1. Provide Schedule 80 pipe with Schedule 80 fittings and appurtenances to locations shown on Drawings.
   2. Furnish materials in full compliance to following material specifications:
      a. Manufacture pipe, fittings and appurtenances from polyvinyl chloride (PVC) compound which meets the requirements of Type 1, Grade 1 (12454-B) Polyvinyl Chloride as outlined in ASTM D1784.
      b. Manufacture pipe, fittings and valves from materials that have been tested and approved for conveying potable water by the NSF.

B. Pipe:
   1. Furnish pipe meeting requirements of ASTM D1785.
   2. Pipe 2 IN and less to be solvent welded.
   3. Pipe larger than 2 IN may be either flanged or solvent welded unless shown otherwise on Drawings.

C. Fittings: Provide ASTM D2467 PVC socket type fittings having the same pressure and temperature rating as the pipe.

D. Flanges/Unions:
   1. Furnish flanges and unions at locations shown on Drawings.
   2. Provide either flanges or unions at valves, penetrations through structures and equipment connections.
   3. For pipe larger than 2 IN, provide 150 LB socket type PVC flange.
   4. For pipe 2 IN and less, provide socket type PVC union with Buna O-rings.
   5. Use flat, full faced natural rubber gaskets at flanged connections.
      a. Furnish heavy hex head bolts, each with one (1) heavy hex nut, ASTM F593 Type 316 stainless steel.
   6. Use spacers supplied by pipe manufacturer when mating raised-faced flanges to other flanges.

E. Installation:
   1. Field threading PVC will not be permitted.
      a. Perform required threaded connections or attachments by the use of factory molded socket by threaded adapters.
      b. Female adapters are not acceptable.
   2. Employ installation and pipe support practices and solvent welding all in compliance to the manufacturer's printed recommendation.
      a. Continuously support PVC piping at liquid operating temperatures in excess of 100 DegF.
      b. For vertical piping, band the pipe at intervals to rigidly support load of twice vertical load.
      c. Support riser clamps on spring hangers.
      d. Do not clamp PVC tightly or restrict movement for expansion and contraction.

2.2 PRESSURE PIPING (UNDERGROUND)

A. Materials: Furnish materials in full compliance with following requirements:
   1. 1/2-3 IN: AWWA C901 PE with Pressure Class of 150 psi per Table A3, AWWA C901.
   2. 4-12 IN: AWWA C900 PVC with Pressure Class of 150 psi per Table 2, AWWA C900.
   3. 14-36 IN: AWWA C905 PVC DR-25.
   4. Joints for polyethylene pipe shall be fusion type in accordance with AWWA C901.
   5. Joints for PVC pipe shall be the elastomeric-gasket type with a pressure rating not less than pipe pressure rating meeting performance requirements of ASTM D3139.

B. Installation:
   1. Field threading of PVC pipe will not be permitted.
   2. Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

2.3 PVC TUBING

A. General: Provide nylon tubing with fittings and appurtenances as shown on Drawings.

B. Materials:
   1. Furnish clear outer braided tubing with braid outside the walls.
   2. Have tubing manufactured of nylon with working temperatures from 5 to 180 DegF.
   3. Design tubing with a minimum safety factor of 4 to 1 ratio of burst pressure to working pressure at maximum temperature.
   4. Provide tubing with working pressure of 75 psi at 180 DegF.
   5. Ensure that tubing is self-extinguishing and fire resistant.

C. Fittings:
   1. Install tubing with nylon fittings and connectors.
   2. Use barbed type adapters with stainless steel clamps.
   3. Provide fittings capable of withstanding temperatures from a -70 to 250 DegF.
   4. Ensure fittings have the same pressure and temperature rating as the tubing.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify each length of pipe clearly at intervals of 5 FT or less.
   1. Include manufacturer's name and trademark.
   2. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications and NSF approvals when applicable.

3.2 PRESSURE PIPING (UNDERGROUND)

A. Installation:
   1. Field threading of PVC pipe will not be permitted.
   2. Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

3.3 PVC TUBING

A. Fittings:
   1. Install tubing with nylon fittings and connectors.
   2. Use barbed type adapters with stainless steel clamps.
   3. Provide fittings capable of withstanding temperatures from a -70 to 250 DegF.
   4. Ensure fittings have the same pressure and temperature rating as the tubing.

END OF SECTION

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SECTION 40 05 51
VALVES - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Valving, actuators, and valving appurtenances.

B. Related Sections include but are not necessarily limited to:
   1. Section 01 61 03 - Equipment - Basic Requirements.
   2. Section 09 91 00 - Ferrous Metal Coatings.
   3. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B1.20.1, Pipe Threads, General Purpose.
      b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
      c. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASTM International (ASTM):
      a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      b. D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
      c. D638, Standard Test Method for Tensile Properties of Plastics.
      d. D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
      e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
      f. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
   3. American Water Works Association (AWWA):
      a. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
      b. C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
      c. C504, Standard for Rubber-Seated Butterfly Valves.
      d. C507, Standard for Ball Valves, 6 IN through 48 IN (150 MM through 1200 MM).
      e. C509, Standard for Resilient-Seated Gate Valves for Water Supply Service.
      f. C550, Standard for Protective Coatings for Valves and Hydrants.
      g. C606, Standard for Grooved and Shouldered Joints.
   4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
      a. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   5. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. MG 1, Motors and Generators.
   6. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).

1.3 DEFINITIONS

A. The following are definitions of abbreviations used in this Specification Section or one of the individual valve sections:
   1. WWP: Water working pressure.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Valve pressure and temperature rating.
      d. Valve material of construction.
      e. Special linings.
      f. Valve dimensions and weight.
      g. Valve flow coefficient.
      h. Wiring and control diagrams for electric or cylinder actuators.
      i. Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70. Include any required calculations per Section 01 61 03.
   2. Test reports.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

C. Informational Submittals:
   1. Verification from valve actuator manufacturer that actuators have been installed properly, that all limit switches and position potentiometers have been properly adjusted, and that the valve actuator responds correctly to the valve position command.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to individual valve Specification Sections for acceptable manufacturers.

2.2 MATERIALS

A. Refer to individual valve Specification Sections.

2.3 VALVE ACTUATORS

A. Valve Actuators - General:
   1. Provide actuators as shown on Drawings or specified.
   2. Counter clockwise opening as viewed from the top.
   3. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
   4. Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or chainwheel or 300 FT-pounds torque on the operating nut.
   5. Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.
   6. Extension stem:
      a. Install where shown or specified.
      b. Solid steel with actuator key and nut, diameter not less than stem of valve actuator shaft.
      c. Pin all stem connections.
      d. Center in valve box or grating opening band with guide bushing.

B. Buried Valve Actuators:
   1. Provide screw or slide type adjustable cast iron valve box, 5 IN minimum diameter, 3/16 IN minimum thickness, and identifying cast iron cover rated for traffic load.
   2. Box base to enclose buried valve gear box or bonnet.
   3. Provide 2 IN standard actuator nuts complying with AWWA C500, Section 3.16.

4. Provide at least two tee handle keys for actuator nuts, with 5 FT extension between key and handle.
5. Extension stem:
    a. Provide for buried valves greater than 4 FT below finish grade.
    b. Extend to within 6 IN of finish grade.
6. Provide concrete pad encasement of valve box as shown for all buried valves unless shown otherwise.

C. Plastic Valve Vault:
1. Provide in non-traffic areas only on valve applications 3-1/2 IN and less.
2. Nominal 7-1/2 IN DIA top section.
3. Design unit for screw type extension section having nominal 9 IN DIA bell.
4. Cast iron ring and lid.
5. Constructed of injection molded polyolefin compound with fibrous inorganic component reinforcing and UV stabilization.
6. Armor Access Boxes.

D. Exposed Valve Manual Actuators:
1. Provide for all exposed valves not having electric or cylinder actuators.
2. Provide handwheels for gate and globe valves.
    a. Size handwheels for valves in accordance with AWWA C500.
3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller.
    a. Lever actuators for butterfly valves shall have a minimum of five intermediate lock positions between full open and full close.
    b. Provide at least two levers for each type and size of valve furnished.
4. Gear actuators required for plug valves, butterfly valves, and ball valves 4 IN DIA and larger.
5. Provide gearing for gate valves 20 IN and larger in accordance with AWWA C500.
6. Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.
7. Provide chain actuators for valves 6 FT or higher from finish floor to valve centerline.
    a. Cadmium-plated chain looped to within 3 FT of finish floor.
    b. Equip chain wheels with chain guides to permit rapid operation with reasonable side pull without "gagging" the wheel.
    c. For smaller valves with lever or handle operators, provide offset tee handles with attached chain for operation from the operating floor.
8. Provide cast iron floor stands where shown on Drawings.
    a. Stands to be furnished by valve manufacturer with actuator.
    b. Stands or actuator to include thrust bearings for valve operation and weight of accessories.

E. Electric Actuators (120 V, 1 PH):
1. Electric Motor Actuators - General:
    a. Provide electric motor actuators for valves and gates so indicated: on the Drawings, in valve schedule in the Specifications, or elsewhere in the Contract Documents.
    b. Unless otherwise specified, provide each electric motor actuator with integral control devices for operation, including pushbuttons. When actuator’s integral control station would be 6 FT or more above the nearest operating floor, or when integral control station would be out of reach of facility personnel standing on the nearest operating floor: (1) integral control station on actuator is not required; and (2) provide remotely-located control station, with pushbuttons, in accordance with this Section.
2. General:
    a. Self contained including motor, gearing, torque switch, limit switches and cast housing.
    b. Electrical enclosure: NEMA 4 or NEMA 7 to comply with area rating classification shown on Drawings.
    c. Factory assembled requiring only field connection of power and control wires.
    d. Comply with Section 01 61 03.

3. Motors:
    a. Produce 1.5 times the required torque.
    b. Sized for two complete open-close cycles without overheating.
    c. One fully closed to fully open cycle to occur within 60 SEC.
    d. Class F insulation.
    e. Operate at plus or minus 10% voltage.
    f. 120 Volt, single phase, 60 Hz.
    g. Provide thermal cutout switch and internal heater for actuator enclosure.
    h. Control wiring as shown on Drawing control diagrams.
4. Remote pushbutton station:
    a. Enclosure: NEMA 4 stainless steel.
    b. Control relays shall include:
        1) Open relay.
        2) Closed relay.
        3) PLC interface relay.
    c. Push-to-test indicating lights shall include:
        1) Open.
        2) Closed.
        3) Remote.
    d. Selector switches shall include:
        1) Local-Remote.
        2) Open-Close.
    e. Space heater for enclosure.
    f. Control wiring as shown on control diagrams.
    g. Wire all components to an internal terminal strip and include mounted wiring diagram inside enclosure.
5. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes. See Section 01 61 03 for information on how to determine the available fault current, such that, the SCCR rating meets or exceeds the available fault current.

F. Cylinder Actuators:
1. General:
    a. Self-contained unit including actuator and controls.
    b. Electrical enclosure to meet area classification shown on Drawings.
    c. Factory assembled requiring field supply connection and control wires.
2. Cylinders:
    a. Conform to pneumatic cylinders.
    b. Cylinder barrel: Stainless steel.
    c. Heads and caps: Ductile iron.
    d. Cylinder pistons: Ductile iron.
    e. Double acting and operate on 60 PSIG water or air supply.
    f. Cylinder rated for 150 PSIG.
    g. Any hoses between control and cylinder to be oil resistant and arranged to avoid sharp bending from hose weight.
    h. Provide supply filter.
    i. Position cylinder above or to side of valve.
    j. For pneumatically operated pump check service provide air-oil tandem cylinder actuator with speed control valves on oil cylinder.
3. Controls:
    a. Provide pre-piped, pre-wired control:
        1) Pipe with corrosion-resistant metal.
        2) Provide four-way, two-position, 110 V solenoid valve in weatherproof enclosure.
        3) Provide open-closed signal limit switches.
        4) Speed control valves, to independently control opening and closing speed between 10 and 60 SEC.

5) Manual-automatic selector valve on supply to solenoid.
6) For modulating valves, provide a positioner, input signal 4-20 mA, including signal converter.
7) For modulating valves, provide valve position transmitter, 4-20 mA, including signal converter, where shown.
8) For pump check valves, provide additional two-way solenoid valve with speed control to allow rapid close on loss of electric power.

G. Valve Lockout Devices:
1. Device manufactured from same material as valve operator, preventing access to valve operator, to accept lock shackle.

2.4 FABRICATION

A. End Connections:
1. Provide the type of end connections for valves as required in the Piping Schedules presented in Section 40 05 00 or as shown on the Drawings.
2. Comply with the following standards:
a. Threaded: ASME B1.20.1.
b. Flanged: ASME B16.1, Class 125 unless otherwise noted or AWWA C207.
c. Bell and spigot or mechanical (gland) type: AWWA/ANSI C111/A21.11.
d. Soldered: ASME B16.18.
e. Grooved: Rigid joints per Table 5 of AWWA C606.

B. Refer to individual valve Specification Sections for specifications of each type of valve used on Project.

C. Nuts, Bolts, and Washers:
1. Wetted or internal to be bronze or stainless steel.
a. Exposed to be zinc or cadmium plated.

D. On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.

E. Epoxy Interior Coating: Provide epoxy interior coating for all ferrous surfaces in accordance with AWWA C550.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Painting Requirements: Comply with Section 09 91 00 for Ferrous Metal Coatings.

C. Setting Buried Valves:
1. Locate valves installed in pipe trenches where buried pipe indicated on Drawings.
2. Set valves and valve boxes plumb.
3. Place valve boxes directly over valves with top of box being brought to surface of finished grade.
4. Install in closed position.
5. Place valve on firm footing in trench to prevent settling and excessive strain on connection to pipe.
6. After installation, backfill up to top of box for a minimum distance of 4 FT on each side of box.

D. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.

E. For grooved coupling valves, install rigid type couplings or provide separate support to prevent rotation of valve from installed position.

F. Install electric or cylinder actuators above or horizontally adjacent to valve and gear box to optimize access to controls and external handwheel.

G. For threaded valves, provide union on one side within 2 FT of valve to allow valve removal.

H. Install valves accessible for operation, inspection, and maintenance.

3.2 ADJUSTMENT

A. Adjust valves, actuators and appurtenant equipment to comply with Section 01 75 00.
   1. Operate valve, open and close at system pressures.

B. For all electric actuators, employ and pay for services of valve actuator manufacturer's field service representative to:
   1. Inspect valve actuators covered by this Specification Section.
   2. Supervise adjustments and installation checks:
      a. Open and close valves electrically under local manual and demonstrate that all limit switches are properly adjusted and that switch contacts are functioning properly by verifying the inputs are received at the remote input/output (RIO) panels or local control panel as appropriate.
      b. Position modulating valves electrically under local manual control and demonstrate that the valve position feedback potentiometer is properly adjusted and that the feedback signal is received at the RIO panels or local control panel as appropriate.
      c. Simulate a valve position command signal at the RIO panel or local control panel as appropriate and demonstrate that the valve is controlled to the desired position without excessive hunting.
   3. Provide Owner with a written statement that the valve actuator manufacturer has verified that the actuators have been installed properly, that all limit switches and position potentiometers have been properly adjusted and that the valve actuator responds correctly to the valve position command.

END OF SECTION

SECTION 40 05 52
MISCELLANEOUS VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Air release valves.
   2. Pressure relief valves.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 01 61 03 - Equipment - Basic Requirements.
   2. Section 40 05 51 - Valves - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. American Water Works Association (AWWA):
      a. C512, Standard for Air-Release, Air-Vacuum, and Combination Air Valves for Waterworks Service.
      b. C550, Standard for Protective Interior Coatings for Valves and Hydrants.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 40 05 51.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 AIR RELEASE VALVES (CLEAN WATER)

A. General: Conform to AWWA C512.
   1. Water:
      a. Combination Air Release and Vacuum Valve:
         1) Acceptable manufacturer:
            a) APCO.
            b) GA Industries.
            c) Vent-O-Mat.
         2) Materials:
            a) Top and lower flange: NSF-61 certified epoxy coating.
            b) Barrel: 316 stainless steel.
            c) Floats: 316 stainless steel.
            d) Float seats and seals: EPDM.
            e) All wetted internal metal parts: 316 stainless steel.
      b. Design requirements:
         1) NSF-61 Certified

2) Inlet Size: 2 IN.
3) Working pressure: 100 PSI.
4) Provide isolation valve.

2.3 AUTOMATIC CONTROL VALVES FOR WATER SERVICE

A. Basic Valve:
1. Designed for use in NSF-61 Application.
2. Type:
a. Diaphragm-actuated hydraulically operated.
1) Acceptable manufacturers (Model as shown for specific valve):
a) Cla-val.
b) Singer.
2) Materials:
a) Body: Ductile iron.
b) Seat insert: Stainless steel.
c) Disc: Buna-N.
d) Diaphragm: Nylon fabric bonded with synthetic rubber.
3) Design requirements: Do not use diaphragm as seating surface.
b. Differential piston hydraulically operated:
1) Acceptable manufacturer:
a) GA Industries.
2) Materials:
a) Body: Cast iron.
b) Piston, liner and seat crown: Bronze.
c) Piston cup and liner cup: Leather or Buna-N.
3) Design requirements: Valve liner with vee-port openings.
3. Design requirements:
a. Size: 4 IN.
b. Operating pressure:
1) Maximum 150 PSI.
2) Minimum 20 PSI.
c. Flow range:
1) Normal maximum 700 GPM.
2) Normal minimum 300 GPM.

B. Control:
1. Type:
a. Pressure relief or pressure-sustaining control:
1) Acceptable manufacturers:
a) Cla-val, Model 50-01.
b) GA Industries, Figure 4800D (relief).
c) Watts ACV 116 Series.
d) Singer, Model 106-RPS.
2) Design requirements: Modulate basic valve to maintain constant upstream pressure by bypassing or relieving excess pressure.
a) Open basic valve rapidly at predetermined overpressure and close slowly after restoration of normal pressure.
b) Open rapidly at predetermined under pressure, remain open to dissipate surge and then slowly close.
2. Design requirements:
a. Assembles all control features and hardware on basic valve at factory.
b. Use corrosion-resistant metal for all exposed portions of the control.
c. Include with valve control:
1) Stop valves.
2) Strainer.
3) Valves for opening and closing speed control.

4) Pilot valves.
5) Solenoid valves.
6) Pressure switches as necessary to provide control function.

2.4 ACCESSORIES

A. Furnish any accessories required to provide a completely operable valve.

2.5 FABRICATION

A. Completely shop assemble unit including any interconnecting piping, speed control valves, control isolation valves and electrical components.

B. Provide internal epoxy coating suitable for potable water for all iron body valves in accordance with AWWA C550.

2.6 SOURCE QUALITY CONTROL

A. Shop hydrostatically test to unit test pressure.

2.7 MAINTENANCE MATERIALS

A. Provide one set of any special tools or wrenches required for operation or maintenance for each type valve.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: See Specification Section 01 61 03 and Specification Section 40 05 51.

B. Air Release Valves:
   1. Pipe exhaust to a suitable disposal point.
   2. Where exhausted to a trapped floor drain, terminate exhaust line 6 IN minimum above floor.

C. Float-Operated Valves: Install baffle around float to minimize turbulence adjacent to float.

3.2 FIELD QUALITY CONTROL

A. Clean, inspect, and operate valve to ensure all parts are operable and valve seats properly.

B. Check and adjust valves and accessories in accordance with manufacturer's instructions and place into operation.

END OF SECTION

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SECTION 40 05 61
GATE VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gate valves.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 40 05 51 - Valves - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   2. American Water Works Association (AWWA):
      a. C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
      b. C504, Standard for Rubber-Seated Butterfly Valves.
      c. C550, Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.
   3. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
      a. SP-9, Spot Facing for Bronze, Iron and Steel Flanges.
      b. SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
      c. SP-80, Bronze Gate, Globe, Angle and Check Valves.
   4. National Sanitation Foundation International (NSF):
      a. 61, Drinking Water System Components - Health Effects.

1.3 DEFINITIONS

A. OS&Y: Outside Screw and Yoke.

B. NRS: Non-rising Stem.

C. RS: Rising Stem.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 40 05 51.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 VALVES: WATER

A. Resilient Wedge Gate Valves, 2 to 48 IN (Potable Water Application):
   1. Comply with AWWA C509.
   2. For use in clean water, potable, system which requires NSF-61 certified products.

3. Materials:
    a. Stem and stem nut: Bronze.
        1) Wetted bronze parts in low zinc bronze.
    b. Body, gate: Ductile iron.
    c. Resilient wedge: Fully encapsulated rubber wedge.
4. Design requirements:
    a. Minimum 150 PSIG working pressure.
    b. Exposed: OS&Y, stuffing box stem seal, handwheel.
    c. Counterclockwise open rotation.
5. Painting:
    a. The valve interior and exterior, except for disc edge, rubber seat and finished portions shall be evenly coated with an NSF61 approved epoxy coating.
6. Manufacturers:
    a. Clow.
    b. Mueller.
    c. American Flow Control.
    d. M & H.

2.3 ACCESSORIES

A. Refer to Drawings and valve schedule for type of actuators.
    1. Furnish actuator integral with valve.

B. Refer to Specification Section 40 05 51 for actuator requirements.

2.4 FABRICATION

A. General:
    1. Provide valves with clear waterways the full diameter of the valve.

B. Spot valves in accordance with MSS SP-9.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 40 05 51.

B. Do not install gate valves inverted or with the stems sloped more than 45 DEG from the upright unless the valve was ordered and manufactured specifically for this orientation.

END OF SECTION

SECTION 40 05 62
THREE-WAY PLUG VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Three-way plug valves.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125 and 250.
   2. ASTM International (ASTM):
      a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
      b. A536, Standard Specification for Ductile Iron Castings.
      c. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
   3. American Water Works Association (AWWA):
      a. C517 Resilient-Seated Cast-Iron Eccentric Plug Valves

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 40 05 51.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
   2. See Specification Section 40 05 51.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed under the specific valve types are acceptable.

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

2.2 NON-LUBRICATED ECCENTRIC PLUG VALVES

A. Manufacturers:
   1. DeZurik.
   2. Henry Pratt.
   3. Millikin.
   4. ValMatic.

B. Materials:
   1. Designed for use in a drinking water application, which requires an NSF-61 certification.
   2. Body: Cast-iron ASTM A126, Class B.
   3. Plug: One or two-piece construction ductile iron, ASTM A536 65-45-12 or cast iron, ASTM A126 Class B.

4. Plug facing: Grease and/or petroleum-resistant resilient Neoprene or Buna-N compound, 70 Type A durometer hardness per ASTM D2240.
5. Shaft bearing bushings: Permanently lubricated TFE or Delrin sleeve type stainless steel or bronze.
6. Valve seats: Welded-in overlay of 90 PCT nickel, (minimum 1/8 IN thick).
7. Stem seal: per AWWA C517, Section 4.4.7.

2.3 ACCESSORIES

A. Refer to Drawings and valve schedule for type of actuator.
   1. Furnish actuator integral with valve.

B. Refer to Specification Section 40 05 51 for actuator requirements.

2.4 DESIGN REQUIREMENTS

A. Non-Lubricated Eccentric Three-Way Plug Valves:
   1. Port area:
      a. Valves 4 IN through 20 IN: Equal to or exceed 80 PCT of full pipe area.
   2. Valve body: Fitted with bolted bonnet.
   3. End connections: See Specification Section 40 05 51.
   4. Stem seal: Adjustable and replaceable without disassembling valve or bonnet.
   5. Designed for seating drip tight in any flow direction.
   6. Rating:
      a. Three-way valves, 125 PSI working pressure.
   7. Actuator:
      a. Actuator gearing in enclosure suitable for running in oil with seals on shaft to prevent entry of dirt or water.
      b. Positive identification on actuator indicating valve position.
      c. Adjustable stop to set closing torque.
      d. Provide position indicating switch.
      e. Electrical actuator, refer to Section 40 50 51.

2.5 FABRICATION

A. See Specification Section 40 05 51.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 40 05 51.

B. Install valves with valve stem horizontal, plug seat on inlet side and with plug rotating up into the open position for valves in horizontal lines.

C. Install valve with actuator above pipe or plug centerline.

END OF SECTION

SECTION 40 05 64
BUTTERFLY VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Butterfly valves.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 40 05 51 - Valves – Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.5, Pipe Flanges and Flanged Fittings - NPS 1/2 Through NPS 24.
   2. ASTM International (ASTM):
      a. A48, Standard Specification for Gray Iron Castings.
      b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      c. A276, Standard Specification for Stainless Steel Bars and Shapes.
      d. A395, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
      e. A436, Standard Specification for Austenitic Gray Iron Castings.
      f. A536, Standard Specification for Ductile Iron Castings.
   3. American Water Works Association (AWWA):
      a. C504, Standard for Rubber-Seated Butterfly Valves.
   4. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
      a. SP-67, Butterfly Valves.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 40 05 51.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. DeZurik.
   2. Pratt
   3. Clow.
   4. Or approved equal.

B. Submit request for pre-approval in accordance with Specification Section 01 25 13.

2.2 HIGH PERFORMANCE BUTTERFLY VALVES

A. In locations where reliability is critical, for automated valves that modulate for flow control.

B. Design Requirements:
   1. One-piece shaft.
   2. Separate shaft seal.
   3. Minimum shaft diameter to conform to AWWA C504, Class 150B.
   4. Shall be NSF-61 certified.

C. Materials of construction:
   1. Disc: 316 stainless steel.
   2. Shaft and pins: 316 stainless steel.
   3. Seals:
      a. Process air and high temperature: Graphite rings.
   4. Backing ring: Stainless steel.
   5. Bushings/Bearings: TFE/Glass liner with a 316 Stainless steel shell.
   6. Seat:
      a. Two part with encapsulated RTFE or PTFE.
      b. Seat Retainer: Stainless Steel.
      c. Or Stainless Steel.
   7. Painting:
      a. The valve interior and exterior, except for disc edge, rubber seat and finished portions shall be evenly coated with an NSF61 approved epoxy coating.

2.3 GENERAL USE BUTTERFLY VALVES

A. For use in all location, except where high performance butterfly valves are required.

B. Comply only with AWWA C504, as noted in this Specification Section.

C. Materials:
   1. Valve bodies:
      a. ASTM A126, Class B or ASTM A536 Grade 65-45-12 ductile iron.
   2. Valve shafts:
      a. One-piece stainless steel, Type 304.
      b. Pins: 304 stainless steel.
      c. Bushings/Packing/O-rings: EPDM.
      d. Bearings: Reinforced TFE or equal.
   3. Valve discs:
      a. 304 Stainless Steel disk.
   4. Valve seats:
      a. Process air: Viton, RTFE, rate for 300 DEG F minimum.
   5. Shaft bearing: Bronze, TFE-coated stainless steel or reinforced TFE.
   6. Shaft seal in addition to any sealing provided by seat: Suitable synthetic rubber rings or PTFE V-ring suitable for operating conditions.
   7. Painting:
      a. The valve interior and exterior, except for disc edge, rubber seat and finished portions shall be evenly coated with an NSF61 approved epoxy coating.

D. Design Requirements:
   1. Seat type: Resilient.
   2. Body type: Short body flange.
   3. Shaft diameter: One-piece constant diameter.
   4. Shall be NSF-61 certified.

2.4 ACCESSORIES

A. Refer to Drawings and/or valve schedule for type of actuators.
   1. Furnish actuator integral with valve.

B. Refer to Section 40 05 51 for actuator requirements.

C. Valve Flange Seal Rings:
   1. If Steel Slip-on flanges are being used on the process piping, flange seals will be required for proper installation of valves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 40 05 51.

END OF SECTION

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SECTION 40 05 66
CHECK VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Check valves.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section 40 05 51 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. American Water Works Association (AWWA):
      a. C508, Standard for Swing-Check Valves for Waterworks Service, 2 IN through 24 IN NPS.
   3. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
      a. SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
      b. SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.3 DEFINITIONS

A. PVDF: Polyvinylidene fluoride.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 40 05 51.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, manufacturers listed under the valve with types are acceptable.

2.2 CHECK VALVES: 2.5 IN AND SMALLER

A. Class 125 Bronze Swing Check Valves (High Pressure Air, Water):
   1. Comply with MSS SP-80.
   2. Acceptable manufacturers:
      a. Nibco T413-Y.
      b. Stockham B-319Y.
   3. Materials:
      a. Body, bonnet, disc: Bronze.

4. Design requirements:
    a. 125 psi steam to 406 DegF, 200 psi WOG.
    b. Horizontal swing, renewable disc.

2.3 SWING CHECK VALVES: 3 IN TO 24 IN

A. Swing Check Valves:
1. Comply with AWWA C508.
2. Acceptable manufacturers:
    a. Clow.
    b. American Darling.
    c. Golden Anderson.
3. Materials:
    a. Body and cover: Cast iron.
    b. Seat ring, hinge: Bronze.
    c. Disc:
        1) 3 to 4 IN: Bronze.
        2) 6 to 24 IN: Cast iron with bronze face.
        3) 6 to 24 IN: Cast iron with rubber face.
    d. Hinge shaft: Stainless steel.
    e. Bearings, connecting hardware: Bronze.
4. Painting:
    a. The valve interior and exterior, except for disc edge, rubber seat and finished portions shall be evenly coated with an NSF61 approved epoxy coating.
5. Design requirements:
    a. 175 psi working pressure (3 to 12 IN).
    b. 150 psi working pressure (14 to 24 IN).
    c. Furnish with outside weight and lever or lever and spring.
    d. Shall be NSF-61 certified.

2.4 SILENT CHECK VALVES

A. ASME B16.1, Class 125.

B. Manufacturers:
1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
    a. APCO Series 300 or 600.
    b. GA Industries, Figures 280 or 290.
2. Materials:
    a. Designed for use in a drinking water application and shall be NSF-61 certified.
    b. Body: Cast iron.
    c. Plug and seat: Bronze.
    d. Spring: Stainless steel.

C. Design Requirements:
1. Body type:
2. 1 to 10 IN: Wafer.
3. 3 to 30 IN: Flanged center guided, globe style.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 40 05 51.

B. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 40 90 00
INSTRUMENTATION FOR PROCESS CONTROL: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Basic requirements for complete instrumentation system for process control.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Canadian Standards Association (CSA).
   2. FM Global (FM).
   3. The International Society of Automation (ISA):
      a. 7.0.01, Quality Standard for Instrument Air.
      b. S5.1, Instrumentation Symbols and Identification.
      c. S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems.
      d. S5.4, Standard Instrument Loop Diagrams.
      e. S20, Standard Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
   4. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   5. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   6. National Institute of Standards and Technology (NIST).
   7. Underwriters Laboratories, Inc. (UL):
      a. 913, Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.

B. WesTech is the filter system supplier and filter system control integrator. The WesTech Process Control Panel (PCP) PLC serves as the plant PLC. WesTech shall perform any required SCADA system and control panel changes and WesTech shall be the plant control integrator.

C. Miscellaneous:
   1. Comply with electrical classifications and NEMA enclosure types shown on Drawings.

1.3 DEFINITIONS

A. Architecturally finished area: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.

B. Non-architecturally Finished Area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.

C. Corrosive Areas: Rooms or areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.

D. Outdoor Area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.

E. Calibrate: To standardize a device so that it provides a specified response to known inputs.

1.4 SYSTEM DESCRIPTION

A. Control System Requirements:

1. This Specification Section provides the general requirements for the instrument and control system.
2. The instrument and control system consists of all primary elements, transmitters, switches, controllers, computers, recorders, indicators, panels, signal converters, signal boosters, amplifiers, special power supplies, special or shielded cable, special grounding or isolation, auxiliaries, software, wiring, and other devices required to provide complete control of the plant as specified in the Contract Documents.

B. All signals shall be directly linearly proportional to measured variable unless specifically noted otherwise.

C. WesTech shall serve as the plant control integrator.

1.5 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Submittals shall be original printed material or clear unblemished photocopies of original printed material.
   a. Facsimile information is not acceptable.
3. Limit the scope of each submittal to one (1) Specification Section.
   a. Each submittal must be submitted under the Specification Section containing requirements of submittal contents.
   b. Do not provide any submittals for Specification Section 40 90 00.
4. Product technical data including:
   a. Equipment catalog cut sheets.
   b. Instrument data sheets:
      1) ISA S20 or approved equal.
      2) Separate data sheet for each instrument.
   c. Materials of construction.
   d. Minimum and maximum flow ranges.
   e. Pressure loss curves.
   f. Physical limits of components including temperature and pressure limits.
   g. Size and weight.
   h. Electrical power requirements and wiring diagrams.
   i. NEMA rating of housings.
   j. Submittals shall be marked with arrows to show exact features to be provided.
5. Loop diagrams per ISA S5.4 as specified in Specification Section 40 98 00.
6. Panel fabrication drawings as specified in Specification Section 40 98 00.
7. PLC equipment drawings.
8. HMI graphics.
9. Nameplate layout drawings.
10. Drawings, systems, and other elements are represented schematically in accordance with ISA S5.1 and ISA S5.3.
    a. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed exclusively throughout submittals.
11. All Shop Drawings shall be modified with as-built information/corrections.
12. All panel and wiring drawings shall be provided in both hardcopy and softcopy.
    a. Furnish electronic files on CD-ROM or DVD-ROM media.
    b. Drawings in AUTO CAD format.
13. Provide a parameter setting summary sheet for each field configurable device.
14. Certifications:
    a. Documentation verifying that calibration equipment is certified with NIST traceability.
    b. Approvals from independent testing laboratories or approval agencies, such as UL, FM or CSA.

1) Certification documentation is required for all equipment for which the specifications require independent agency approval.

15. Testing reports: Source quality control reports.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.
   2. Warranties: Provide copies of warranties and list of factory authorized service agents.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not remove shipping blocks, plugs, caps, and desiccant dryers installed to protect the instrumentation during shipment until the instruments are installed and permanent connections are made.

1.7 SITE CONDITIONS

A. Unless designated otherwise on the Drawings, area designations are as follows:
   1. Outdoor area:
      a. Wet.
      b. Corrosive when specifically designated on the Drawings or in the Specifications.
      c. Below grade vaults and manholes:
         1) Subject to temporary submergence when specifically designated on the Drawings or Specifications.
   2. Architecturally finished area:
      a. Dry.
      b. Noncorrosive unless designated otherwise on the Drawings or in the Specifications.
   3. Non-architecturally finished area:
      a. Dry unless otherwise indicated.

PART 2 - PRODUCTS

2.1 NEMA TYPE REQUIREMENTS

A. Provide enclosures/housing for control system components in accordance with the following:
   1. Areas designated as wet, outdoor, or corrosive: NEMA Type 4X.
   2. Either architecturally or non-architecturally finished areas designated as dry and nonhazardous: NEMA Type 12.
   3. Areas designated to be subject to temporary submersion: NEMA 6P.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. System Operating Criteria:
   1. Stability: After controls have taken corrective action, as result of a change in the controlled variable or a change in setpoint, oscillation of final control element shall not exceed two (2) cycles per minute or a magnitude of movement of 0.5 percent full travel.
   2. Response: Any change in setpoint or change in controlled variable shall produce a corresponding corrective change in position of final control element and become stabilized within 30 seconds.
   3. Agreement: Setpoint indication of controlled variable and measured indication of controlled variable shall agree within 3 percent of full scale over a 6:1 operating range.
   4. Repeatability: For any repeated magnitude of control signal, from either an increasing or decreasing direction, the final control element shall take a repeated position within 0.5 percent of full travel regardless of force required to position final element.
   5. Sensitivity: Controls shall respond to setpoint deviations and measured variable deviations within 1.0 percent of full scale.

6. Performance: All instruments and control devices shall perform in accordance with manufacturer's specifications.
7. All wetted parts shall be NSF-61 compliant for potable water.

2.3 ACCESSORIES

A. Provide identification devices for instrumentation system components in accordance with Specification Section 10 14 00.

B. Provide corrosion resistant spacers to maintain 1/4 IN separation between equipment and mounting surface in wet areas, on below grade walls and on walls of liquid containment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wherever feasible, use bottom entry for all conduit entry to instruments and junction boxes.

B. Install electrical components per the requirements of the Electrical design.

C. Panel-Mounted Instruments:
1. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
2. Locate all devices mounted inside enclosures so terminals and adjustment devices are readily accessible without use of special tools and with terminal markings clearly visible.

D. See Specification Section 26 05 19.

3.2 FIELD QUALITY CONTROL

A. See Specification Section 01 75 00.

B. Maintain accurate daily log of all startup activities, calibration functions, and final setpoint adjustments.
1. Documentation requirements include the utilization of the forms located at the end of this Specification Section.
   a. Loop Check-out Sheet.
   b. Instrument Certification Sheet.
   c. Final Control Element Certification Sheet.

C. Instrumentation Calibration:
1. Verify that all instruments and control devices are calibrated to provide the performance required by the Contract Documents.
2. Calibrate all field-mounted instruments, other than local pressure and temperature gages, after the device is mounted in place to assure proper installed operation.
3. Calibrate in accordance with the manufacturer's specifications.
4. Bench calibrate pressure and temperature gages.
   a. Field mount gage within seven (7) days of calibration.
5. Check the calibration of each transmitter and gage across its specified range at 0, 25, 50, 75, and 100 percent.
   a. Check for both increasing and decreasing input signals to detect hysteresis.
6. Replace any instrument which cannot be properly adjusted.
7. Stroke control valves to verify control action, positioner settings, and other functions.
8. Calibration equipment shall be certified by an independent agency with traceability to NIST.
   a. Certification shall be up-to-date.
   b. Use of equipment with expired certifications shall not be permitted.
9. Calibration equipment shall be at least three (3) times more accurate as the device being calibrated.

D. Loop check-out requirements are as follows:
   1. Check control signal generation, transmission, reception and response for all control loops under simulated operating conditions by imposing a signal on the loop at the instrument connections.
      a. Use actual signals where available.
      b. Closely observe controllers, indicators, transmitters, HMI displays, recorders, alarm and trip units, remote setpoints, ratio systems, and other control components.
         1) Verify that readings at all loop components are in agreement.
         2) Make corrections as required.
            a) Following any corrections, retest the loop as before.
   2. Stroke all control valves, cylinders, drives and connecting linkages from the local control station and from the control room operator interface.
   3. Check all interlocks to the maximum extent possible.
   4. In addition to any other as-recorded documents, record all setpoint and calibration changes on all affected Contract Documents and turn over to the Owner.

E. Provide verification of system assembly, power, ground, and I/O tests.

F. Verify existence and measure adequacy of all grounds required for instrumentation and controls.

END OF SECTION

Loop Check-out Sheet

Project Name:	Owner's Project No. (if applicable):	Page of
Project Owner:	Regulatory Agency Project No. (if applicable):	
HDR Project No.:	Date:	

LEAK AND TERMINATION/CONTINUITY CHECKS

DESCRIPTION	FIELD					CONTROL CAB	
	LEAK CHECK(1)			TERM/CONT CHECK(2)		TERM/CONT CHECK(2)	
	Device Tag No.	Process Conn.	Signal Tube	Device Tag No.	Termination Ident.	Device Tag No.	Termination Ident.

1. Leak check for pneumatic signal tubing to be per ISA-PR7.1.
2. Termination/continuity check includes check at terminated equipment for: (a) correct polarity, (b) appropriate signal generation, transmission and reception, and (c) correct shield & ground terminations.

OPERATOR INTERFACE CHECK-OUT

MONITORING POINTS OBSERVED

PARAMETER TYPE	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.
PROCESS VAR						
EQUIP STATUS						
ALARM POINT						

OPERATOR CONTROL FUNCTIONS CHECKED

FUNCTION TYPE	TAG NO.	LOCATION	TAG NO.	LOCATION	TAG NO.	LOCATION

AS LEFT SETTINGS

TAG NO.	SWITCH & ALARM SP	CONTROLLERS			
		Gain	Reset, rpm	Deriv. (rate), min	PV Set Point

Describe all interlocks checked, equipment started/stopped, valves/operators stroked. Describe modes of operation checked, and location of operator interface (local/remote).

I certify that the control loop referenced on this page has been completely checked and functions in accordance with applicable drawings and specifications.

Certified by:_____ Date:_____

(Work Performed By)

Instrument Certification Sheet

Project Name:	Owner's Project No. (if applicable):
Project Owner:	Regulatory Agency Project No. (if applicable):
HDR Project No.	Date:
Control Loop No.:	
Instrument Tag No.	Transmitter/gauge span:
Manufacturer:	Switch set-point:
Model No.	Switch dead band:
Serial No.	Switch range:

TRANSMITTERS AND INDICATORS

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	**INPUT**	**OUTPUT**	**ERROR (% of span)**	**INPUT**	**OUTPUT**	**ERROR (% of span)**
0%						
10%						
25%						
50%						
75%						
90%						
100%						
Other (if applicable)						
Other (if applicable)						

SWITCHES

	INCREASING INPUT			DECREASING INPUT		
ACTUATION POINT	**INPUT**	**OUTPUT**	**ERROR (% of range)**	**INPUT**	**OUTPUT**	**ERROR (% of range)**
High (Increasing input)						
Low (Decreasing input)						

Maximum allowable error (per Contract Documents): _____

Remarks: _____

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?

Certified by: _____ Date Certified: _____

Final Control Element Certification Sheet

Project Name:	Owner's Project No. (if applicable):
Project Owner:	Regulatory Agency Project No. (if applicable):
HDR Project No.	Date:
Control Loop No.:	

Tag No.	
Description:	
Manufacturer:	
Model No.	
Serial No.	

Actuator:	Pneumatic: _____ Electric: _____
Positioner:	Direct: _____ Reverse: _____
Positioner:	Input: _____ Output: _____
I/P Converter:	Input: _____ Output: _____
Valve to	_____ on air failure
Valve to	_____ on power failure

I/P CONVERTER

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	OUTPUT	ERROR (% of span)	INPUT	OUTPUT	ERROR (% of span)
0%						
10%						
25%						
50%						
75%						
90%						
100%						

Specified I/P converter accuracy: _____ % of span.

FINAL CONTROL ELEMENT

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	TRAVEL	ERROR (% of full travel)	INPUT	TRAVEL	ERROR (% of full travel)
0%						
10%						
25%						
50%						
75%						
90%						
100%						

Remarks: _____

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?

Certified by: Date Certified:

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SECTION 40 90 05
CONTROL LOOP DESCRIPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Instrumentation control loops.

1.2 QUALITY ASSURANCE

A. See Specification Section 40 90 00.

1.3 SYSTEM DESCRIPTION

A. The control loop descriptions provide the functional requirements of the control loops represented in the Contract Documents.

B. The control loop descriptions are not intended to be an inclusive listing of all elements and appurtenances required to execute loop functions, but are rather intended to supplement and complement the Drawings and other Specification Sections.
   1. The control loop descriptions shall not be considered equal to a bill of materials.

C. Provide instrumentation hardware and software as necessary to perform control functions specified herein and shown on Drawings.

1.4 SUBMITTALS

A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. See Specification Section 40 90 00.

C. Control Strategy for Record Documents:
   1. Obtain this Specification Section 40 90 05 in electronic format (Microsoft Word) from Engineer at beginning of Project.
   2. Revise and update the file monthly during construction and start-up to reflect all changes that occur due to specific equipment and systems supplied on the Project.
      a. Show all revisions in 'track change' mode.
      b. Change Specification Section Title to read "Control Loop Descriptions - Contractor Record Document."
      c. Reference all changes by Request for Information (RFI) number or Change Proposal Request (CPR) number.
      d. Submit revised file monthly to Engineer for review.
   3. Deliver the revised and updated file as a final control loop description Record Document in the Operation and Maintenance Manual described in Specification Section 01 33 04.
   4. Provide both paper copy and electronic copy (on CD-ROM) of the Record Document control loop descriptions in the Operation and Maintenance Manual described in Specification Section 01 33 04.

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

PART 3 - EXECUTION

3.1 CONTROL LOOPS

A. General:
   1. Loss of power will cause all drives to shut down. Upon restoration of power, drives in Auto shall start in sequence to operating state prior to power failure and then return to normal control.
   2. If a drive is called to start and fails to start within a preset time an alarm shall be generated and the next drive in sequence shall be started.
   3. If a drive is running in auto and stops while still called, the next drive in sequence shall be started and an alarm generated.
   4. If a drive is called to stop and fails to stop with in a preset time an alarm shall be generated.

B. Raw Water Transfer System:
   1. Develop an operator interface screen for the raw water transfer system.
   2. See input/output schedule for applicable raw water transfer system I/O.
   3. The operator interface screen is only for PLC mode which is set by a local off PLC mode switch on the field LCP. If mode switch is in local, there no control from operator interface until the LCP mode switch is placed in PLC position.
   4. The operator interface screen shall have the following:
      a. System in PLC mode indication which will only illuminate if LCP mode switch is in PLC, VFD is in remote mode, transfer valve is in remote mode and there is no VFD fault.
      b. Lights for pump run and VFD fail indication.
      c. Pump speed indication.
      d. Valve in transfer position indication.
      e. Valve in normal position indication.
      f. Valve in remote mode indication.
      g. VFD in remote mode indication.
      h. Indicator for setting transfer run time and showing remaining run time while transfer in running.
      i. Raw water transfer start button.
   5. Control sequence for PLC operation from operator interface.
      a. System must be in PLC mode.
      b. Set desired run time (1-24 hours).
      c. Set desired pump run speed (60% to 100%).
      d. Press raw water transfer system start button. System will start if run time is set for more than 1 hour, pump speed is set for 60% or more, system is in PLC mode, VFD is in remote mode and not in fault and valve actuator is in remote mode.
      e. First step is valve will go to transfer position.
      f. Once valve is in transfer position, the transfer pump will start and go to preset speed.
      g. Pump will run for duration of time setting and at end of time period will stop and valve will go to normal position.

C. In Line Mixer:
   1. In Auto, PCO to start in line mixer when plant is started and stop in line mixer when plant stops.

D. Plant Control Modifications:
   1. Eliminate surface wash pump control, modify air scour control, modify blower control for two blowers, add high/low backwash, add backwash flow meter and add finished water flow meters (2-16”).

END OF SECTION

SECTION 40 91 10
PRIMARY METERS AND TRANSMITTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flow meters.
   2. Level components.
   3. Pipe, tubing and fittings.
   4. Instrument valves.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Gas Association (AGA):
      a. Gas Measurement Committee Report #3.
   2. American Iron and Steel Institute (AISI).
   3. American National Standards Institute (ANSI).
   4. American Society of Mechanical Engineers (ASME):
      a. B16.5, Pipe Flanges and Flanged Fittings.
      b. B31.1, Power Piping.
      c. Section II, Part A SA-182, Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
      d. Section II, Part A SA-479, Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
   5. ASTM International (ASTM):
      a. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
      b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      c. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
      d. A276, Standard Specification for Stainless Steel Bars and Shapes.
      e. A479, Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
      f. B16, Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
      g. B75, Standard Specification for Seamless Copper Tube.
      h. B124, Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes.
      i. B283, Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).
      j. B453, Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Rod, Bar, and Shapes.
   6. The International Society of Automation (ISA):
      a. MC96.1, Temperature Measurement Thermocouples.
   7. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   8. US Department of Interior Bureau of Reclamation (USDIBR):
      a. Water Measurement Manual.

1.3 SYSTEM DESCRIPTION

A. The instruments specified in this Specification Section are the primary element components for instruments shown on the Drawings and specified.

1. These instruments are integrated with other control system components specified under Specification Section 40 90 00 series to produce the functional control defined in the Contract Documents.
2. All wetted parts shall be NSF-61 compliant for potable water.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 40 90 00.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the Articles describing the elements are acceptable.

2.2 FLOW METERS

A. Magnetic Flow Meters:
   1. Acceptable manufacturers:
      a. ABB.
      b. Rosemount.
      c. Krohne.
      d. Endress + Hauser.
      e. Seimens.
      f. Or approved equal.
   2. Design and fabrication:
      a. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.
      b. High input impedance pre-amplifiers.
         1) Minimum impedance: 10^{10} ohms.
      c. Provide flanged end connections per ASME B16.5 rated for piping system operating and test conditions.
      d. Operating pressure: 100 psi.
      e. Operating temperature: 100 DegF.
      f. Bonding requirements: Provide 2-316 stainless steel grounding rings for bonding.
      g. Provide cable between magnetic flow meter and transmitter, approximately 400 feet, Contractor to confirm.
      h. Pulsed DC magnetic field excitation.
      i. Automatic zero.
      j. Adjustable low flow cutoff.
      k. Minimum signal lock (empty tube zero) to prevent false measurement when tube is empty.
      l. Inaccuracy:
         1) Above 10 percent of range: +/-1.0 percent of rate.
         2) Below 10 percent of range: +/-0.1 percent of range setting.
         3) Add +0.1 percent of range to above inaccuracies for analog outputs.
      m. 4-20 mA DC isolated output into maximum 800 ohms.
      n. Power supply: 117 V +/-10 percent, 60 Hz.
      o. Indication of flow rate and totalized flow at transmitter.
      p. Meter operable as specified in liquids with 5.0 micro mho/cm or more conductivity.

q. Transmitter electronics shall use microprocessor based architecture and be configured using parameters.
r. Electrode: 316 stainless steel.
s. Liner: Hard rubber or Teflon.

3. Schedule:

TAG NUMBER	SERVICE	FLOW RANGE (GPM)	METER SIZE (IN)	INTEGRAL, FIELD OR PANEL-MOUNTED TRANSMITTER
FE/FIT-601	Treated Water	0 – 5,000	16	Field (wall mounting)
(Owner furnished, contractor installed)				
FE/FIT-602	Treated Water	0 – 5,000	16	Field (wall mounting)
FE/FIT-402	Filter Backwash	0 – 2,500	12	Integral

B. Propeller Meter:
1. Acceptable manufacturer:
a. McCrometer / Water Specialties.
2. Materials:
a. Body: Carbon steel with NSF-61 coating inside and out to match color of tank.
b. Propeller support shaft: Stainless steel.
c. Propeller: Polypropylene, nylafil, injection molded thermoplastic or polystyrene.
d. Meter head: Manufacturer standard.
e. Gear housing: Bronze.
f. O-Ring:
1) Up to 105 DEGF: Buna-N.
2) Up to 350 DEGF: Viton.
3. Design and fabrication:
a. Fabricate with four straightening vanes, radially spaced 90 DEG apart.
b. Meter tube: Nominal inside diameter throughout its length.
c. Provide flanged end connections:
1) Per ASME B16.5.
2) Rated for piping system operating and test conditions.
d. Connect meter head to tube by means of a flanged connection designed for easy removal.
e. Use O-ring, compression type seal to seal the meter head to the tube.
f. An electronic sensor housed in the gear housing shall be magnetically driven from the propeller magnet and be isolated form the water flow by means of an O-ring sealed housing.
1) Units utilizing vertical shafts or flexible cables will not be accepted.
g. Provide a digital indicating/totalizer integral to the meter head which is electronically driven by a sensor output proportional to the rotation of the propeller.
1) The indicator shall have 4 digits and have 0.350 IN high numbers minimum.
2) The totalizer shall have 6 digits and have 0.200 IN high numbers minimum.
3) Provide unit with EPROM memory so that total flow will not be lost during battery change or failure.
4) Provide unit equipped with an eight year lithium battery.
5) Completely encapsulate unit to protect it from moisture.
h. Protect register by an O-ring sealed register box located under the hinged lid.
1) Provide hinged lid complete with locking hasp.
i. Accuracy: ±2% of rate within 10:1 turndown.

4. Schedule:

TAG NUMBER	SERVICE	PIPE ID (IN)
FE/FIT-603	Water	12

2.3 PIPE, TUBING, AND FITTINGS

A. Acceptable Manufacturers:
   1. Tube fittings:
      a. Parker CPI.
      b. Swagelok.
      c. Or approved equal.

B. Instrument Tubing and Fittings:
   1. Material:
      a. Tubing: ASTM A269, Grade TP 316 stainless steel.
      b. Straight fittings: 316 stainless steel per ASME SA-479 or ASTM A276.
      c. Shaped bodies: ASME SA-182 F316 stainless steel.
   2. Design and fabrication:
      a. Tubing:
         1) Seamless.
         2) Fully annealed.
         3) Maximum hardness: 80 Rb.
         4) Free from surface scratches and imperfections.
         5) Diameter: 1/2 IN OD unless specified otherwise.
         6) Wall thickness:
            a) Meet requirements of ASME B31.1, Paragraph 122.3.
            b) Minimum 0.049 IN for 1/2 IN OD tubing.
      b. Fittings:
         1) Flareless.
         2) Compression type.

C. Instrument Piping:
   1. For applications where the instrument is supported solely by the sensing line, (e.g., pressure gauge directly mounted to process line) utilize piping as specified below.
      a. Diameter: 1/2 IN unless specified otherwise.
      b. Schedule 80.
      c. 316 stainless steel.

2.4 INSTRUMENT VALVES

A. Process instrument multi-valve manifolds, isolation, vent and blow-down valves:
   1. Acceptable manufacturers:
      a. Whitey Co.
      b. Anderson-Greenwood USA, Inc.
      c. Or approved equal.
   2. Materials:
      a. Packing:
         1) 450 DegF and above: Graphite.
         2) Below 450 DegF: Graphite or Teflon.
      b. Body: 316 stainless steel per ASTM A479.
      c. Stem: 316 stainless steel per ASTM A276.
      d. Ball: 316 stainless steel per ASTM A276.
      e. Support rings: 316 stainless steel per ASTM A276.
      f. Seats:
         1) Metal:
            a) 316 stainless steel per ASTM A276.

2) Soft:
a) Teflon, Delrin.
b) Only utilized on applications where manufacturer's temperature and pressure ratings exceed process design conditions.

3. Design and fabrication:
a. Either of the following:
1) Ball valve with 1/4 turn activation.
2) Free-swiveling ball stem.
b. Provide body wall thickness sufficient for process design conditions per ASME B31.1.
c. Temperature: Manufacturer's temperature rating for all components shall exceed process design conditions.

2.5 ACCESSORIES

A. Furnish all mounting brackets, hardware and appurtenances required for mounting primary elements and transmitters.
1. Materials, unless otherwise specified, shall be as follows:
a. Bolts, nuts, washers, expansion anchors: 316 stainless steel.
b. Mounting brackets:
1) Standard: 316 stainless steel.
c. Mounting plates, angles:
1) Standard: 316 stainless steel.
d. Instrument pipe stands:
1) Standard: 316 stainless steel.

B. Tubing Support Angles and Brackets:
1. Any of the following materials are acceptable:
a. Type 316 stainless steel.
b. Fiberglass.

C. Tubing Tray or Channel:
1. Aluminum.
2. Provide dielectric material between tray or channel and tubing.

D. Provide handheld communicator compatible with all intelligent transmitters furnished.
1. Hand held communicator shall provide capability to check calibration, change transmitter range, and provide diagnostics.
2. If these features are provided with the intelligent transmitter, the hand held communicator is not required.

E. Cable lengths between sensors and transmitters shall be continuous (without splices) and as required to accommodate locations as shown on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install instrument mounting pipe stands level and plumb.

C. Instrument Valves:
1. Orient stems for proper operation.
2. Install arrays orderly and neat in appearance with true horizontal and vertical lines.
3. Provide a minimum of 2 IN clearance between valve handle turning radii where there are multiple valve handles appearing in a straight line.
4. Valves shall have bonnets and any soft seals removed during welding or soldering into the line.
a. When cool, reassemble the valves.

5. Support each valve individually.
    a. The tubing system does not qualify as support for the valve.

D. Locate instrument piping and tubing so as to be free of vibration and interference with other piping, conduit, or equipment.

E. Keep foreign matter out of the system.

F. Remove all oil on piping and tubing with solvent before piping and tubing installation.

G. Plug all open ends and connections to keep out contaminants.

H. Tubing Installation:
1. General:
    a. Install such that tube shows no sign of crumpling, bends of too short a radius, or flattening, etc.
    b. Make tube runs straight and parallel or perpendicular to the floor, equipment and piping runs.
    c. For liquid and steam applications, slope continuously from the process to the instrument with a minimum slope of 0.50 IN per foot.
    d. For gas and air applications, slope continuously from the instrument to the process with a minimum slope of 0.50 IN per foot.
    e. If the sensing line cannot be continuously sloped, install high point vents and low point drains.
    f. Keep instrument tubing clean during all phases of work.
    g. Blow out with clean, dry, oil-free air immediately before final assembly.
    h. Cut by sawing only and debur.
2. Bending:
    a. Make each bend with tube bender of the correct size for the tube.
    b. Make all bends smooth and continuous.
    c. Rebending is not permitted.
    d. Make bends true to angle and radius.
    e. Maintain a true circular cross section of tubing without buckling or undue stretch of tube wall.
    f. Allowable tolerance for flattening out of tubing bends: Maximum of 8 percent of the OD for stainless steel tubing.
    g. Minimum bending radius for stainless steel tubing:

TUBE OD, INCHES	MINIMUM BENDING RADIUS, INCHES
1/4	9/16
3/8	15/16
1/2	1-1/2

    h. Minimum bending radius for type L, hard (drawn) copper:

TUBE OD, INCHES	MINIMUM BENDING RADIUS, INCHES
3/8	1-3/4
1/2	2-1/2

3. Tubing support:
    a. Intermittently support by clamping to support angle.
    b. Install supports to be self-draining, supported by hangers, or cantilevered from walls or structural beams.
    c. Support at 5 FT-0 IN maximum spans for horizontal or vertical runs.
    d. Use tubing trays in areas where spans between supports are greater than 5 FT and for all signal tubing support.

e. Support each tubing tray at 10 FT maximum spans.
f. Align tubing in orderly rows and retain in the tray by bolted clips.
    1) The use of spring or speed clips is not acceptable.
g. Maintain order of the tubing throughout the length of the tray.
h. Locate angle, channel and tray installation to protect tubing from spills and mechanical damage.
i. Locate support members to clear all piping, conduit, equipment, hatchways, monorails, and personnel access ways and allow access for equipment operation and maintenance.
j. Support trays to prevent torsion, sway or sag.
k. Permanently attach supports to building steel or other permanent structural members.
l. Arrange supports and trays so that they do not become a trough or trap.

4. Routing and orientation:
    a. Route to maintain a minimum headroom clearance of 8 FT.
    b. Locate and orient valves and specialties so that they are accessible for operation and maintenance from the operating floor.
        1) Do not route through or over equipment removal areas, below monorails or cranes nor above or below hatches.
5. Expansion and vibration provisions:
    a. Provide horizontal expansion loops at the process connections.
    b. Route tubing parallel to relative motion through sleeved supports that allow linear tube movement.
    c. Cold springing of tubing to compensate for thermal expansion is prohibited.
    d. Utilize flexible hoses to connect pneumatic tubing to air users which may move or vibrate.

I. Threaded Connection Seals:
1. Use Tite-Seal or acceptable alternate.
2. Use of lead base pipe dope or Teflon tape is not acceptable.
3. Do not apply Tite-Seal to tubing threads of compression fittings.

J. Instrument Mounting:
1. Mount all instruments where they will be accessible from fixed ladders, platforms, or grade.
2. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.
3. Mount instruments level, plumb, and support rigidly.
4. Mount to provide:
    a. Protection from heat, shock, and vibrations.
    b. Accessibility for maintenance.
    c. Freedom from interference with piping, conduit and equipment.

3.2 TRAINING

A. Provide on-site training in accordance with Specification Section 01 75 00.

END OF SECTION

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SECTION 40 97 00
CONTROL AUXILIARIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Signal modules.
   2. Pilot devices:
      a. Selector switches.
      b. Pushbuttons.
      c. Indicating lights.
   3. Relays/timers:
      a. Control relay.
      b. Time delay relays.
   4. Termination equipment:
      a. Terminal blocks.
      b. Fuse holders.
   5. Power supplies:
      a. DC power supplies.
   6. Voltage surge protection devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. The International Society of Automation (ISA):
      a. S18.1, Annunciator Sequences and Specifications.
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
   3. Underwriters Laboratories, Inc. (UL).

B. Miscellaneous:
   1. Assure units comply with electrical area classifications and NEMA enclosure type shown on Drawings.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 40 90 00.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01 33 04 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

B. Provide similar components from the same manufacturer for uniformity of appearance, operations, and maintenance.

2.2 SIGNAL MODULE

A. Acceptable manufacturers:
   1. AGM Electronics.
   2. Moore Industries.
   3. Or approved equal.

B. Design and fabrication:
   1. Solid state electronics.
   2. Transmit analog output signal directly proportional to measured input signal.
   3. Power source: 120 Vdc.
   4. Analog input: 4-20 mA DC or 1-5 Vdc.
   5. Output signal: 4-20 mA DC into 1400 ohms.
   6. Impedance:
      a. Voltage input: 10 Meg.
      b. Current input: 50 ohms.
      c. Voltage output: 1 ohm.
      d. Current output: 1650 ohms.
   7. Accuracy: Better than ± 0.10 percent of span.
   8. Isolation: Up to 500 V rms (input, output and case).
   9. Temperature effect: ±0.0025 percent of span per DegF.
   10. Ambient temperature range: 0-140 DegF.
   11. Factory calibrated.

2.3 PILOT DEVICES

A. Selector Switches:
   1. Acceptable manufacturers:
      a. Eaton.
      b. Allen-Bradley.
      c. Or approved equal.
   2. Design and fabrication:
      a. Heavy-duty type.
      b. Oiltight.
      c. Rotary cam units conforming to NEMA ICS 2-216.22.
      d. Mounting hole: 30.5 mm.
      e. Supply switches having number of positions required with contact blocks to fulfill functions shown and specified.
      f. UL listed.
      g. Maintained contact type.
      h. Knob type operators.
      i. Black colored operators.
      j. Designed with cam and contact block with approximate area of 2 IN SQ.
      k. Legend plate marked per Contract Documents.
      l. Contact block requirements:
         1) Dry and indoor locations: Standard contact blocks rated for 10 A continuous current.
         2) Wet or outside locations: Hermetically sealed contact blocks.

B. Pushbuttons:
   1. Acceptable manufacturers:
      a. Eaton.
      b. Allen-Bradley.
      c. Or approved equal.
   2. Materials:
      a. Backing diaphragm: Buna-N.

3. Design and fabrication:
    a. Heavy-duty type.
    b. Oiltight.
    c. Conforming to NEMA ICS 2-216.22.
    d. Mounting hole: 30.5 mm.
    e. Diaphragm backed.
    f. UL listed.
    g. Emergency stop pushbuttons to have mushroom head operator and maintained contact.
    h. Non-illuminated type:
        1) Momentary contact with necessary contact blocks.
        2) Molded, solid color melamine buttons.
        3) Standard flush operators with full shroud.
        4) Green colored buttons for START or ON and redcolor for STOP or OFF.
        5) Appropriate contact blocks to fulfill functions shown or specified.
    i. Contact block requirements:
        1) Dry and indoor locations: Standard contact blocks rated for 10 A continuous current.
        2) Wet or outside locations: Hermetically sealed contact blocks.
        3) Legend plate marked per Contract Documents.
    j. Illuminating type:
        1) Momentary contact with necessary contact blocks.
        2) Serves as both pushbutton control and indicating light.
        3) Green colored lenses for start or on and red for STOP or OFF.
        4) LED light unit with lens and panel gasket.
        5) Legend plate marked per Contract Documents.
        6) Appropriate contact blocks to fulfill functions shown or specified.

C. Indicating Lights:
1. Acceptable manufacturers:
    a. Eaton.
    b. Allen-Bradley.
    c. Or approved equal.
2. Design and fabrication:
    a. Heavy duty type.
    b. Oiltight.
    c. Type allowing replacement of bulb without removal from control panel.
    d. LED.
    e. UL listed.
    f. 120 V.
    g. Legends marked per Contract Documents.
    h. Nominal 2 IN SQ face.
    i. Mounting hole: 30.5 mm.
    j. Glass lens.
    k. Color code lights as follows:
        1) Green: ON or running; valve open.
        2) Amber: Standby; auto mode; ready.
        3) Red: OFF or stopped; valve closed; alarm.
    l. Legend plate engraved for each light.

2.4 RELAYS/TIMERS

A. Control Relays:
1. Acceptable manufacturers:
    a. Idec.
    b. Potter & Brumsfield.
    c. Allen-Bradley.
    d. Or approved equal.

2. Design and fabrication:
    a. Plug-in general purpose relay.
    b. Blade connector type.
    c. Switching capacity: 10 A.
    d. Contact material: Silver cadmium oxide.
    e. Provide relays with a minimum of 3 SPDT contacts.
    f. Coil voltage: 120 Vac or 24 Vdc.
    g. Relay sockets are DIN rail mounted.
    h. Internal neon or LED indicator is lit when coil is energized.
    i. Clear polycarbonate dust cover with clip fastener.
    j. Check button.
    k. Temperature rise:
        1) Coil: 85 DegF max.
        2) Contact: 65 DegF max.
    l. Insulation resistance: 100 Meg min.
    m. Frequency response: 1800 operations/hour.
    n. Operating temperature: -20 to +150 DegF.
    o. Life expectancy:
        1) Electrical: 500,000 operations or more.
        2) Mechanical: 50,000,000 operations or more.
    p. UL listed or recognized.

B. Time Delay Relays:
1. Acceptable manufacturers:
    a. Eagle Signal Controls.
    b. Idec.
    c. Or approved equal.
2. Design and fabrication:
    a. Melt design test and performance requirements of NEMA ICS 2-218.
    b. Heavy-duty.
    c. Solid-state construction.
    d. External adjusting dial.
    e. Auxiliary relays as required to perform functions specified or shown on Drawings.
    f. Operates on 117 Vac (±10 percent) power source.
    g. Contact rating: A150 per NEMA ICS 2-125.
    h. Furnish with "on" and "timing out" indicators.

2.5 TERMINATION EQUIPMENT

A. Terminal Blocks:
1. Acceptable manufacturers:
    a. Phoenix Contact.
    b. Allen-Bradley.
    c. Or approved equal.
2. Design and fabrication:
    a. Modular type with screw compression clamp.
    b. Screws: Stainless steel.
    c. Current bar: Nickel-plated copper allow.
    d. Thermoplastic insulation rated for -40 to +90 DegC.
    e. Wire insertion area: Funnel-shaped to guide all conductor strands into terminal.
    f. Install end sections and end stops at each end of terminal strip.
    g. Install machine-printed terminal markers on both sides of block.
    h. Spacing: 6 mm.
    i. Wire size: 22-12 AWG.
    j. Rated voltage: 600 V.
    k. Din rail mounting.
    l. UL listed.

3. Standard-type block:
    a. Rated current: 30 A.
    b. Color: Gray body.
4. Bladed-type block:
    a. Terminal block with knife blade disconnect which connects or isolated the two (2) sides of the block.
    b. Rated current: 10 A.
    c. Color:
        1) Panel control voltage leaves enclosure - normal: Gray body, orange switch.
        2) Foreign voltage entering enclosure: Orange body, orange switch.
5. Grounded-type block:
    a. Electrically grounded to mounting rail.
    b. Use to terminal ground wires and analog cable shields.
    c. Color: Green and yellow body.

B. Fuse Holders:
1. Acceptable manufacturers:
    a. Phoenix Contact.
    b. Allen-Bradley.
    c. Or approved equal.
2. Design and fabrication:
    a. Modular-type with screw compression clamp.
    b. Screws: Stainless steel.
    c. Current bar: Nickel-plated copper alloy.
    d. Thermoplastic insulation rated for -40 to +105 DegC.
    e. Wire insertion area: Funnel-shaped to guide all conductor strands into terminal.
    f. Blocks can be ganged for multi-pole operation.
    g. Install end sections and end stops at each end of terminal strip.
    h. Install machine-printed terminal markers on both sides of block.
    i. Spacing: 9.1 mm.
    j. Wire size: 30-12 AWG.
    k. Rated voltage: 300 V.
    l. Rated current: 12 A.
    m. Fuse size: 1/4 x 1-1/4.
    n. Blown fuse indication.
    o. DIN rail mounting.
    p. UL listed.

2.6 POWER SUPPLIES

A. DC Power Supplies:
1. Acceptable manufacturers:
    a. Phoenix Contact.
    b. Rockwell Automation.
    c. Or approved equal.
2. Design and fabrication:
    a. Converts 120 Vac input to DC power at required voltage.
    b. DIN rail mount with enclosure (i.e., not open frame).
    c. Switching type.
    d. AC input: 120 Vac +/-15 percent, nominal 60 Hz.
    e. Efficiency: Minimum 86 percent.
    f. Rated mean time between failure (MTBF): 500,000 HRS.
    g. Voltage regulation:
        1) Static: Less than 1.0 percent V_{out}.
        2) Dynamic: +/-2 percent V_{out} overall.
    h. Output ripple/noise: Less than 100 mV peak to peak (20 MHz).
    i. Overload, short circuit and open circuit protection.

j. Temperature rating: 0 to 60 DegC full rated, derated linearly to 50 percent at 70 DegC.
k. Humidity rating: Up to 90 percent, non-condensing.
l. LED status indication for DC power.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

END OF SECTION

SECTION 40 98 00
CONTROL PANELS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for control panels, enclosures and modifications utilized as follows:
      a. Unless noted otherwise, all control panels and enclosures housing control components that are specified in Specification Division 13.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI).
   2. ASTM International (ASTM):
      a. B75, Standard Specification for Seamless Copper Tube.
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. ICS 4, Industrial Control and Systems: Terminal Blocks.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC):
         1) Article 409, Industrial Control Panels.
   5. Underwriters Laboratories, Inc. (UL):
      a. 508A, Standard for Safety Industrial Control Panels.

B. Miscellaneous:
   1. Approved supplier of Industrial Control Panels under provisions of UL 508A.
      a. Entire assembly shall be affixed with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.
      b. Control panel(s) without an affixed UL 508A label shall be rejected and sent back to the Contractor’s factory.

1.3 DEFINITIONS

A. The term "panel" refers to control panels or enclosures listed in the schedule included in this Specification Section.

B. Foreign Voltages: Voltages that may be present in circuits when the panel main power is disconnected.

C. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

D. Instrumentation Cable:
   1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
   2. Instrumentation cable is typically either TSP (twisted-shielded pair) or TST (twisted-shielded triad), and is used for the transmission of low current or low voltage signals.

E. Ground Fault Circuit Interrupter (GFCI): A type of device (e.g., circuit breaker or receptacle) which detects an abnormal current flow to ground and opens the circuit preventing a hazardous situation.

F. Programmable Logic Controller (PLC): A specialized industrial computer using programmed, custom instructions to provide automated monitoring and control functions by interfacing software control strategies to input/output devices.

G. Remote Terminal Unit (RTU): An industrial data collection device designed for location at a remote site, that communicates data to a host system by using telemetry such as radio, dial-up telephone, or leased lines.

H. Input/Output (I/O): Hardware for the moving of control signals into and/or out of a PLC or RTU.

I. Supervisory Control and Data Acquisition (SCADA): Used in process control applications, where programmable logic controllers (PLCs) perform control functions but are monitored and supervised by computer workstations.

J. Highway Addressable Remote Transducer (HART): An open, master-slave protocol for bus addressable field instruments.

K. Digital Signal Cable: Used for the transmission of digital communication signals between computers, PLCs, RTUs, etc.

L. Uninterruptible Power Supply (UPS): A backup power unit that provides continuous power when the normal power supply is interrupted.

M. Loop Calibrator: Portable testing and measurement tool capable of accurately generating and measuring 4-20ma DC analog signals.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. See Specification Section 40 90 00.
3. Prepared with computer aided design (CAD) software.
4. Printed on 11 by 17 IN sheets.
5. Drawings shall include a title block containing the following:
   a. Plant or facility name where panel(s) are to be installed.
   b. Drawing title.
   c. Drawing number.
   d. Revision list with revision number and date
   e. Drawing date.
   f. Drawing scale.
   g. Manufacturer name, address, and telephone number.
6. Cover sheet for each drawing set shall indicate the following:
   a. Plant or facility name.
   b. Project name.
   c. Submittal description.
   d. Revision number.
   e. Issue date.
7. Table of contents sheet(s) shall indicate the following for each drawing in the set:
   a. Drawing number.
   b. Drawing title.
   c. Sheet number.
8. Legend and abbreviation sheet shall indicate the following:
   a. Description of symbols and abbreviations used.
   b. Panel construction notes including enclosure NEMA rating, finish type and color, wire type, wire color strategy, conductor sizes, and wire labeling strategy.
   c. Confirmation that the panel(s) are to be affixed with a UL 508A label prior to shipment from the factory.
9. Bill of Material for each panel shall include the following component information:
   a. Instrument tag number.
   b. Quantity.
   c. Functional name or description.
   d. Manufacturer.

e. Complete model number.
f. Size or rating.

10. Panel exterior layout drawings to scale and shall indicate the following:
    a. Panel materials of construction, dimensions, and total assembled weight.
    b. Panel access openings.
    c. Conduit access locations.
    d. Front panel device layout.
    e. Nameplate schedule:
        1) Nameplate location.
        2) Legend which indicates text, letter height and color, and background color.
11. Panel interior layout drawings shall be drawn to scale and shall indicate the following:
    a. Sub-panel or mounting pan dimensions.
    b. Interior device layouts.
    c. PLC/RTU general arrangement layouts.
    d. Wire-way locations, purpose, and dimensions.
    e. Terminal strip designations.
    f. Location of external wiring and/or piping connections.
    g. Location of lighting fixtures, switches and receptacles.
12. Wiring diagrams shall consist of the following:
    a. Panel power distribution diagrams.
    b. Control and instrumentation wiring diagrams including field wiring connections.
    c. PLC/RTU I/O information:
        1) Model number of I/O module.
        2) Description of I/O module type and function.
        3) Rack and slot number.
        4) Terminal number on module.
        5) Point or channel number.
        6) Programmed point addresses.
        7) Signal function and type.
    d. Wiring diagrams shall identify each wire as it is to be labeled.

B. Manufacturer catalog cut sheets for enclosure, finish, panel devices, control auxiliaries, and accessories.

C. Electrical load calculations for each panel:
1. Total connected load.
2. Peak electrical demand for each panel.

D. Climate control calculations for each panel.
1. Verify that sufficient dissipation and/or generation of heat is provided to maintain interior panel temperatures within the rated operating temperatures of panel components.

E. Operation and Maintenance Manuals:
1. See Specification Section 01 33 04 for requirements for:
    a. The mechanics and administration of the submittal process.
    b. The content of Operation and Maintenance Manuals.
2. See Specification Section 40 90 00.

F. Informational Submittals:
1. Record Drawings:
    a. Updated panel drawings delivered with the panel(s) from the Contractor’s factory.
    b. Drawings shall be enclosed in transparent plastic and firmly secured within each panel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

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

1. Enclosures:
    a. Hoffman Engineering Co.
    b. Rittal.
    c. Hammond Manufacturing.
    d. Millbank Mfg. Co.
    e. Or approved equal.
2. Cooling fans and exhaust packages:
    a. Hoffman Enclosures, Inc.
    b. Rittal.
    c. Or approved equal.
3. Internal corrosion inhibitors:
    a. Hoffman Enclosures, Inc.; Model A-HCI.
    b. Northern Technologies International Corporation (NTIC); Model Zerust VC.
    c. Cortec Corporation; Model VpCl Emitting Systems.
    d. Or approved equal.

2.2 ACCESSORIES

A. Panel Nameplates and Identification:
    1. See Section 10 14 00.

2.3 FABRICATION

A. General:
    1. Fabricate panels with instrument arrangements and dimensions identified in the Contract Documents.
    2. Provide panel(s) with the required enclosure rating per NEMA 250 to meet classifications identified in the Contract Documents.
    3. Devices installed in panel openings shall have a NEMA enclosure rating at least equal to the panel enclosure rating.
        a. Devices that cannot be obtained with an adequate NEMA rating shall be installed behind a transparent viewing window.
        b. The window shall maintain the required NEMA rating of the enclosure.
    4. Panel(s) shall be completely assembled at the Contractor’s factory.
        a. No fabrication other than correction of minor defects or minor transit damage shall be performed on panels at the jobsite.
    5. Painting:
        a. Panels fabricated from steel shall have their internal and external surfaces prepared, cleaned, primed, and painted.
            1) Mechanically abrade all surfaces to remove rust, scale, and surface imperfections.
            2) Provide final surface treatment with 120 grit abrasives or finer, followed by spot putty to fill all voids.
            3) Utilize solvent or chemical methods to clean panel surfaces.
            4) Apply surface conversion of zinc phosphate prior to painting to improve paint adhesion and to increase corrosion resistance.
            5) Electrostatically apply polyester urethane powder coating to all inside and outside surfaces.
            6) Bake powder coating at high temperatures to bond coating to enclosure surface.
                a) Panel interior shall be white with semi-gloss finish.
                b) Panel exterior shall be ANSI #61 gray with flat finish.
            7) Application of alkyd liquid enamel coating shall be allowed in lieu of polyester urethane powder for wall mounted NEMA 1 or NEMA 12 rated panels.
        b. Panels fabricated from stainless steel, aluminum, or fiberglass shall not be painted.
    6. Finish opening edges of panel cutouts to smooth and true surface conditions.
        a. Panels fabricated from steel shall have the opening edges finished with the panel exterior paint.
    7. Panel shall meet all requirements of UL 508A.

a. If more than one (1) disconnect switch is required to disconnect all power within a panel or enclosure, provide a cautionary marking with the word "CAUTION" and the following or equivalent, "Risk of Electric Shock-More than one (1) disconnect switch required to de-energize the equipment before servicing."

8. Provide control panel in accordance with NFPA 70, Article 409.
   a. In the event of any conflict between NFPA 70, Article 409 and UL 508A, the more stringent requirement shall apply.

B. Free-Standing Panels:
   1. Welded construction.
   2. Completely enclosed, self-supporting, and gasketed dusttight.
   3. Rolled lip around all sides of enclosure door opening.
   4. Seams and corners welded and ground smooth to touch and smooth in visual appearance.
   5. Full height, fully gasketed flush pan doors.
   6. Full length piano hinges rated for 1.5 times door plus instrument weight.
   7. Doors with keyed alike locking handles and three-point catch.
   8. Appropriate conduit, wiring, and instrument openings shall be provided.
   9. Lifting eyebolts to allow simple, safe rigging and lifting of panel during installation.

C. Wall Mounted Panels:
   1. Seams continuously welded and ground smooth.
   2. Rolled lip around all sides of enclosure door opening.
   3. Gasketed dust tight.
   4. Door clamps and hasp for padlocking.
   5. Key doors alike.
   6. Continuous heavy GA hinge pin on doors.
      a. Hinges rated for 1.5 times door plus instrument weight.
   7. Front full opening door.
   8. Brackets for wall mounting.

D. Internal Panel Wiring:
   1. Panel wire duct shall be installed between each row of components, and adjacent to each terminal strip.
      a. Route wiring within the panel in wire-duct neatly tied and bundled with tie wraps.
      b. Follow wire-duct manufacturer's recommended fill limits.
      c. Wire-duct shall have removable snap-on covers and perforated walls for easy wire entrance.
      d. Wire-duct shall be constructed of nonmetallic materials with rating in excess of the maximum voltage carried therein.
   2. Wiring shall be installed such that if wires are removed from one (1) device, source of power will not be disrupted to other devices.
   3. Splicing and tapping of wires permitted only at terminal blocks.
   4. Wire bunches to doors shall be secured at each end so that bending or twisting will be around longitudinal axis of wire.
      a. Protect bend area with sleeve.
   5. Arrange wiring neatly, cut to proper length, with surplus wire removed.
      a. Arrange wiring with sufficient clearance.
      b. Provide abrasion protection for wire bundles that pass through openings or across edges of sheet metal.
   6. AC circuits shall be routed separate from analog signal cables and digital signal cables.
      a. Separate by at least 6 IN, except at unavoidable crossover points and at device terminations.
   7. Provide at least 6 IN of separation between intrinsically safe devices and circuits and non-intrinsically safe devices and circuits.
   8. Wiring to pilot devices or rotary switches shall be individually bundled and installed with a "flexible loop" of sufficient length to permit the component to be removed from panel for maintenance without removing terminations.

9. Conductors for AC and DC circuits shall be type MTW stranded copper listed for operation with 600 V at 90 DegC.
    a. Conductor size shall be as required for load and 16 AWG minimum.
    b. Internal panel wiring color code:
        1) AC circuits:
            a) Power wiring: Black.
            b) Control interconnections: Yellow.
            c) Neutral: White.
            d) Ground: Green.
        2) Low voltage DC circuits:
            a) Power wiring: Blue.
            b) Control interconnections: Violet.
        3) Foreign voltage circuits: Pink.
        4) Intrinsically safe circuits: Orange.
10. Analog signal cables shall be of 600 V insulation, stranded copper, twisted-shielded pairs.
    a. Conductor size: 18 AWG minimum.
    b. Terminate shield drain conductors to ground only at one (1) end of the cable.
11. High precision 250 ohm resistors with 0.25 percent accuracy shall be used where 4-20 mA DC analog signals are converted to 1-5 Vdc signals.
    a. Resistors located at terminal strips.
    b. Resistors terminated using individual terminal blocks and with no other conductors.
    c. Resistor leads shall be un-insulated and of sufficient length to allow test or calibration equipment (e.g., HART communicator, loop calibrator) to be properly attached to the circuit with clamped test leads.
12. Analog signals for devices in separate enclosures shall not be wired in series.
    a. Loop isolators shall be used where analog signals are transmitted between control enclosures.
13. Wire and cable identification:
    a. Wire and cables numbered and tagged at each termination.
    b. Wire tags:
        1) Slip-on, PVC wire sleeves with legible, machine-printed markings.
        2) Adhesive, snap-on, or adhesive type labels are not acceptable.
    c. Markings as identified in the Shop Drawings.

E. Grounding Requirements:
1. Equipment grounding conductors shall be separated from incoming power conductors at the point of entry.
2. Minimize grounding conductor length within the enclosure by locating the ground reference point as close as practical to the incoming power point of entry.
3. Bond electrical racks, chassis and machine elements to a central ground bus.
    a. Nonconductive materials, such as paint, shall be removed from the area where the equipment contacts the enclosure.
4. Bond the enclosure to the ground bus.
    a. It is imperative that good electrical connections are made at the point of contact between the ground bus and enclosure.
5. Panel-mounted devices shall be bonded to the panel enclosure or the panel grounding system by means of locknuts or pressure mounting methods.
6. Sub-panels and doors shall be bonded to ground.

F. Termination Requirements:
1. Wiring to circuits external to the panel connected to interposing terminal blocks.
2. Terminal blocks rigidly mounted on DIN rail mounting channels.
3. Terminal strips located to provide adequate space for entrance and termination of the field conductors.
4. One (1) side of each strip of terminal blocks reserved exclusively for the termination of field conductors.
5. Terminal block markings:

a. Marking shall be the same as associated wire marking.
b. Legible, machine-printed markings.
c. Markings as identified in the shop drawings.

6. Terminal block mechanical characteristics, and electrical characteristics shall be in accordance with NEMA ICS 4.
7. Terminal blocks with continuous marking strips.
   a. Each terminal block shall be identified with machine printed labels.
8. Terminals shall facilitate wire sizes as follows:
   a. 120 Vac applications: Conductor size 12 AWG minimum.
   b. Other: Conductor size 14 AWG minimum..
9. Analog signal cable shield drain conductors shall be individually terminated.
10. Install minimum of 20 percent spare terminals.
11. Bladed, knife switch, isolating type terminal blocks where control voltages enter or leave the panel.
12. Fused terminal blocks shall be used in the following circuits:
    a. Control voltage is used to energize a solenoid valve.
    b. DC power is connected to 2-wire, loop-powered instruments.
13. Fused terminal blocks shall be provided with blown fuse indicators.
14. When control circuits require more than one (1) field conductor connected to a single wiring point, a sufficient number of terminal points shall be connected internally to allow termination of only one (1) field conductor per terminal block.
15. DIN rail mounting channels shall be installed along full length of the terminal strip areas to facilitate future expansion.
16. Connections to devices with screw type terminals shall be made using spade-tongue, insulated, compression terminators.

G. Component Mounting and Placement:
1. Components shall be installed per manufacturer instructions.
2. Control relays and other control auxiliaries shall be mounted on DIN rail mounting channels where practical.
3. Front panel devices shall be mounted within a range of 40 to 70 IN above the finished floor, unless otherwise shown in the Contract Documents.
4. PLC/RTU and I/O rack installation:
   a. Located such that the LED indicators and switches are readily visible with the panel door open.
   b. Located such that repair and/or replacement of component can be accomplished without the need to remove wire terminations or other installed components.
5. Locate power supplies with sufficient spacing for circulation of air.
6. Where components such as magnetic starters, contactors, relays, and other electromagnetic devices are installed within the same enclosure as the PLC/RTU system components, provide a barrier of at least 6 IN of separation between the “power area containing the electromagnetic devices” and the “control area”.
7. Components mounted in the panel interior shall be fastened to an interior sub-panel using machine screws.
   a. Fastening devices shall not project through the outer surface of the panel enclosure.
8. Excess mounting space of at least 20 percent for component types listed below to facilitate future expansion:
   a. Fuse holders.
   b. Circuit breakers.
   c. Control relays.
   d. Time delay relays.
   e. Intrinsically safe barriers and relays.
9. Components installed on sub-panels shall be provides with a minimum spacing between component and wire duct of 1 IN.
   a. Minimum of 2 IN separation between terminal strips and wire ducts.

H. Power Distribution:
   1. Main incoming power circuits shall be protected with a thermal magnetic circuit breaker.
      a. Limit load to maximum of 80 percent of circuit breaker rating.
   2. Powered components shall be individually fused so that they may be individually de-energized for maintenance.
   3. Each control panel with PLC/RTU components shall be furnished with power protection in the form of a double conversion UPS.
   4. Equip each panel with necessary power supplies with ratings required for installed equipment and with minimum 25 percent spare capacity.
   5. Constant voltage transformers, balancing potentiometers, and rectifiers as necessary for specific instrument requirements.

I. Internal Panel Lighting and Service Receptacles:
   1. Panels less than or equal to 4 FT wide:
      a. One (1) electrical GFCI duplex receptacle.
      b. One (1) compact fluorescent light fixture with manual switch(es).
   2. Panels or panel faces greater than 4 FT wide:
      a. One (1) duplex electrical GFCI receptacle per 6 FT of length.
      b. Continuous fluorescent lighting strip with manual switches.

J. Environmental Controls:
   1. Indoor panels located in a designated electrical room or control room:
      a. Thermostat controlled cooling fans with exhaust louvers if required to maintain temperature inside panel(s) below the maximum operating temperature rating of the internal components.
      b. Internal corrosion inhibitors.
   2. Indoor panels not located within a designated electrical room or control room:
      a. Thermostat controlled heaters to maintain temperature approximately 10 DegF above ambient for condensation prevention inside the panels.
      b. Automatically controlled, closed-loop heat exchangers or closed-loop air conditioners where required to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the panel(s).
      c. Internal corrosion inhibitors.
   3. Outdoor panels:
      a. Thermostat controlled heaters to maintain temperature approximately 10 DegF above ambient for condensation prevention inside the panels.
      b. Internal corrosion inhibitors.
         1) Contains chemical which vaporizes and condenses on surfaces in the enclosure.
         2) Inhibitor shall be applied in accordance with manufacturer instructions for the enclosure volume.
         3) Inhibitor shall be applied in the panel(s) prior to shipment from the Contractor's factory.

2.4 MAINTENANCE MATERIALS

A. Extra Materials:
   1. Quantity of 10 percent replacement lamps for each replaceable type installed (minimum of 5 of each type).
   2. One (1) quart of exterior finish touch-up paint.
   3. One (1) complete set of replacement corrosion inhibitors in sealed packages for each panel.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. Scope: Inspect and test entire panel assembly to verify readiness for shipment.

B. Location: Contractor's factory.

C. Factory Tests:
   1. Tests shall be fully documented and signed by the Contractor's factory supervisor.
   2. The panel shop shall fully test the control panel for correct wiring.
      a. Each I/O point shall be checked by measuring or connecting circuits at the field terminal blocks.
   3. Burn-in test: Panel(s) shall be fully energized for a minimum period of 48 HRS.
   4. A PLC Central Processing Unit (CPU) shall be obtained and connected to the panel(s) if necessary for testing purposes.
   5. Testing equipment (such as digital multi-meters, analog loop calibrators, and laptop computers with PLC programming software) shall be used as required for testing.
   6. The following functions shall be tested as a minimum:
      a. Demonstrate functions of the panel(s) required by the Contract Documents.
      b. Correctness of wiring from all panel field terminals to all I/O points and to all panel components.
      c. Simulate and test each discrete signal at the field terminal strips.
      d. Simulate and test each analog signal using loop calibrators.
      e. Correct operation of communications between PLC system Central Processing Units (CPUs) and Remote I/O bases.
      f. Correct operation of single-loop controllers (including digital communication to microprocessor based devices).
      g. Correct operation of all digital communication devices.
      h. Demonstrate online and offline diagnostic tests and procedures.
      i. The Contractor shall notify the Engineer in writing a minimum of 15 calendar days prior to the Factory Tests.
         1) Engineer has the option to witness all required tests.
   7. Make following documentation available to the Engineer at test site during the tests:
      a. Contract Documents.
      b. Factory Demonstration Testing procedures.
      c. List of equipment to be testing including make, model, and serial number.
      d. Shop Drawing submittal data for equipment being tested.
   8. Deficiencies shall be corrected prior to shipment from the Contractor's factory.

3.2 INSTALLATION

A. Install free-standing panels on 4 IN high concrete housekeeping pads.

B. Anchor panels in a manner to prevent the enclosure from racking, which may cause the access doors to become misaligned.

C. Obtain approved panel layouts prior to installation of conduits.

D. Install products in accordance with manufacturer's instructions.

E. Replacement of existing WesTech Process Control Panel (PCP) interior and door.
   1. Prior to removal each field wire is to be identified, removed from the terminal strip and tagged so that it can be properly connected to the replacement PCP.
   2. Remove and tag any equipment that is to be reinstalled in the replacement PCP interior and door.
   3. Disconnect all existing conduits and disconnect all associated wires from WesTech PCP and reinstall conduits and wires to replacement PCP interior and door.

3.3 WESTECH PCP INPUT/OUTPUT SCHEDULE (asterisk [*] indicates existing I/O)

A. Digital Input:
   1. Unit 1 Adsorption Clarifier, PSH104, High Pressure.*
   2. Unit 2 Adsorption Clarifier, PSH204, High Pressure.*
   3. Unit 1 Adsorption Clarifier, PSHH104, High-High Pressure.*
   4. Unit 2 Adsorption Clarifier, PSHH204, High-High Pressure.*
   5. Unit 1 Filter Low Level, LSL101, Low Level.*
   6. Unit 2 Filter Low Level, LSL201, Low Level.*

7. Unit 1 Filter High Level, LSH101, High Level.*
8. Unit 2 Filter High Level LSH201, High Level.*
9. Air Scour Blower, PSH001, High Air Pressure.
10. Air Compressor, PSL006, Low Air Pressure.*
11. In-Line Mixer, Run.
12. In-Line Mixer, PCP Mode.
13. Raw Water Transfer Pump, Running.
14. Raw Water Transfer Pump, Fault.
15. Raw Water Transfer Valve, Transfer position.
16. Raw Water Transfer Valve, Normal position.
17. Raw Water Transfer Valve, Remote mode.
18. Raw Water Transfer System in PCP mode.
19. Polymer Feed Pump 1, CP001A, Run.
20. Polymer Feed Pump 2, CP001B, Run.
21. Polyphosphate Feed Pump 1, CP002A, Run.
22. Polyphosphate Feed Pump 2, CP002B, Run.
23. Sodium Hypochlorite Feed Pump 1, CP003A, Run.*
24. Sodium Hypochlorite Feed Pump 1, CP003B, Run.*

B. Digital Output:
1. Raw Water Sample Valve, SV004, Open/Close CMD.*
2. Polymer Feed Pump 1, CP001A, Start/Stop CMD.
3. Polymer Feed Pump 2, CP001B, Start/Stop CMD.
4. Polyphosphate Feed Pump 1, CP002A, Start/Stop CMD.
5. Polyphosphate Feed Pump 2, CP002B, Start/Stop CMD.
6. Sodium Hypochlorite Feed Pump 1, CP003A, Start/Stop CMD.*
7. Sodium Hypochlorite Feed Pump 1, CP003B, Start/Stop CMD.*
8. Unit 1 Waste Gate, GV107, Open/Close CMD.*
9. Unit 2 Waste Gate, GV207, Open/Close CMD.*
10. Unit 1 Adsorption Clarifier Air Scour, V103, Open/Close CMD.*
11. Unit 2 Adsorption Clarifier Air Scour, V203, Open/Close CMD.*
12. Unit 1 Filter Air Scour, V105, Open/Close CMD.
13. Unit 2 Filter Air Scour, V205, Open/Close CMD.
14. Unit 1 Filter Effluent Turbidity, SV101, Pump 101, Start/Stop CMD.*
15. Unit 2 Filter Effluent Turbidity, SV201, Pump 201, Start/Stop CMD.*
16. Unit 1 Backwash Valve, V102, Open/Close CMD.*
17. Unit 2 Backwash Valve, V202, Open/Close CMD.*
18. Filter Backwash Rate Valve, V009, High/Low Rate CMD.
19. Air Scour Blower #1, B001, Start/Stop CMD.
20. Air Scour Blower #2, B002, Start/Stop CMD.
21. Raw Water Sample Valve, SV101, Open/Close CMD.*
22. Raw Water Transfer, Start Transfer CMD.
23. Raw Water Transfer, Stop Transfer CMD.
24. Inline Mixer, Start/Stop CMD.

C. Analog Input:
1. Raw Water Streaming Current, AIT004, Units.*
2. Raw Water pH, AIT005, pH Units.*
3. Unit 1 Raw Water Flow, FIT104, GPM.*
4. Unit 2 Raw Water Flow, FIT204, GPM.*
5. Unit 1 Filter Level, LT101, Feet.*
6. Unit 2 Filter Level, LT201, Feet.*
7. Unit 1 Filter Effluent Turbidity, AIT101, NTU.*
8. Unit 2 Filter Effluent Turbidity, AIT201, NTU.*
9. Combined Filter Effluent Turbidity, AIT007, NTU.*
10. Backwash Flow, FIT402, GPM.*
11. Finished Water 16” Flow Meter, FE/FIT601, GPM.

12. Finished Water 16” Flow Meter, FE/FIT602, GPM.
13. Unit 1 Adsorption Clarifier, PIT104, PSI.*
14. Unit 2 Adsorption Clarifier, PIT204, PSI.*
15. Unit 1 Filter Effluent, PIT101, PSI.*
16. Unit 2 Filter Effluent, PIT201, PSI.*
17. Unit 1 Backwash Turbidity, AIT100, NTU.*
18. Unit 2 Backwash Turbidity, AIT210, NTU.*
19. Storage Tank 1, LIT401, Level.*
20. Storage Tank 2, LIT402, Level.*
21. Clearwell, LIT-008, Level.*
22. Raw Water Transfer Pump, Speed.*
23. Distribution System Chlorine Residual, AIT009.*
24. Backwash Recovery Turbidity, AIT010.*
25. Backwash Recovery Flow, FIT010.*

D. Analog Output:
1. Polymer Feed Pump 1, CP001A, Pacing CMD.
2. Polymer Feed Pump 2, CP001B, Pacing CMD.
3. Polyphosphate Feed Pump 1, CP002A, Pacing CMD.
4. Polyphosphate Feed Pump 2, CP002B, Pacing CMD.
5. Sodium Hypochlorite Feed Pump 1, CP003A, Pacing CMD.*
6. Sodium Hypochlorite Feed Pump 2, CP003B, Pacing CMD.*
7. Unit 1 Raw Water Control Valve, ZC104, Position CMD.*
8. Unit 2 Raw Water Control Valve, ZC204, Position CMD.*
9. Unit 1 Effluent Control Valve, ZC101, Position CMD.*
10. Unit 2 Effluent Control Valve, ZC201, Position CMD.*
11. Unit 1 Filter to Waste Control Valve, ZC108, Position CMD.*
12. Unit 2 Filter to Waste Control Valve, ZC208, Position CMD.*
13. Raw Water Transfer Pump, Speed CMD.

3.4 RAW WATER TRANSFER LCP

A. Construction.
1. NEMA 12, wall mount.
2. See CD-2.

B. Front Cover Devices.
1. Nameplate.
2. VFD operator interface.
3. Switches, light and RTM shown with nameplates and legend plates.

C. Rear Panel Devices.
1. VFD.
2. Terminal strips, relays, power supplies and other required devices.
3. Main circuit breaker with cover mounted handle.

3.5 EXHAUST FAN, EF-1 LCP

A. Construction.
1. NEMA 12, wall mount.
2. See CD-5.

B. Front Cover Devices.
1. Nameplate.
2. Switch and light with nameplate and legend plates.
3. Line voltage cooling thermostat.

C. Rear Panel Devices.
1. NEMA size 1 FVNR starter, 120 VAC.
2. Main circuit breaker with cover mounted handle.

END OF SECTION

SECTION 43 11 34
REGENERATIVE BLOWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Packaged regenerative blowers with sound-attenuating enclosures and appurtenances.
   2. Each unit shall consist of the following items:
      a. Blower and motor.
      b. Mounting base.
      c. Inlet filter/silencer.
      d. Inlet and discharge flexible sleeve.
      e. Pressure relief valve.
      f. Check valve.
      g. Butterfly valve.
      h. Pressure gauges.
      i. Sound-Attenuating Enclosures
      j. All other appurtenances required or shown on the Drawings.

B. The regenerative blower and all related appurtenance shall be furnished by the sole-sourced supplier for items specified Section 46 07 13.

C. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

1.2 REFERENCES

A. Abbreviations:
   1. “ACFM” means “actual cubic feet per minute”, referring to volumetric flow rate of air or gas measured at actual, local conditions of temperature, absolute pressure, and relative humidity.
   2. “ICFM” means “inlet cubic feet per minute”, referring to ACFM entering blower equipment, measured at blower’s inlet flange (or similar connection).
   3. “PSIA” means “pounds (force) per square inch absolute”, referring to measured pressure of air or gas, expressed as atmospheric pressure at local conditions plus locally-measured gauge pressure (i.e., above atmospheric pressure).
   4. “PSIG” means “pounds (force) per square inch gauge”, referring to pressure measured above local atmospheric pressure.
   5. “SCFM” means “standard cubic feet per minute”, referring to volumetric flow rate of air or gas at 68 DEGF, 14.70 PSIA (i.e., ambient, atmospheric air pressure at sea level), and 36 percent relative humidity.

B. Reference Standards:
   1. Acoustical Society of America (ASA):
      a. ANSI/ASA S2.19, Standard Mechanical Vibration - Balance Quality Requirements of Rigid Rotors, Part 1: Determination of Possible Unbalance, Including Marine Applications.
   2. American Bearing Manufacturers Association (ABMA):
      a. ABMA/ANSI 9, Load Ratings and Fatigue Life for Ball Bearings.
      b. ABMA/ANSI 11, Load Ratings and Fatigue Life for Roller Bearings.
   3. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE):
      a. ANSI/ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size,

4. American Society of Mechanical Engineers (ASME):
    a. Boiler and Pressure Vessel Code (BPVC), Section VIII, Construction of Pressure Vessels (Division 1).
    b. ASME/ANSI B16, Standards for Pipes and Fittings:
        1) B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
5. ASTM International (ASTM):
    a. ASTM SAE AISI 1045, Carbon Steel Heat Treatment Chemical Composition Properties.
6. International Organization for Standardization (ISO):
    a. 1217, Displacement Compressors – Acceptance Tests.
7. National Electrical Manufacturers Association (NEMA):
    a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
8. Underwriters Laboratories (UL):
    a. 508, Industrial Control Panels.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: All equipment called for under this Section shall be supplied by a single Manufacturer.

B. Qualifications: The supplier or Manufacturer shall have experience in producing similar equipment, and shall show evidence of five (5) installations in satisfactory operation for at least five (5) years.

C. Warranty:
1. A written Supplier's warranty shall be provided for the equipment specified in this Section.
2. The warranty shall be for a minimum period of three (3) years from date of purchase.
3. Such warranty shall cover all defects or failures of materials or workmanship which occur as the result of normal operation and service.

D. Shop Assembly and Testing:
1. Blowers will receive factory mechanical run and amperage testing to be checked for compliance with standards. Testing report shall be furnished with system O&M manuals.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
    a. Schedule (table) of proposed blower equipment, indicating proposed performance, manufacturer and model, and similar information.
    b. Schedule (table) of electric motors, indicating manufacturer, model, enclosure type, motor size, and similar information.
    c. Bill of materials for all equipment, components, and appurtenances.
    d. Equipment fabrication drawings indicating arrangement, materials, dimensions, weight, and similar matters, showing plan, section, and cutaway views of blower units, enclosures, and blower system package.
    e. System process and instrumentation (P&ID) drawings for the blower Work.
    f. Control panel layout drawings and wiring diagrams.
2. Product Data:
    a. Component manufacturer’s published product data, including brochures, specifications, and blower data.
    b. Factory-certified performance curves from previous tests of identical blower units, indicating speed, capacity, horsepower, and efficiency over the range of operation.
    c. Catalog information showing the details of blower, motor, belt drives, valves, and other accessory construction.
    d. Blower weight and weights of each separate item of equipment, as well as total package weight, including enclosure and control panel.
    e. Blower enclosure and associated enclosure accessories data.

f. Flexible connection data.
g. Control valves and actuators furnished by blower equipment manufacturer.
h. Silencers technical data.
i. Product data for control panel and associated components, including microprocessors, indicators, transmitters, relays, human-machine interfaces, cabling, and similar items.
j. Product data for blower system instrumentation provided by blower equipment manufacturer, including: vibration monitoring and control; ammeter; switches; pressure and temperature sensors and transmitters; temperature protection devices; limit switches; and similar items.
k. VFDs: Furnish Submittals under, and in accordance with, Section 26 29 23 – Variable Frequency Drives – Low Voltage.

3. Samples:
   a. Color Samples of finish coat of blower and enclosure, from Manufacturer's standard finish coat colors.
4. Testing Plans:
   a. Plan for performing required source quality control activities (including shop testing). Indicate limitations of testing facility. Include copies of most-recent certification of calibration for test instruments.
   b. Plan for performing required field quality control activities.

B. Informational Submittals: Submit the following:
1. Certifications:
   a. Manufacturer’s written statement of installation, checkout, and startup, in accordance with Section 01 75 00 - Checkout and Startup Procedures.
2. Manufacturer’s Instructions:
   a. Instructions and recommendations for handling, storing, protecting, and installing the equipment.
3. Source Quality Control Results:
   a. Written results of required source quality control activities.
      1) Results of blower equipment manufacturer’s standard factory tests and inspections.
      2) Results of motor manufacturer’s standard factory tests and inspections.
      Report of dynamic balancing and maximum vibration amplitude.
4. Field Quality Control Results:
   a. Written results of required field quality control activities, including:
      1) Field performance testing.
      2) Vibration testing.
      3) Sound test.
   b. Written results of motor tests at the Site.
5. Supplier Reports:
   a. Submit written report of results of each visit to the 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. Operation and Maintenance Data:
   a. Submit in accordance with Section 01 33 04 - Operation and Maintenance Manuals.
   b. Indicate serial number and Project equipment designation (or tag number).
   c. For each protective relay, PLC, or microprocessor with programmable requirements, provide the final as-constructed settings for all devices.

D. Maintenance Materials Submittals: Furnish the following items and submit documentation of delivery to and acceptance by the Owner or facility manager (as applicable):
1. Spare Parts and Extra Materials:
   a. One complete set of bearings, seals, and O-rings for one blower-and-motor unit.
   b. Multiple V-belts and sheaves for each type and size of blower furnished.

c. One complete set of inlet filters for each type and size of blower furnished.
d. One complete set of gaskets for one blower-and-motor unit.
e. Lubricants, recommended by blower equipment manufacturer, sufficient for first year of operation.
f. One quart of touch-up coating of finish coat of blower and enclosure.

2. Tools:
a. Two sets of special tools, if any, required for normal maintenance.

PART 2 - PART 2 – PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. FPZ.
2. Or Approved equal.

2.2 EQUIPMENT REQUIREMENTS

A. Air Flow and Discharge Pressure Requirements:
1. 350 SCFM @ 4.1 psi.

B. Design Conditions:
1. Maximum Inlet Temperature: 110F.
2. Maximum Relative Humidity: 100 percent.
3. Elevation: 187 ft above MSL.

2.3 MATERIALS AND CONSTRUCTION

A. Blower:
1. General:
a. Each blower shall be of the horizontal, regenerative type.
2. Materials of Construction:
a. Blower housing, cover, and impeller to be of aluminum construction.
3. Lubrication:
a. Bearings to be permanently sealed bearings and shall not require periodic greasing.
4. Units will hold CE mark.
5. Belt driven blowers are not acceptable.
6. Motor:
a. The motor shall be TEFC.
b. Class F insulation.
c. 3 phase, 208-230/460 Volt, 60 hz.
d. 15 HP.
e. 3500 rpm.
f. 1.15 service factor.
7. Maximum noise level for each individual blower shall be 82 dBA.

B. Pressure Relief Valve:
1. Provide one valve for each blower.
2. Valve shall have an initial set pressure 0.50 psig over the specified design operating pressure.
3. Size valve to relieve 110% of the maximum calculated air flow at the specified local conditions.

C. Check Valve:
1. Provide one valve on the discharge of each blower.
2. Type: Wafer, Double Door.
3. Materials:
a. Body – Ductile Iron.

b. Shaft – Type 316 SS.
c. Plate – Type 316 SS.
d. Springs – Type 316 SS.
e. Seals – EPDM.

4. Temperature Rating: Suitable for 3000F.
5. Manufacturer:
   a. API International.
   b. Crane, Duo Check II.
   c. Gulf Valve, Model MB.
   d. Or Equal.

D. Discharge Valve:
1. Provide one valve on the discharge of each blower.
2. Type: High Performance Butterfly.
3. Materials:
   a. Body – Ductile Iron.
   b. Shaft – 17-4 SS.
   c. Disc – Type 316 SS.
   d. Seat – EPDM.
4. Temperature Rating: Suitable for 3000F.
5. Manufacturer:
   a. API International.
   b. Tyco/Keystone Figure F362.
   c. Pratt, Series 400.
   d. Or Equal.

E. Inlet Air Filter/Silencer:
1. Provide one filter/silencer on the inlet of each blower.
2. Inlet air filter shall be rated and sized to filter 150 percent of the maximum calculated airflow at specified conditions.
3. Inlet filter/silencer shall include sound absorbing materials.
4. Tubular silencing design.
5. Filter Media: Polyester.
6. Filter shall achieve 99% removal efficiency standard to 5 microns.
7. Carbon steel construction with baked enamel finished and powder coated weatherhood.
8. Include pressure drop indicator.

F. Provide molded synthetic rubber and cork vibration isolation pads for each blower, sized to fit the structural base. Isolators shall be as manufactured by Korfund or equal.

G. Pressure Gauge:
1. Provide one gauge for each blower.
2. Range: 0 to 15 psig.
3. Type: Direct mounted, dial-type pressure gage.
4. Construction: Weatherproof.
   a. Case:
      1) 4-inch diameter
      2) Material: cast aluminum with black finish or 304 stainless steel.
      3) Flangeless.
      4) Bottom 1/4-inch N.P.T. connection.
   b. Ring: Chrome plated or stainless steel, close type.
   c. Dial: White face, black numbers and graduations.
   d. Window: Laminated safety glass or clear acrylic plastic.
   e. Pointer: Micrometer type, black finish, red tip.
   f. Movement: Stainless steel, rotary type, delrin sector and bushings.
   g. Bourdon Tube: Seamless phosphor bronze, Grade A over pressured and stress relieved.
   h. Socket and Tip: Forged brass, alloy steel and Type 316 stainless steel.
5. Accuracy: 1 percent minimum.

6. Gage Cocks: Provide brass tee handle cock before each gage.
7. Reference ANSI B40.1 for Grade 1A gages.

H. Flexible Sleeves:
1. Provide sleeved cylindrical steel reinforced coated fiberglass flexible tubing connectors for blower inlet and discharge connections.
2. Furnish units that are capable of withstanding 25 psi and handling operating temperatures of 3500F.

I. Sound-Attenuating Enclosures:
1. Provide freestanding, rigid, noise-reducing, acoustical, factory-mounted enclosure for each blower package housing the following:
   a. Blower.
   b. Motor.
   c. Interconnecting piping between blower and silencers.
2. Enclosure Panel Material:
   a. Material: Galvanized ("galvaneal") steel sheet.
   b. Thickness: 16 gage.
   c. Finish: Painted exterior, in accordance with this Section's "Factory Finishes" provision, below.
3. Fabrication and Assembly:
   a. Provide enclosure so that belt tensioning, oil level checks, and oil changes are performed without removing enclosure or any part thereof. Provide in enclosure panels latched and hinged access doors and lintels, on each side, for such purposes.
   b. Weight Limit: Removable panels shall weigh less than 50 LBS each.
   c. Install gauges at enclosure's exterior to allow convenient reading by personnel standing adjacent to enclosure..

Sound Attenuation:
   d. Provide enclosure with flame-retardant acoustic lining.
   e. Maximum allowable noise, when blower is operating at maximum speed, shall not exceed 85 dBA measured thee feet from any part of blower enclosure.
4. Enclosure Cooling and Ventilation:
   a. Provide electric-driven cooling fan, properly sized for appropriate cooling and ventilating of blower enclosure.

2.4 FASTENERS

A. Anchor Bolts:
1. All anchor bolts shall be a minimum of 1/2 inch diameter and made of Type 304 stainless steel.
2. The equipment supplier shall furnish all anchor bolts, nuts, and washers required for the equipment.

B. Fasteners:
1. All fasteners shall be Type 18-8 stainless steel.
2. The equipment supplier shall furnish all fasteners required for the assembly of the equipment.

2.5 PAINTING

A. Blowers shall receive primer and top coat at the factory as recommended by the Manufacturer.

B. Coordinate with Owner for color.

2.6 SPARE PARTS

A. Provide a set of spare parts as recommended by the Manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation – General:
   1. Install equipment in accordance with the Contract Documents, manufacturer's written instructions, and Laws and Regulations. Obtain Engineer's written interpretation or clarification in event of conflict between such requirements.
   2. Do not modify structures to install equipment, without Engineer's written approval.
   3. Comply with:
      a. Section 01 61 03 - Equipment - Basic Requirements.
      b. Section 01 75 00 - Checkout and Startup Requirements.

B. Field-Applied Finishes:
   1. Apply field touch-up paint, furnished by blower equipment manufacturer, to scratches and blemishes in equipment's factory-applied coatings.
   2. Apply in accordance with coating manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

A. Field Testing and Inspections:
   1. General:
      a. After equipment installation is complete, Contractor and qualified, factory-trained field service representative of blower equipment manufacturer shall perform tests and inspections required in this Article, in accordance with field testing plan approved by Engineer.
      b. Perform required field tests in Engineer's presence.
   2. Inspect the installed Work and remedy defects as necessary.
   3. Operating Tests:
      a. Field-test each blower 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 necessary testing equipment, labor, and appurtenances. Motor testing shall comply with Section 01 61 03 - Equipment - Basic Requirements.
      b. Verify: (1) equipment operates at design point as intended; (2) vibration limits are not excessive and beyond manufacturer's recommendations; and (3) blower operates smoothly without excessive noise, temperature rise, or other defects, across entire range of operating curve. Verify all controls operate as intended in all operating modes. Successfully test-operate each blower in accordance with Section 01 61 03 - Equipment – Basic Requirements, and Section 01 75 00 - Checkout and Startup Requirements.
      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.
   4. Vibration Testing:
      a. Perform field vibration testing of equipment when required by Section 01 61 03 - Equipment - Basic Requirements..
      b. Vibration testing shall comply with Section 01 61 03 - Equipment - Basic Requirements.
   5. Sound Tests:
      a. Perform sound pressure level test on one blower of each type and size provided. Engineer will select the blower to be so tested following field operating tests.
      b. Present test results in decibels.
      c. Obtain overall sound pressure level at points evenly spaced around blower tested and motor assembly and at three feet from nearest part of blower enclosure. Sound level shall not exceed 85 dBA at distance of three feet from blower enclosure.

6. Manufacturer shall submit, through Contractor, written statement regarding the blowers' compliance with the Contract Documents and equipment manufacturer's recommendations, regarding whether remedial measures are required, and if so, what remedial measures he proposes.

B. Manufacturer's Services:
   1. Provide services of qualified, factory-trained service person to perform the following:
      a. Instruct Contractor's workers in handling, storing, and installing equipment.
      b. Be present to supervise delivery, unloading, handling, and storage of equipment, and assist Contractor with inspecting condition of equipment and verifying that all required items, including required spare parts and extra materials, were furnished and are appropriate for the equipment,
      c. After installation, inspect and adjust equipment, verify proper operation, and assist with required field testing and inspections.
      d. Instruct facility operations and maintenance personnel.
   2. Submit, through Contractor, written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner or facility manager (as applicable).
   3. Manufacturer's factory-trained service representative shall revisit the Site as often as necessary until installed equipment is acceptable, and as necessary during the correction period.
   4. All costs, including travel, lodging, sustenance, and incidentals, for visits to the Site are included in the Contract Price.

END OF SECTION

SECTION 43 21 00
PUMPING EQUIPMENT: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pumping equipment.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Hydraulic Institute (HI):
      a. 9.6.4, Rotodynamic Pumps for Vibration Measurements and Allowable Values.
      b. 11.6, Rotodynamic Submersible Pump for Hydraulic Performance, Hydrostatic Pressure, Mechanical, and Electrical Acceptance Tests.
      c. 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.
   2. National Sanitation Foundation International (NSF):
      a. NSF 61 Drinking Water System Components - Health Effects.

B. Fully coordinate all mechanical seal systems specified to ensure pump and seal compatibility.

C. Pump/motor and VFD coordination: See Specification Section 01 61 03.

1.3 DEFINITIONS

A. The abbreviations are defined as follows:
   1. IPS: Iron Pipe Size.
   2. NPSHR: Net Positive Suction Head Required.
   3. TDH: Total Dynamic Head.
   4. TEFC: Totally Enclosed Fan Cooled.
   5. VFD: Variable Frequency Drive.

B. Pump Service Category: Pump or pumps having identical names (not tag numbers) used for specific pumping service.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 01 61 03.
   3. Product technical data including:
      a. Performance data and curves with flow (gpm), head (FT), horsepower, efficiency, NPSH requirements, submergence requirement.
      b. Pump accessory data.
      c. Bearing supports, shafting details and lubrication provisions.
         1) Bearing life calculations.
         2) Critical speed calculations.
      d. Solids passage information.
   4. Certifications:
      a. Certified pump performance curves as described in the SOURCE QUALITY CONTROL Article.
   5. Test reports:
      a. Factory hydrostatic test.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:

a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

C. Informational Submittals:
1. Certifications:
a. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Pumps:
a. See individual pump Specification Sections.
2. Mechanical seals:
a. Chesterton.
b. Garlock.
c. Or as noted in the individual pump Specification Sections.

2.2 CENTRIFUGAL PUMP DESIGN

A. Provide units with increasing head characteristics from the end run out portion of the curve to shut-off condition.

2.3 ACCESSORIES

A. See Specification Section 01 61 03.

B. Each Unit:
1. Lifting eye bolts or lugs.
2. Plugged gage cock connection at suction and discharge nozzles.
3. Tapped and plugged openings for casing and bearing housing vents and drains.
4. Fittings for properly adding flushing lubricant.
5. Pressure relief fittings for grease lubrication.

C. Packing Seal:
1. Provide packing unless mechanical seal is specified in narrow-scope pump sections.
2. Minimum of five (5) rings graphite impregnated synthetic packing.
3. Provide minimum 1/4 IN DIA supply tap and 1/2 IN DIA minimum drain tap.
4. Provide split Teflon or bronze water seal ring.
5. Adjustable split follower cast iron or bronze gland.

D. Mechanical Seals:
1. Provide as specified in the narrow-scope pump sections.
2. Provide rotating balanced O-ring type.
3. Provide water oil lubrication - cooling.
4. Materials:
a. Metal parts except springs: 316 stainless steel.
b. Springs: Hastelloy C.
c. Seal faces: Unfilled carbon graphite versus silica-free Grade 99.5 ceramic.
d. Elastomers: Viton.

2.4 FABRICATION

A. Pump Support:
1. Design base to support weight of drive, shafting and pump.
2. Comply with HI vibration limitations.
3. Mount horizontal pump, motor and coupling on single piece drip lip type baseplate.

4. Mount vertical pumps on single piece pedestal baseplate.
5. Fabricate to withstand all operating loads transmitted from the pump and drive.

2.5 SOURCE QUALITY CONTROL

A. Factory hydrostatic test all pumps at 150 percent of shut-off head for a minimum of 5 minutes.

B. If specifically required in the individual pump specification sections, provide factory tests:
   1. All units:
      a. Conduct tests in accordance with HI.
         1) Shut-off head and design condition: Positive unilateral performance tolerance meeting Grade 1U per HI 14.6 for Rotodynamic Pumps.
         2) Shut-off head and design conditions: Positive unilateral performance tolerances meeting Grade 1U per HI 11.6 for Rotodynamic Submersible Pumps.
   2. Adjustable speed units:
      a. Head (FT) verses flow (gpm) pump curves:
         1) Maximum, minimum and two (2) equally spaced intermittent speeds.
         2) Efficiencies along each curve.
         3) Brake horsepower along each curve.
   3. Constant speed units:
      a. Head (FT) versus flow (gpm) pump curves:
         1) Efficiencies along curve.
         2) Brake horsepower along each curve.
   4. Results certified by a registered professional engineer.

C. Statically and dynamically balance each pump per HI standards.
   1. If specifically required in the individual pump specification sections or in Specification Section 01 61 03, field vibration test pumps:
      a. To meet requirements of HI 9.6.4 for Rotodynamic Pumps at any point on the pumps and motor.

D. To meet requirements of HI 11.6 for Submersible Pumps.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 01 61 03.

B. Floor or Pad-Mounted Units (Non-Submersible):
   1. Align vertically and horizontally level, wedge and plumb units to match piping interfaces.
   2. Assure no unnecessary stresses are transmitted to equipment flanges.
   3. Tighten flange bolts at uniform rate and manufacturer's recommended torque for uniform gasket compression.
   4. Support and match flange faces to uniform contact over entire face area prior to bolting pipe flange and equipment.
   5. Permit piping connecting to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
   6. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
   7. Assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
      a. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
      b. Realign as necessary, install flange bolts and make equipment connection.
   8. Field paint units as defined in Specification Section 09 91 00.
   9. Provide pressure gage on discharge of all pumps and on suction and discharge of all non-submersible units.

C. Submersible Units:
   1. Assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
      a. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
      b. Realign as necessary, install flange bolts and make equipment connection.
   2. Field paint units as defined in Specification Section 09 91 00.

D. Provide pressure gage on discharge of all pumps and on suction and discharge of all non-submersible units.

E. For submersible units, provide discharge pressure gage visible from grade or operating floor.

3.2 FIELD QUALITY CONTROL

A. Provide services of equipment manufacturer's field service representative(s) to:
   1. Inspect equipment covered by this Specification Section.
   2. Supervise pre-start adjustments and installation checks.
   3. Conduct initial start-up of equipment and perform operational checks.
   4. Instruct Owner's personnel for the specified minimum number of hours at jobsite per Specification Section 01 30 00 on operation and maintenance of each of following pumping equipment:

END OF SECTION

SECTION 43 24 27
PUMPING EQUIPMENT: VERTICAL TURBINE (LINE SHAFT)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vertical turbine pump for raw water transfer. Refer to Drawings P02 and P03 for depth of clear/wet well in which these pumps will be installed.
   2. Modifications to four total existing vertical turbine pumps.
      a. Two raw water vertical turbine pumps
      b. Two finish water vertical turbine pumps.

1.2 REFERENCES

A.	ANSI B16.1	Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
B.	HI Standard 9.6.	Hydraulic Institute Standards
C.	SAE	Society of Automotive Engineers

1.3 SUBMITTALS

A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. See Specification Section 43 21 00.
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation instructions.

C. Shop Drawings.

D. Product Data.

E. Reed Critical frequency calculations showing natural frequency's at least 20 percent outside operating range. Operating range is 300-700 gallons per minute for critical frequency calculations.

F. Letter from Manufacturer confirming compliance with specification requirements.
   1. Certifications:
      a. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable for the raw water transfer pumps:
   1. Floway.
   2. Goulds.
   3. Or Approved Equal.

B. Subject to compliance with the Contract Documents, the following vendor is acceptable for the modifications to the raw water and finish water vertical turbine pumps:
   1. PumpMan NorCal
      a. Contact: Jason Smith
      b. Address: 4000 South Moorland Ave, Santa Rosa, CA 95407
      c. Email: jason.smith@pumpmannorcal.com
      d. Phone

1) Office: (707) 584-9191
2) Mobile: (707) 293-6542

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. Performance Parameters:
1. Raw Water Transfer Pumps:
a. Primary design condition: 700 gallons per minute at 167 feet total dynamic head.
b. Secondary design condition: 300 gallons per minute at 120 feet total dynamic head.
c. Maximum speed: 1,200 rpm.
d. Maximum horsepower: 50 HP.
e. Discharge flange: 10 inch.
f. Type of discharge head: Surface type, fabricated.
g. Maximum NPSHR at any design condition: 16-feet.

B. Provide pumps with net positive suction head requirements (NPSHR) less than the net positive suction head available (NPSHA) at all operating conditions.

2.3 ACCESSORIES

A. See Section 01 61 03.

2.4 COMPONENTS

A. General:
1. Furnish units consisting of a vertical shaft turbine, direct connected to a vertical hollow shaft motor. Design unit with non-reversing ratchets.
2. Weight of revolving parts of pump including unbalanced hydraulic thrust of impeller is carried by thrust bearing in driver.
3. Make provision at driver shaft or discharge head for adjusting impeller with reference to bowls.
4. Pumping equipment to be NSF 61 certified.

B. Column:
1. Construct discharge column pipe of steel and supply with flanged connections.
2. Sandblast column and coat inside and outside of column with a minimum 15 mils dry film thickness epoxy system at the factory.
3. Provide coating equal to that recommended by Tnemec, Koppers or Carboline or Approved Equal and NSF 61 approved for use with potable water.

C. Open Line Shaft:
1. 416 stainless steel, rolled and ground.
2. Maximum length: 10-feet.
3. Furnish renewable shaft sleeves constructed from 416 stainless steel at each bearing location.
4. Undercutting of shafting at sleeve locations is not permitted.
5. Provide rubber bearings at each column connection supported by retainers butted between machined faces of discharge column.

D. Pump Bowl and Suction Bell:
1. Provide bowl and suction bell constructed of close grained cast iron, free from imperfections and accurately machined and fitted.
2. Coat pump bowl water passages with an abrasion-resistant baked enamel, phenolic, or epoxy.
3. Provide minimum 15 mils dry film thickness NSF 61 approved coating suitable for potable water service.
4. Design to ensure easy removal of bearings and impeller.
5. Furnish suction bell with flared end to reduce entrance losses and with a sufficient number of vanes to support lower guide bearings and weight of impeller and pump shaft when dismantling pump.

E. Bearings:
   1. Provide units with sleeve bearings of UNS C89835 bronze in each bowl and in suction bell.
   2. In bowl, provide main bronze bearing immediately above impeller and a lower bronze bearing immediately below impeller.
   3. Provide for lubrication of bowl bearings with pumped liquid.
   4. Furnish suction bell bearing having minimum length equal to five shaft diameters.
   5. Ensure bell bearing is permanently packed type with packing to be a nonsoluble grease.
   6. Provide stainless steel collar for bell bearing to prevent abrasives from entering bearing.
   7. Provide motor bearing resistance temperature detectors (RTDs).
      a. Two per motor for thrust and guide bearing.
      b. 3 wire platinum, 1,000 Ohm.

F. Pump Shaft and Impeller:
   1. Provide pump unit shaft constructed of rolled and ground 416 or 410 stainless steel.
   2. Furnish enclosed type impellers constructed of bronze and securely attached to impeller shaft.
   3. Ensure impeller is accurately fitted and statically and dynamically balanced.
   4. Provide aluminum bronze replacement wear rings in each bowl to prevent wear on bowls.

G. Discharge Head Assemblies:
   1. Design discharge head assembly for 150 pounds per square inch test pressure.
   2. Provide discharge head for above ground mounting constructed of fabricated steel with integral discharge flange.
   3. Furnish ANSI B16.1 150 pounds flange.
   4. Ensure baseplate is of sufficient size to span opening in support structure.
   5. Furnish cartridge style mechanical seal with API 13 seal flush.
   6. Provide minimum 15 mils dry film thickness epoxy coating on head water ways and primer or O.D.
   7. Construct discharge nozzle with a vertical vane to minimize turbulence.
   8. Supply base plate with lifting lugs capable of supporting weight of entire unit.

H. Data Plates:
   1. Provide stainless steel data plate securely attached to pump.
   2. Include manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data.

I. Motors:
   1. Inverter duty, vertical hollow shaft, squirrel cage, induction type.
   2. 460 Volt, 60 Hertz, 3 phase.
   3. 120 VAC motor heater.
   4. TEFC with 1.15 service factor. Premium Efficiency.
   5. Size motor to drive pump continuously over the complete head - capacity range without the load exceeding the nameplate rating.
   6. Design motor for 104 degrees Fahrenheit ambient.

J. Suction Barrel:
   1. Standard pressure suction barrel.
   2. Refer to drawings for additional information.

K. Vibration Monitoring:
   1. Provide Robertshaw, Vibraswitch Malfunction Detector Model 366 or Approved Equal. 120 VAC reset coil, contact D.

L. Flow Conditioning Basket:
   1. Supply flow conditioning basket constructed of stainless steel 316L.
   2. The vanes and bottom grating shall have a depth to spacing ration of at least 1 to 1.
   3. The flow conditioning basket shall have a height of at least 1/4th the bell diameter and shall have an open area of at least 150 percent of the bell area.
   4. A suction strainer is not an acceptable alternative to a flow conditioning basket.

5. Flow conditioning basket shall be as provided by Flow Optimizers, LLC of Lizella, GA or equal.

2.5 MAINTENANCE MATERIALS

A. Extra Materials:
   1. Furnish the following extra parts for each pump service category:
      a. One set of pump bearings, including bowl and line shaft assemblies.
      b. Seal kit: One set.
      c. Bowl wearing rings: One set.

2.6 PUMP MODIFICATIONS/REFURBISHMENT

A. Pumps to be modified/refurbished:
   1. Raw water pump no. 3
   2. Raw water pump no. 4
   3. Final/Finish water pump no. 3
   4. Final/Finish water pump no. 4

B. Work to be performed, includes but is not limited to:
   1. Complete refurbishment package, including but not limited to:
      a. Replacement of bearings, packings, seals etc.
      b. Restore impeller clearances
      c. If necessary, make repairs to the suction bell, impeller, etc.
      d. Swap column and shaft
      e. Cut the column and shaft into two equally long sections
         1) The purpose of this work is to make removal of these pumps within the vertical constraints of the Control Building more convenient in the future.
      f. Perform pre and post vibration analysis to assess effectiveness of the overhaul.
   2. Contractor is responsible for removal and re-installation of all four pumps.
      a. If there are any vibration or other performance issues after installation, the contractor is solely responsible for any associated costs.
      b. Contractor is limited to refurbish one pump at a time. Three of the four pumps must be operational, without any interruptions.

C. Refer to Appendix A for the record shop drawings of the vertical turbine pumps.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. Provide services of equipment manufacturer’s field service representative(s) to:
   1. Inspect equipment covered by these Specifications.
   2. Conduct initial startup of equipment and perform operational checks.
   3. Provide a written statement from the manufacturer that equipment has been installed properly, started up and is ready for operation by Owner’s personnel.
   4. Provide demonstration and training to Owner’s personnel for 8 hours on operation and maintenance of the equipment.

B. Perform vibration testing per Section 01 61 03 after the new and refurbished equipment is installed and during demonstration period. Test results to be within limits indicated on Figure 9.6.4.14 of HI Standard 9.6.4.

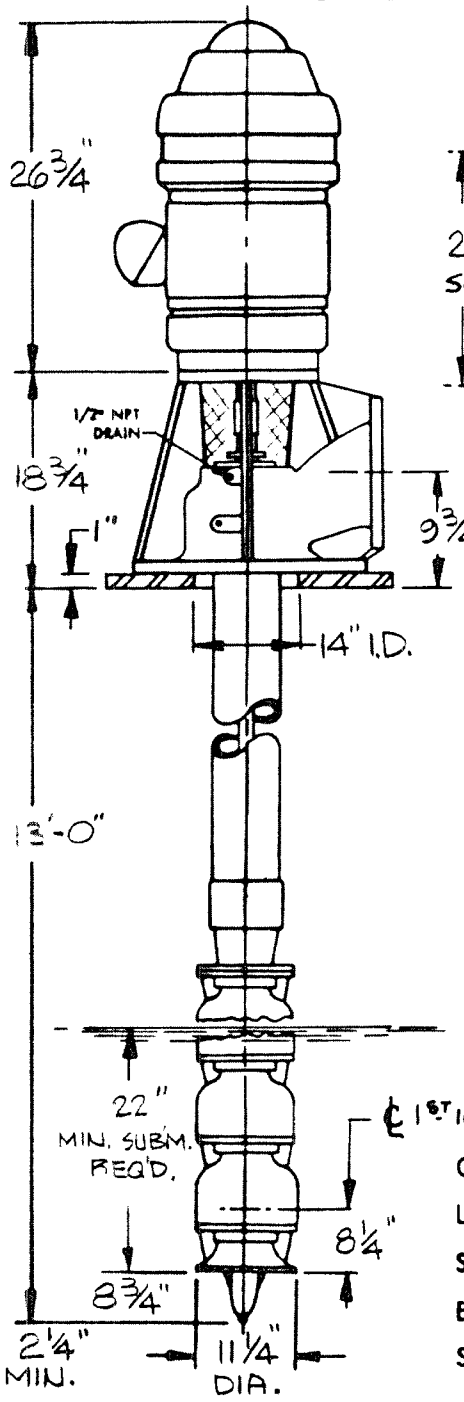
END OF SECTION

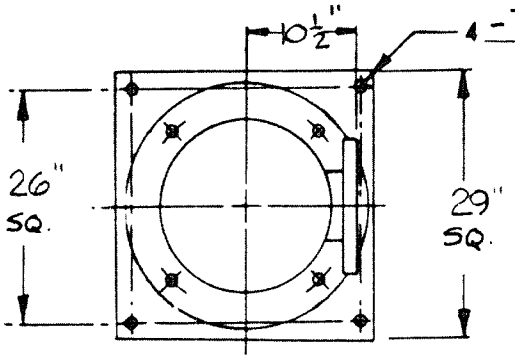
APPENDIX A - RECORD VERTICAL TURBINE PUMP SHOP DRAWINGS

Peabody Floway

VERTICAL TURBINE PUMP

TYPE 'A'





8" - 125# ANSI - F.F. DISCH FLG.
(8) - 7/8" DIA HOLES*
11 3/4" DIA. BOLT CIRCLE
13 1/2" DIA. FLANGE
*BOLT HOLES STRADDLE VERTICAL ℄

CERTIFIED
FOR CONSTRUCTION
CUST. ORDER NO. 3916
OUR ORDER NO. 87-01094-95
BY TL DATE 12-16-86

MOTOR (WP-1)

MAKE U.S.
TYPE VHS NRR YES ☐
HP 15 RPM 1760
PHASE 3 HERTZ 60
VOLTAGE 230-460
FRAME NO. 254 TP
TYPE COUPLING THREADED

PUMP

8 x 12 'A' C.I. DISCH HD
1" LINE SHAFT 8" COL
~ SHAFT TUBE
PROD LUBE X OIL LUBE ___
TYPE 12 DOM STAGE 1
1000 GPM 47' TDH
IMPELLER SEMI OPEM
STRAINER NO

MATERIAL

COL PIPE SCH. 40 STL.
LINE SHAFT A108-GR.1045 STL.
SHAFT TUBE ~
BOWL SHAFT A 276-304 S.S.
SHAFT PACKING J.C. #100M
(HIGH PRESSURE PKG BOX)

PUMP BOWL A48-CL. 30 C.I.E.
IMPELLER B584-838 BRZ.
BEARINGS (BOWL) B505-844 BRZ.
BEARINGS (LINESHAFT) NEOPRENE
STRAINER ~

REMARKS

NO. UNITS REQ'D. 2
FINAL WATER
PUMPS
F.W.P-3 & FWP-4

FLUID WATER
SPEC. GRAVITY 1.0
VISCOSITY ~
TEMPERATURE AMB.
PH ~

CUSTOMER FORT BRAGG W.T.P.
31901 CEDAR ST.
FORT BRAGG CA. 95437
ORDER NO. 3916
SUPPLIER KIRKWOOD BLY. INC.
P.O. BOX 3339 SANTA ROSA CA. 95437
DWG. NO. 87-01094-2
SERIAL NO. 87-01094, 01095

REV. 1 12-16-86
By: JSH Date: 11-10-86

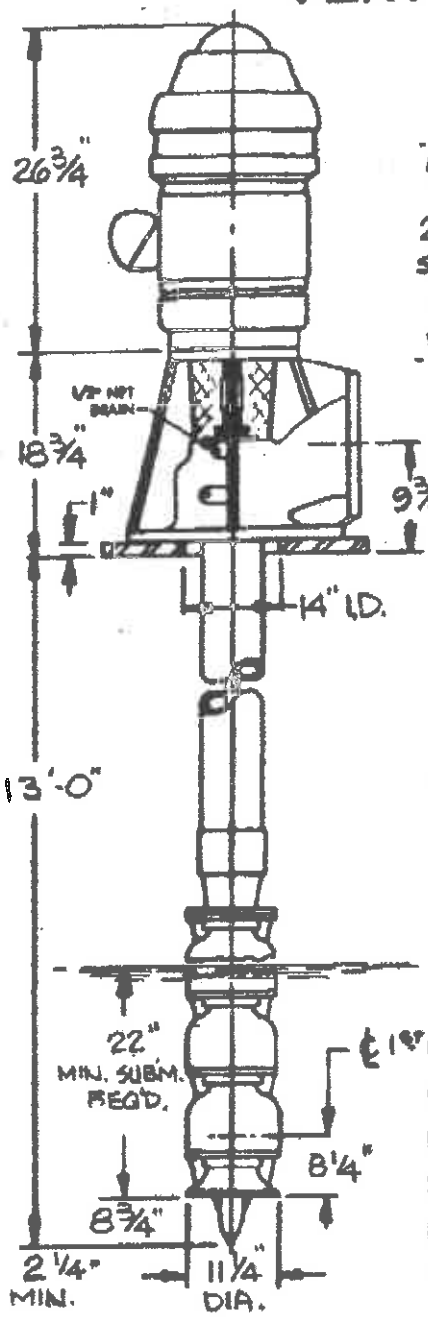
NOT TO BE USED FOR CONSTRUCTION UNLESS CERTIFIED

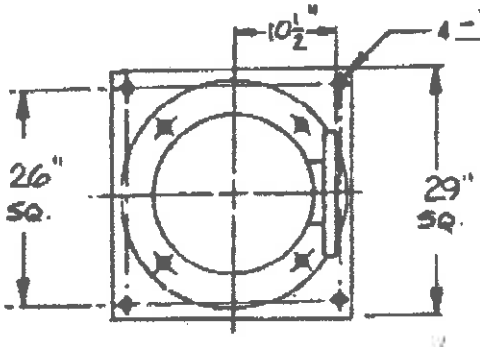
"There's a Difference..."

Peabody Floway

VERTICAL TURBINE PUMP

TYPE 'A'





8" - 125# ANSI - F.F. DISCH FLG.
(8) - 7/8" DIA HOLES*
11 3/4" DIA. BOLT CIRCLE
13 1/2" DIA. FLANGE
*BOLT HOLES STRADDLE VERTICAL &

CERTIFIED
FOR CONSTRUCTION
CUST. ORDER NO. 3916
G.W.A. ORDER NO. 87-01096-97
BY JC DATE 12-16-86

MOTOR (WP-1)

MAKE U.S.
TYPE VHS NRR
HP 15 RPM 1760
PHASE 3 HERTZ 60
VOLTAGE 230-460
FRAME NO. 254 TP
TYPE COUPLING THREADED

PUMP

8 x 12 'A' C.I. DISCH HD
1" LINE SHAFT 8" COL
~ SHAFT TUBE
PROD LUBE X OIL LUBE
TYPE 12 DOM STAGE 1
1000 GPM 36' TDH
IMPELLER SEMI OPEN
STRAINER NO

MATERIAL

COL PIPE SCH. 40 STL.
LINE SHAFT A108-GR. 1045 STL.
SHAFT TUBE ~
BOWL SHAFT A276-304 S.S.
SHAFT PACKING J.C. #100M
(HIGH PRESSURE PKG. BOX)

PUMP BOWL A48-CL. 30 C.I.E.
IMPELLER B584-838 BRZ.
BEARINGS (BOWL) B505-844 BBZ.
BEARINGS (LINESHAFT) NEOPRENE
STRAINER ~

REMARKS

NO. UNITS REQ'D. 2
RAW WATER
PUMPS
RWP-3 & RWP-4

FLUID WATER
SPEC. GRAVITY 1.0
VISCOSITY ~
TEMPERATURE AMB.
PH ~

CUSTOMER FORT BRAGG W.T.P
31901 CEDAR ST.
FORT BRAGG CA. 95437
ORDER NO. 3916
SUPPLIER KIRKWOOD BLY. INC.
P.O. BOX 3339 SANTA ROSA CA. 95437
DWG. NO. 87-01094-4
SERIAL NO 87-01096, 01097

REV. 1 12-16-86 BY: JSH DATE: 11-10-86

NOT TO BE USED FOR CONSTRUCTION UNLESS CERTIFIED

"There's a Difference"

SECTION 46 07 13
FILTER TREATMENT UNITS RETROFIT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Material, design, fabrication, and installation requirements for the retrofit of the two existing filter treatment units at the city of Fort Bragg water treatment plant. Unless noted otherwise, all retrofit components shall be furnished by WesTech Engineering, LLC (WesTech).
   2. The retrofit components include, but are not limited to:
      a. Adsorption Clarifier
      b. Filter
      c. Media
      d. Air Scour Blowers
      e. Valves
      f. Instrumentation
      g. Control Panel
      h. Commissioning Support

B. Pricing and Scope:
   1. The Owner has pre-negotiated a scope of supply and pricing for supply of the materials (excluding concrete and field paint) described under this Specification Section and refer to Appendix A for WesTech's proposal.
   2. The scope of this work includes but is not limited to:
      a. Retrofit of two existing Trident TR-420-stretch filter treatment units with the multiblock underdrain and Laser Shield™ direct media retention system in the filter section of the unit.
      b. The filter and adsorption media and existing underdrain laterals are to be replaced. The media shall be replaced to conform to the manufacturer's current standard.
      c. The laterals are to be replaced and upgraded to the current Trident standard, directly supporting media underdrain. This modification shall remove the gravel support layer associated with the existing laterals.
      d. Identical equipment and materials shall be utilized for both tanks. Additionally, the air wash laterals, air nozzles, and buoyant media retention screen shall be replaced.
      e. The interior and the exterior surfaces of the filter treatment units shall be sand blasted and repainted. Refer to Section 09 91 00 for filter treatment unit coating work.

C. Appendices:
   1. Appendix A: WesTech's proposal
   2. Appendix B: Record shop drawings of the existing filter treatment units

D. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. All necessary items specified in this Section are to be identical to the parts and installation provided by the original equipment Manufacturer. The Contractor has sole source responsibility for coordinating all items for compatibility and proper operation. This Specification Section is intended to describe details of the filter rehabilitation for the purpose specified. Contractor is responsible for all details necessary to properly install, adjust, and place in operation a working system.

B. Conduct performance testing verifying replacement filter media and underdrains produce turbidity readings equal to or better than the original equipment.

C. All items, including but not limited to, filter media, clarifier media, replacement parts, piping and appurtenances to be supplied for the purpose of rehabilitation of the existing filter treatment units shall be NSF 61 certified, without any exceptions.

D. Provide operational and performance field test.

E. Warranty:
   1. Provide a two year warranty on all equipment from date of start-up. Warranty shall cover defects in workmanship, design, and materials. If any component should fail during the warranty period, it shall be corrected and the unit restored to service at no expense to the Owner.

1.3 SUBMITTALS

A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. Submit the following items for approval:
   1. Shop Drawings:
      a. Retrofit drawings showing all underdrain and media retention system components, piping, structural components, equipment repair, and other appurtenances directly associated with the system.
      b. Manufacturer shall provide information pertaining to the general assembly, materials of construction, performance characteristics, coatings, power requirements, wiring diagrams, service connections, and additional information necessary. The Contractor shall provide interconnection shop drawings as part of this package that show all wiring, terminations, and conduits and pull boxes. The interconnection shop drawings shall be submitted and approved prior to installation of the conduits and wire.
   2. Product Data:
      a. Catalog data consisting of specifications, illustrations and a parts schedule that identifies the materials to be used for the various system components and accessories.
      b. Detailed description of construction, including parts list with materials of construction and metallurgy with ASTM designations.
      c. Description and quantity of each part supplied, including catalog cut sheets, materials of construction, and spare parts list.
      d. Manufacturer’s installation instructions.
      e. Manufacturer’s painting and finishing recommendations.
      f. Installation drawings showing all important details of construction, dimensions, and anchor bolt requirements.
      g. Data on the characteristics, features, and performance of the equipment.
      h. Electrical Schematics, panel layouts, field wiring diagrams, interconnection diagrams, instrumentation sheets, and product data sheets for all electrical equipment being supplied by the clarification system manufacturer.
      i. A complete total bill of materials for all equipment.
      j. Complete motor drive data.
      k. Complete data and drawings on control system.

C. NSF 61 certifications.

D. Contractor’s certification of satisfactory installation and operation of the rehabilitated filter treatment units.

E. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle materials to prevent damage during unloading and installation. Follow manufacturer’s instructions.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER:

A. Subject to compliance with the Contract Drawings, the following sole-sourced manufacturer is acceptable:
   1. Trident, by WesTech Engineering, LLC.
   2. No like, equivalent, or “or equal” item or substitution is permitted.

2.2 EXISTING CONFIGURATION

A. Refer to Appendix B for the record shop drawings of the existing Trident units.

2.3 SERVICE CONDITIONS AND PERFORMANCE

A. General:
   1. Replacement parts and media shall be the exact same material, quality, and physical layout as current Trident standard. All labor and installation methods shall be in accordance with the requirement of the original manufacturer of the Trident TR-420-Stretch filter treatment units.

B. Water Quality:
   1. Filtered water from the complete installation shall produce finished water quality equal to the water quality prior to the retrofit work.

2.4 COMPONENTS AND MATERIALS

A. All materials to be used for this work shall be NSF-61 certified, without any exceptions.

B. The following component shall be supplied for the retrofit of two Trident units. Unless noted otherwise, Contractor is solely responsible for all installation.

C. Adsorption Clarifier
   1. Adsorption Clarifier Media
      a. Media Depth: 4 feet
      b. 50% beads
      c. 50% fiber balls
   2. Clarifier Media Retention
      a. Stainless Steel screen mesh under aluminum grating
   3. Splash Guards
      a. To be placed around the top of tank perimeter of the Adsorption Clarifier section on three sides.
      b. Provide support angles & attachment hardware.
      c. Installation by the contractor
   4. Lower media support grating
      a. Aluminum grating at the bottom of the Adsorption Clarifier section just above the inlet and air distributions.
   5. Inlet Distribution
      a. PVC header-lateral pipe system with supports.
      b. The supports shall be field welded to the tank by the Contractor.
   6. Air Distribution
      a. PVC header-lateral pipe system with supports.
      b. The supports shall be field welded to the tank by the Contractor.
   7. Air Tank Connection
      a. 4 inch tank connection with flanged ends
      b. Contractor is responsible for the field installation of this connection.

D. Filter
   1. Multiblock Underdrain
      a. Dual later blocks, designed to interlock with each other to form the overall lateral length.

b. The underdrain system shall include a factory installed media retaining Laser Shield plate constructed of type 304 stainless steel.
c. Concrete fill is required to be placed in bottom of the filter section for support of the Multiblock laterals. Concrete fill and grout shall be installed by the contractor.

2. Air/Water Distribution
   a. 304 stainless steel plenum with air and water connections
3. Effluent/Backwash Supply Pipe
   a. 304 stainless steel
   b. Pipe shall connect the internal underdrain plenum to the tank wall.
4. Air Supply Pipe
   a. 304 stainless steel
   b. Pipe shall connect the internal underdrain plenum to the tank wall.
5. Tank Stiffeners
   a. External vertical and horizontal tank stiffeners, which shall reinforce the tank to facilitate internal underdrain upgrades.
   b. Carbon steel
      1) To be coated by the contractor after field installation
   c. Stiffeners shall be field cut and welded into place by the contractor.
6. Air Tank Connection
   a. 6 inch with flanged ends.
   b. Contractor shall make the necessary modifications to the tank and install and in-place the new air tank connection.
   c. The air tank connection shall be coated after installation is completed.

E. Filter Media
1. The filter media shall be a 30-inch deep mixed media separation bed composed of three materials, each of different size and specific gravity, providing uniform void distribution from coarse to fine in the direction of flow. The mixed media shall consist of 18 inches of anthracite coal, 9 inches of silica sand and 3 inches of Garnet. The top of the bed shall consist of material of approximately 1.2 mm particle size, and the bottom of approximately 0.2 mm particle size.
2. The filter media shall be supplied by the manufacturer and shall be shipped in bags for ease of installation. The manufacturer will advise exact volume of each layer of mixed media to be installed by the Contractor.

F. Air Scour Blower
1. Refer to Specification Section 43 11 34.

G. Valves
1. Effluent
   a. Size: 8 inch
   b. Quantity: 1 per Trident Unit
   c. Type: Butterfly
   d. Actuator Type: Electropneumatic, modulating
2. Filter-to-Waste
   a. Size: 8 inch
   b. Quantity: 1 per Trident Unit
   c. Type: Butterfly
   d. Actuator Type: Electropneumatic, modulating
3. Adsorption Clarifier Air Scour
   a. Size: 4 inch
   b. Quantity: 1 per Trident Unit
   c. Type: Butterfly
   d. Actuator Type: Pneumatic, Open/Close
4. Filter Air Scour
   a. Size: 6 inch
   b. Quantity: 1 per Trident Unit

c. Type: Butterfly
d. Actuator Type: Pneumatic, Open/Close

5. Backwash Inlet
   a. Size: 12 inch
   b. Quantity: 1 total
   c. Type: Butterfly
   d. Actuator Type: Pneumatic, Open/Close
6. Backwash High-Rate
   a. Size: 12 inch
   b. Quantity: 1 total
   c. Type: Butterfly
   d. Actuator Type: Pneumatic, Open/Close
7. Backwash High-Rate Set
   a. Size: 12 inch
   b. Quantity: 1 total
   c. Type: Butterfly
   d. Actuator Type: Manual, Handwheel or Chainwheel
8. Backwash Lowe Rate Set
   a. Size: 4 inch
   b. Quantity: 1 total
   c. Type: Butterfly
   d. Actuator Type: Manual, Handwheel or Chainwheel
9. Adsorption Clarifier Air Check Valve
   a. Size: 4 inch
   b. Quantity: 1 per Trident Unit
   c. Type: Check
   d. Actuator Type: None
10. Filter Air Check Valve
    a. Size: 6 inch
    b. Quantity: 1 per Trident Unit
    c. Type: Check
    d. Actuator Type: None

H. Instrumentation
1. Backwash Control Level Switches
   a. Type: Float (Low and High)
   b. Quantity: 2 per Trident Unit
   c. Signal: On/Off
2. Clarifier Pressure Switch Assembly
   a. Quantity: 1 per Trident Unit
      1) 2-1/2 inch, 0 to 5 psi with two pressure switches per assembly
   b. Signal: Discrete

I. Control Panel
1. Control Panel Door
2. Sub-Panel
3. PLC
4. RTB
5. I/O
6. I/O Rack
7. Communication Module
8. Memory Card
9. Selector Switches
10. Potentiometers & Relays
11. Power Supply
12. Programming Modifications

PART 3 - EXECUTION

3.1 PREPARATION

A. Backwash and skim the filter media a minimum of three times each in order to remove all fines prior to placing systems back into operation.

B. The Contractor shall disinfect the filter treatment units in accordance with AWWA C653-13 prior to placing them in service.

3.2 INSTALLATION

A. Equipment installation to be completed in accordance with the manufacturer's instructions and recommendations.

B. Proper storage of all materials to be the responsibility of the installing Contractor, and the Owner assumes no responsibility for materials which are not properly protected from the weather by the Contractor.

C. Filter material that becomes contaminated with dirt or other unsanitary materials, in the opinion of the Owner, is to be replaced at no additional cost to the Owner.

D. Sufficient quantities of filter media shall be furnished so that the finished depths correspond to the original depths once the filter beds have been backwashed and skimmed of fines.

E. The Contractor shall furnish labor, supervision, expendable materials, equipment and new materials to perform the following scope of work:
   1. Removal of existing equipment from the filter compartment of two filter treatment units, consisting of the following:
      a. Remove existing filter media retaining screens and media and dispose of media.
      b. Remove surface wash arms and dispose.
      c. Remove existing filter underdrain laterals and dispose.
      d. Remove existing underdrain header and dispose.
      e. Remove existing Magnetrol level controller, and dispose.
      f. Remove low level float switches and hardware. Dispose of float switches, retain hardware.
      g. Remove other minor appurtenances as shown on the drawings, and save for reinstallation as required.
      h. Clean effluent piping.
   2. Removal of existing equipment from the adsorption clarifier compartment of two filter treatment units, consisting of the following:
      a. Remove existing adsorptive media and salvage as directed by Owner.
      b. Remove and clean influent distribution headers.
      c. Remove existing air wash laterals and nozzles, and dispose.
      d. Remove existing media retention screens and hardware. Dispose of media retention screens, save hardware as shown on drawings.
      e. Remove existing pneumatic waste gate actuators and dispose.
      f. Remove existing waste gate and hardware, and save for reinstallation.
      g. Remove existing Magnetrol level controller, and dispose.
   3. Install new filter air scour piping for both filter units including 6-inch air supply lines from filter compartment inner wall to tie into filter effluent header.
   4. Install new filter compartment internal components for both filters, consisting of the following:
      a. Pour concrete as shown on the Retrofit drawings and per manufacturer's installation procedures.
      b. Install filter underdrain laterals and new support/retainer angles.
      c. Install new filter mixed media.
      d. Install new low level float switch using existing hardware.
   5. Install new clarifier compartment internal components for clarifiers, or both filter treatment units consisting of the following:

a. Install new media retainer screens and appurtenances, including reinstallation of salvaged hardware as shown on the drawings.
b. Install new air wash laterals, lateral support system, and air nozzles.
c. Reinstall existing waste gate.
d. Install new buoyant adsorptive media.

6. Surface preparation and coating shall be per Section 09 91 00.

3.3 FIELD QUALITY CONTROL

A. General:
1. Employ and pay for services of equipment manufacturer's field service representative(s) to:
a. Inspect equipment covered by this Specification.
b. Supervise adjustments and installation checks.
c. Provide test equipment, tools, and instruments necessary to accomplish equipment testing.
d. Conduct initial startup of equipment, perform operational checks, and supervise acceptance testing.

B. Provide through Contractor a written statement certifying that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

C. Tests:
1. General: Conduct tests in presence of the Owner and its representatives.
2. Upon completion of installation by the Contractor and certification of proper installation of the equipment by the manufacturer’s factory trained service technician, the equipment shall be functionally tested under supervision of Contractor and manufacturer’s factory trained service technician for a minimum of 120 HRS to ensure that all clearances, vibration, tracking, and motor operation characteristics are within acceptable limits.
3. Functional Testing:
a. Hydrostatically test all vessels in the field with clean water upto operating water levels after field installation is complete. Hold water for a minimum of 24 hours with no visible signs of leakage or wall deflections greater than 1/8 IN.
b. After completion of the installation field panel shall be field tested by the Contractor to ensure compliance with the performance requirements and operation with a factory-employed service technician, on-site to witness and assist in the testing.
c. The Contractor shall provide labor, equipment, and materials to perform testing. Testing procedures shall duplicate as nearly as possible the conditions of operation and shall be selected to demonstrate that the equipment is operational and free from damage.

3.4 MANUFACTURER’S FIELD SERVICES

A. A factory trained manufacturer’s Representative shall budget for not less than 8 trips and 24 days to inspect the system installation, assist in start up, and instruct plant personnel in the proper operation and maintenance of the system.

B. Field Testing:
1. The Manufacturer shall inspect the installation of all equipment in this Section prior to start-up in order to verify that the equipment has been properly installed and operates properly as a system and individually.
2. After the equipment has been properly installed, the Manufacturer shall calibrate the equipment with the Owner’s operator present and verify that the system is operating properly.

C. The Manufacturer shall provide the following services for training plant personnel for the minimum duration shown and at such times as requested by the Owner:
1. Minimum number of training sessions: Two (2).
2. Minimum training session duration: 4 hours per session.
3. Video Recording Presentation: 1-hour session.

4. The training sessions shall familiarize plant personnel with the optimal operation and maintenance of the equipment.

END OF SECTION

APPENDIX A - WESTECH'S PROPOSAL

Fort Bragg

California

Engineer
HDR

Representative
Dwight Craig
MISCOwater
Pleasanton, California
(925) 225-1900
dcraig@miscowater.com

Contact
Matt Swaney
mswaney@westech-inc.com

Miles Snyder
msnyder@westech-inc.com

WesTech®

Proposal Number: 1630021
Thursday, July 06, 2023

Table of Contents

Technical Proposal

Item A – Two (2) Lots of Rehab/Upgrade Components for Existing Trident Units

Clarifications and Exceptions

Commercial Proposal

Bidder's Contact Information
Pricing
Payment Terms
Schedule
Freight

Warranty

Terms & Conditions

Technical Proposal

The following rehab/upgrade components are being proposed for the existing Trident units at Fort Bragg, CA. The existing design criteria is based on available project information, the current configuration of the units is as follows:

Existing Design Configuration	
Installation Year	1986 (Project No. 506148)
Model	TR-420 "S"
Number of Units	2
Tank Material	Carbon Steel
Tank Dimension	27'-3" L x 9'-10 5/8" W x 10'-1" H
Adsorption Clarifier® Area	77.1 ft^2 per unit
AC Media	4 ft., Buoyant
Filter Area	154 ft^2 per unit
Filter Underdrain	Header-Lateral
Filter Media	Mixed Media w/ Gravel Support
Backwash Method	Surface Wash & Water Only
Valves	Pneumatic Actuators
Influent Flow Control	Flow Meter & Modulating Influent Valve
Effluent Flow Control	Ultrasonic Filter Level
Blower	1; regenerative, 300 scfm, 15 HP

Item A – Two (2) Lots of Rehab/Upgrade Components for Existing Trident Units

Adsorption Clarifier Scope of Supply		
Feature	**Quantity**	**Notes**
Adsorption Clarifier Media	308.4 ft^3/unit	Media depth is 4 ft. Adsorption Clarifier media is 50% beads and 50% fiber balls. Beads are 50/50 R&S. All media is NSF Std. 61 approved.
Clarifier Media Retention	77.1 ft^2/unit	Stainless steel screen mesh under aluminum grating
Lower media support grating	77.1 ft^2/unit	Aluminum grating at the bottom of the AC section just above the header-lateral pipe distributions
Splash Guards	1 set/unit	Aluminum material of construction. For placement around the top tank perimeter of AC section on three sides. Support angles and attachment hardware included.
Inlet Distribution	1 Lot/unit	PVC header-lateral pipe system with supports
Air Distribution	1 Lot/unit	PVC header-lateral pipe system with supports
Air Tank Connection	1/unit	4 in tank connection with flanged ends

Note

- Components unless otherwise noted are shipped loose for installation by others.
- Air tank connection requires field welding by installing contractor.

Filter Scope of Supply

Feature	Quantity	Notes
MULTIBLOCK® Underdrain	154 ft^2/unit	Dual lateral blocks, 11 in wide x 12 in high x 36 in long designed to interlock with each other to form the overall lateral length. The underdrain system shall include a factory installed media-retaining Laser Shield™ plate constructed of 304 stainless steel.
Air/Water Distribution	1 Lot/unit	304 stainless steel plenum with air and water connections
Effluent/Backwash Supply Pipe	1/unit	304 stainless steel construction, connecting the internal underdrain plenum to the tank wall.
Air Supply Pipe	1/unit	304 stainless steel construction, connecting the internal underdrain plenum to the tank wall.
Tank Stiffeners	1 Lot/unit	External vertical and horizontal stiffeners shipped as bare carbon steel bar stock for field cutting and welding into place to stiffen the tank properly for underdrain upgrade.
Air Tank Connection	1/unit	6 in tank connection with flanged ends, requires field welding by installing contractor.

Note

- Concrete fill of 6.9 yd^3/unit is required to be placed in the bottom of filter section for support of MULTIBLOCK laterals. Concrete fill and grout *not* by WesTech.
- Underdrain plenums, tank stiffeners and air tank connections require field welding by installing contractor.
- All required hardware is supplied by WesTech for assembly of the tank internals at the jobsite by the contractor.
- Components unless otherwise noted are shipped loose for installation by others.

Filter Media Scope of Supply

Type	Quantity	Depth	Effective Size	U.C.	Packaging
Anthracite	468 ft^3	18 in	1.0-1.1 mm	$\leq$1.7	Bagged and palletized
Silica Sand	244 ft^3	9 in	0.35-0.45 mm	$\leq$1.4	Bagged and palletized
Garnet	82 ft^3	3 in	0.2-0.32 mm	$\leq$1.7	Bagged and palletized

Note

- Media quantities shown above is the total quantity needed for installation in both units and includes sufficient volume for skimming.
- Media is shipped loose for installation by others.

Trident Control Panel Components Scope of Supply

Feature	Description	Notes
Control Panel Door	NEMA 12	Coated Steel
Sub-Panel	NEMA 12	Coated Steel
PLC	Allen Bradley CompactLogix	Included
RTB	Allen Bradley	1756 model
I/O Cards	Allen Bradley – Analog and Discrete	1756 model input and output cards
I/O Rack	Allen Bradley	1756 model
Communication Module	Allen Bradley	Communication protocol via Ethernet/IP
Memory Card	Allen Bradley	
Power Supply	Allen Bradley	
Selector Switches		Valves, Blowers, Pumps
Potentiometers & Relays		For modulating valve controls
Air Conditioner		Includers exhaust fan and thermostat
Programming		Programming modifications

Note

- Filter control panel components are shipped loose for field installation by others.
- 120 V AC power to the control panel is to be provided by others.
- Field terminations within the Trident control panel are to be performed by others.

Valves Scope of Supply

Item	Quantity	Size	Type	Operator Type
Effluent	2	8 in	Butterfly	Electro-pneumatic – Modulating
Filter to Waste	2	8 in	Butterfly	Electro-pneumatic – Modulating
AC Air Scour	2	4 in	Butterfly	Pneumatic – Open/Close
Filter Air Scour	2	6 in	Butterfly	Pneumatic – Open/Close
Backwash Inlet	2	12 in	Butterfly	Pneumatic – Open/Close
Backwash High Rate	1	12 in	Butterfly	Pneumatic – Open/Close
Backwash Low-Rate Set	1	4 in	Butterfly	Manual – Handwheel
Backwash High-Rate Set	1	12 in	Butterfly	Manual – Handwheel
AC Air Check	2	4 in	Check	None
Filter Air Check	2	6 in	Check	None

Note

- All butterfly valves are Bray wafer style with cast iron body, nylon coated disc, EPDM seat and shaft seal.
- Automatic butterfly valves have Bray pneumatic cylinder actuators with solenoids locally mounted.
- Valves are shipped loose for installation by others.

Instrumentation Scope of Supply

Description	Quantity	Type	Signal	Notes
Treated Water Meter (FE/FIT-602)	1	Magnetic Flow	4–20 mA	Endress+Hauser
Backwash Supply Meter (FE/FIT-402)	1	Magnetic Flow	4–20 mA	Endress+Hauser
Treated Water Meter (FE/FIT-603)	1	Propeller Meter	4–20 mA	McCrometer
Backwash Control Level Switches	4	Float	On/Off	One low and one high
Clarifier Pressure Switch Assembly	2	2 ½ in, 0–5 psi with two pressure switches per assembly	Discrete	Ashcroft
Air Scour Blower Pressure Switch	1	4 ½ in, 0–10 psi	Discrete	Ashcroft

Note

- Components are shipped loose for installation by others.
- Electrical wiring, conduit, and connection of electrical wiring to terminals within the Trident control panel is not provided by WesTech and is to be furnished and installed by others.

Air Scour Blower Scope of Supply

Quantity	Volume	Pressure	Type	Motor
2	350 scfm (each)	4.1 psi	Regenerative	15 hp, 230/460 V, 60 Hz, 3 ph, TEFC
Features				
Air intake filter with dirty filter indicator				
Spring loaded pressure safety relief valve				
Check valve				
Pressure indicator				
Aluminum housing with common steel baseplate				

Note

- Blower manufactured by FPZ.
- Pressure gauge and switch to be placed in main air supply line for installation by others.
- Components are shipped loose for installation by others.
- Motor starters (if required), electrical wiring, conduit, and connection of electrical wiring to terminals within the Trident control panel is not provided by WesTech and is to be furnished and installed by others.

WesTech Trips to the Site

Trips	Days	Includes
8	24	Installation inspection of major Trident components, observation of filter media installation, startup, and instruction of plant personnel

Note: Any Item Not Listed Above to Be Furnished by Others.

Clarifications and Exceptions

General Clarifications

Terms & Conditions: This proposal, including all terms and conditions contained herein, shall become part of any resulting contract or purchase order. Changes to any terms and conditions, including but not limited to submittal and shipment days, payment terms, and escalation clause shall be negotiated at order placement, otherwise the proposal terms and conditions contained herein shall apply.

Paint: If your equipment has paint included in the price, please take note to the following. Primer paints are designed to provide only a minimal protection from the time of application (usually for a period not to exceed 30 days). Therefore, it is imperative that the finish coat be applied within 30 days of shipment on all shop primed surfaces. Without the protection of the final coatings, primer degradation may occur after this period, which in turn may require renewed surface preparation and coating. If it is impractical or impossible to coat primed surfaces within the suggested time frame, WesTech strongly recommends the supply of bare metal, with surface preparation and coating performed in the field. All field surface preparation, field paint, touch-up, and repair to shop painted surfaces are not by WesTech.

Escalation: If between the proposal date and actual procurement and through no fault of the Seller, the relevant cost of labor, material, freight, tariffs, and other Seller costs combined relating to the contract, increase by greater than 2.5% of the overall contract price, then the contract price shall be subject to escalation and increased. Such increase shall be verified by documentation and the amount of contract price escalation shall be calculated as either the actual increased cost to the Seller or, if agreed by the Parties, the equivalent increase of a relevant industry recognized third-party index, and in both cases without any additional profit or margin being added.

USA Tariffs and Current Trade Laws: All prices are based on current USA and North America tariffs and trade laws/agreements at time of bid. Any changes in costs due to USA Tariffs and trade laws/ agreements will be passed through to the purchaser at cost.

The Infrastructure Investment and Jobs Act of 2021 (IIJA) includes potentially significant changes to historical "Buy American" or "American Iron and Steel" (AIS) requirements for federally funded projects, including water-related infrastructure projects as administered by the Environmental Protection Agency (EPA). The IIJA was signed into law on Nov 15, 2021. However the EPA has yet to issue additional information and guidance clarifying the application and interpretation of these changes. Although WesTech makes every effort to source the steel for our equipment and products domestically, not everything is reasonably or commercially available to meet all project specific constraints. Consequently, any proposal or offer for sale by WesTech, including any resulting equipment order, does not guarantee compliance with the Buy American provisions of the Infrastructure Investment and Jobs Act of 2021 at this time.

Trident Clarifications

- The proposed components are for installation into two existing Trident TR-420 "S" units.
- All tank modifications, including sandblasting and painting, required to perform the proposed work on the Trident units is not by WesTech and to be completed by the installing contractor.
- The proposed field service supervision by WesTech is based on one Trident unit being rehabilitated at a time.

- The proposed Adsorption Clarifier air distribution assembly will require a new tank connection for the air supply be installed into the tank wall. This may require the removal of the existing external plenum box.
- The proposed Mixed Media Adsorption Clarifier (MMAC) configuration requires a higher air rate for the AC flush process. Therefore, new blowers are being proposed to provide the required air flow.
- The MULTIBLOCK underdrain allows for air scour as part of the filter backwash process. Therefore, the existing surface wash assemblies are not required and should be removed.
- For the control panel components, the existing control panel enclosure will be reused. The internal components will be upgraded, and a new door installed to incorporate the manual control switches. The existing OIT/HMI will be reused and installed into the new door.
- This scope of work has been reviewed by HDR, any item not called out or included within this proposal is to be provided by others.
- The influent pumping system should provide a range of 20–30 feet head at tank inlet connection. The high-rate water only backwash of the filter shall be 15–18 gpm/ft^2 with an available head of 13 feet at the tank connection.
- A 50 percent duty cycle is recommended for the compressed air system.
- Availability of equipment components specified may dictate substitutions of equal quality at the discretion of WesTech.
- All hardware is crated and shipped to the jobsite for assembly by the contractor.

Items Not Furnished by WesTech

- Unloading of equipment from delivering carrier, protected storage of equipment, installation, supervision of installation
- All underground and interconnecting piping, filter face piping and fittings, pipe supports, wall inserts or sleeves, Dresser or flexible couplings, hangers, valves (not specifically listed), pneumatic tubing from air compressor to filter batteries, air release piping and valves, sampling lines and sinks, small pressure water supply piping, field work of piping (i.e., drilling and tapping for instrumentation) and flow meters (not specifically listed)
- Interconnection wiring and conduit
- Walkways, handrails, stairways and ladders
- Finish paint and intermediate field coats, cathodic protection systems
- All chemical feeders (not specifically listed), feed lines, chemicals, tanks (not specifically listed), labor and procedures for the disinfection of equipment, laboratory test equipment.
- Structural design, supply and installation of concrete pads, foundations, rebar, anchors, concrete, grout, sealant, sumps and concrete fill for filter underdrains
- Motor control center, motor starters, disconnects, electrical wiring and conduit, connection of electrical wiring to terminals within WesTech's control panels, telemetering equipment, turbidity monitoring equipment (not specifically listed), supports for controls.
- SCADA System
- All pumps (not specifically listed), air compressors, dryers, operating and start-up lubricants.
- Any equipment or service not listed in this proposal.

Exceptions

Not applicable

Commercial Proposal

Proposal Name: Fort Bragg
Proposal Number: 1630021
Thursday, July 06, 2023

1. Bidder's Contact Information

Company Name	WesTech Engineering, LLC
Primary Contact Name	Matt Swaney
Phone	(801) 265-1000
Email	mswaney@westech-inc.com
Address: Number/Street	3665 S West Temple
Address: City, State, Zip	Salt Lake City, UT 84115

2. Firm Pricing

Currency: USD

Scope of Supply

A	Two (2) Lots of Rehab/Upgrade Components for Existing Trident Units	$731,449.00
	Taxes (sales, use, VAT, IVA, IGV, duties, import fees, etc.)	Not Included

Prices are valid for a period not to exceed 30 days from date of proposal.

Additional Field Service

Daily Rate (Applicable Only to Field Service Not Included in Scope)	$1,200

Pricing does not include field service unless noted in scope of supply, but is available at the daily rate plus expenses. The greater of a two week notice or visa procurement time is required prior to departure date. Our field service policy can be provided upon request for more details.

3. Payment Terms

Purchase Order Acceptance and Contract Execution	10%
Submittals Provided by WesTech	15%
Release for Fabrication	35%
Notification of Ready to Ship	40%

All payments are net 30 days. Partial shipments are allowed. An approved Letter of Credit is required if Incoterms CIF, CFR, DAP, CIP, or CPT are applicable. Payment is required in full for all other Incoterms prior to international shipment. Other terms per WesTech proforma invoice. Please note that the advising bank must be named as: Wells Fargo Bank, International Department, 9000 Flair Drive, 3rd Floor, El Monte, California 91731, USA.

4. Schedule

Submittals, after Purchase Order Acceptance and Contract Execution	10 to 12 weeks
Ready to Ship, after Receipt of Final Submittal Approval	22 to 24 weeks
Estimated Weeks to Ready to Ship	**32 to 36 weeks***

*Customer submittal approval is typically required to proceed with equipment fabrication and is not accounted for in the schedule above. Project schedule will be extended to account for time associated with receipt of customer submittal approval.

5. Freight

Domestic	FOB Shipping Point - Full Freight Allowed to Jobsite (FSP-FFA)	
From	**Final Destination**	**Number of Trucks or Containers**
WesTech Shops	Fort Bragg, CA	TBD

One-Year Warranty

WesTech is meeting a global need for clean water through technology treatment solutions. We are proud that the equipment and systems we design, build, maintain, and operate are making the world a better place and creating a more sustainable environment for future generations.

Equipment manufactured or sold by WesTech Engineering, LLC, once paid for in full, is backed by the following warranty:

Subject to the terms below, WesTech warrants all new equipment manufactured or sold by WesTech Engineering, LLC to be unencumbered and free from defects in material and workmanship, and WesTech will replace or repair, F.O.B. its factories or other location it chooses, any part or parts returned to WesTech which WesTech's examination and analysis determine have failed within the warranty period because of defects in material and workmanship. The warranty period is either, one calendar year immediately following start-up, or eighteen (18) months from when WesTech sent its ready-to-ship notification to the purchaser, whichever expires sooner. All repair or replacement parts qualifying under this warranty shall be free of charge. Purchaser will provide timely written notice to WesTech of any defects it believes should be repaired or replaced under this warranty. WesTech will reject as untimely any warranty defect claim that purchaser submits more than thirty (30) days after the possible warranty defect first occurred. Unless specifically stated otherwise, this warranty does not cover normal wear or consumables. This warranty is not transferable.

This warranty shall be void and shall not apply where the equipment or any part thereof

a) has been dismantled, modified, repaired or connected to other equipment, outside of a WesTech factory, or without WesTech's written approval, or
b) has not been installed in complete adherence to all WesTech's or parts manufacturer's requirements, recommendations, and procedures, or
c) has been subject to misuse, abuse, neglect, or accident, or has not at all times been operated and maintained in strict compliance with all of WesTech's requirements and recommendations therefor, including, but not limited to, the relevant WesTech Operations & Maintenance Manual and any other of WesTech's specified guidelines & procedures, or
d) has been subject to force majeure events; use of chemicals not approved in writing by WesTech; electrical surges; overloading; significant power, water or feed supply fluctuations; or non-compliance with agreed feedwater or chemical volumes, specifications or procedures.

In any case where a part or component of equipment under this warranty is or may be faulty and the component or part is also covered under the warranty of a third party then the purchaser shall provide reasonable assistance to first pursue a claim under the third party warranty before making a claim under this warranty from WesTech. WesTech Engineering, LLC gives no warranty with respect to parts, accessories, or components purchased other than through WesTech. The warranties which apply to such items are those offered by the respective manufacturers.

This warranty is expressly given by WesTech and accepted by purchaser in lieu of all other warranties whether written, oral, express, implied, statutory or otherwise, including without limitation, warranties of merchantability and fitness for particular purpose. WesTech neither accepts nor authorizes any other person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever. The purchaser's exclusive and only remedy for breach of this warranty shall be the repair and or replacement of the defective part or parts within a reasonable time of WesTech's accepting the validity of a warranty claim made by the purchaser.

Terms & Conditions

Terms and Conditions appearing in any order based on this proposal which are inconsistent herewith shall not be binding on WesTech Engineering, LLC The sale and purchase of equipment described herein shall be governed exclusively by the foregoing proposal and the following provisions:

1. SPECIFICATIONS: WesTech Engineering, LLC is furnishing its standard equipment as outlined in the proposal and as will be covered by final approved drawings. The equipment may not be in strict compliance with the Engineer's/Owner's plans, specifications, or addenda as there may be deviations. The equipment will, however, meet the general intention of the mechanical specifications of these documents.

2. ITEMS INCLUDED: This proposal includes only the equipment specified herein and does not include erection, installation, accessories, nor associated materials such as controls, piping, etc., unless specifically listed.

3. PARTIES TO CONTRACT: WesTech Engineering, LLC is not a party to or bound by the terms of any contract between WesTech Engineering, LLC's customer and any other party. WesTech Engineering, LLC's undertakings are limited to those defined in the contract between WesTech Engineering, LLC and its direct customers.

4. PRICE AND DELIVERY: All selling prices quoted are subject to change without notice after 30 days from the date of this proposal unless specified otherwise. Unless otherwise stated, all prices are F.O.B. WesTech Engineering, LLC or its supplier's shipping points. All claims for damage, delay or shortage arising from such equipment shall be made by Purchaser directly against the carrier. When shipments are quoted F.O.B. job site or other designation, Purchaser shall inspect the equipment shipped, notifying WesTech Engineering, LLC of any damage or shortage within forty-eight hours of receipt, and failure to so notify WesTech Engineering, LLC shall constitute acceptance by Purchaser, relieving WesTech Engineering, LLC of any liability for shipping damages or shortages.

5. PAYMENTS: All invoices are net 30 days. Delinquencies are subject to a 1.5 percent service charge per month or the maximum permitted by law, whichever is less on all past due accounts. Pro rata payments are due as shipments are made. If shipments are delayed by the Purchaser, invoices shall be sent on the date when WesTech Engineering, LLC is prepared to make shipment and payment shall become due under standard invoicing terms. If the work to be performed hereunder is delayed by the Purchaser, payments shall be based on the purchase price and percentage of completion. Products held for the Purchaser shall be at the risk and expense of the Purchaser. Unless specifically stated otherwise, prices quoted are for equipment only. These terms are independent of and not contingent upon the time and manner in which the Purchaser receives payment from the owner.

6. PAYMENT TERMS: Credit is subject to acceptance by WesTech Engineering, LLC's Credit Department. If the financial condition of the Purchaser at any time is such as to give WesTech Engineering, LLC, in its judgment, doubt concerning the Purchaser's ability to pay, WesTech Engineering, LLC may require full or partial payment in advance or may suspend any further deliveries or continuance of the work to be performed by the WesTech Engineering, LLC until such payment has been received.

7. ESCALATION: If between the proposal date and actual procurement and through no fault of the Seller, the relevant cost of labor, material, freight, tariffs, and other Seller costs combined relating to the contract, increase by greater than 2.5% of the overall contract price, then the contract price shall be subject to escalation and increased. Such increase shall be verified by documentation and the amount of contract price escalation shall be calculated as either the actual increased cost to the Seller or, if agreed by the Parties, the equivalent increase of a relevant industry recognized third-party index, and in both cases without any additional profit or margin being added.

8. APPROVAL: If approval of equipment submittals by Purchaser or others is required, a condition precedent to WesTech Engineering, LLC supplying any equipment shall be such complete approval.

9. INSTALLATION SUPERVISION: Prices quoted for equipment do not include installation supervision. WesTech Engineering, LLC recommends and will, upon request, make available, at WesTech Engineering, LLC's then current rate, an experienced installation supervisor to act as the Purchaser's employee and agent to supervise installation of the equipment. Purchaser shall at its sole expense furnish all necessary labor equipment, and materials needed for installation.

Responsibility for proper operation of equipment, if not installed by WesTech Engineering, LLC or installed in accordance with WesTech Engineering, LLC's instructions, and inspected and accepted in writing by WesTech Engineering, LLC, rests entirely with Purchaser; and any work performed by WesTech Engineering, LLC personnel in making adjustment or changes must be paid for at WesTech Engineering, LLC's then current per diem rates plus living and traveling expenses.

WesTech Engineering, LLC will supply the safety devices described in this proposal or shown in WesTech Engineering, LLC's drawings furnished as part of this order but excepting these, WesTech Engineering, LLC shall not be required to supply or install any safety devices whether required by law or otherwise. The Purchaser hereby agrees to indemnify and hold harmless WesTech Engineering, LLC from any claims or losses arising due to alleged or actual insufficiency or inadequacy of the safety devices offered or supplied hereunder, whether specified by WesTech Engineering, LLC or Purchaser, and from any damage resulting from the use of the equipment supplied hereunder.

10. ACCEPTANCE OF PRODUCTS: Products will be deemed accepted without any claim by Purchaser unless written notice of non-acceptance is received by WesTech Engineering, LLC within 30 days of delivery if shipped F.O.B. point of shipment, or 48 hours of delivery if shipped F.O.B. point of destination. Such written notice shall not be considered received by WesTech Engineering, LLC unless it is accompanied by all freight bills for said shipment, with Purchaser's notations as to damages, shortages and conditions of equipment, containers, and seals. Non-accepted products are subject to the return policy stated below.

11. TAXES: Any federal, state, or local sales, use or other taxes applicable to this transaction, unless specifically included in the price, shall be for Purchaser's account.

12. TITLE: The equipment specified herein, and any replacements or substitutes therefore shall, regardless of the manner in which affixed to or used in connection with realty, remain the sole and personal property of WesTech Engineering, LLC until the full purchase price has been paid. Purchaser agrees to do all things necessary to protect and maintain WesTech Engineering, LLC's title and interest in and to such equipment; and upon Purchaser's default, WesTech Engineering, LLC may retain as liquidated damages any and all partial payments made and shall be free to enter the premises where such equipment is located and remove the same as its property without prejudice to any further claims on account of damages or loss which WesTech Engineering, LLC may suffer from any cause.

13. INSURANCE: From date of shipment until the invoice is paid in full, Purchaser agrees to provide and maintain at its expense, but for WesTech Engineering, LLC's benefit, adequate insurance including, but not limited

to, builders risk insurance on the equipment against any loss of any nature whatsoever.

14. SHIPMENTS: Any shipment of delivery dates recited represent WesTech Engineering, LLC's best estimate but no liability, direct or indirect, is assumed by WesTech Engineering, LLC for failure to ship or deliver on such dates.

WesTech Engineering, LLC shall have the right to make partial shipments; and invoices covering the same shall be due and payable by Purchaser in accordance with the payment terms thereof. If Purchaser defaults in any payment when due hereunder, WesTech Engineering, LLC may, without incurring any liability therefore to Purchaser or Purchaser's customers, declare all payments immediately due and payable with maximum legal interest thereon from due date of said payment, and at its option, stop all further work and shipments until all past due payments have been made, and/or require that any further deliveries be paid for prior to shipment.

If Purchaser requests postponements of shipments, the purchase price shall be due and payable upon notice from WesTech Engineering, LLC that the equipment is ready for shipment; and thereafter any storage or other charge WesTech Engineering, LLC incurs on account of the equipment shall be for the Purchaser's account.

If delivery is specified at a point other than WesTech Engineering, LLC or its supplier's shipping points, and delivery is postponed or prevented by strike, accident, embargo, or other cause beyond WesTech Engineering, LLC's reasonable control and occurring at a location other than WesTech Engineering, LLC or its supplier's shipping points, WesTech Engineering, LLC assumes no liability in delivery delay. If Purchaser refuses such delivery, WesTech Engineering, LLC may store the equipment at Purchaser's expense. For all purposes of this agreement such tender of delivery or storage shall constitute delivery.

15. WARRANTY: WesTech Engineering LLC warrants equipment it supplies only in accordance with the attached WesTech Warranty. This warranty is expressly given by WesTech and accepted by purchaser in lieu of all other warranties whether written, oral, express, implied, statutory or otherwise, including without limitation, warranties of merchantability and fitness for particular purpose. WesTech neither accepts nor authorizes any other person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever. The purchaser's exclusive and only remedy for breach of this warranty shall be the repair and or replacement of the defective part or parts within a reasonable time of WesTech's accepting the validity of a warranty claim made by the purchaser.

16. PATENTS: WesTech Engineering, LLC agrees that it will, at its own expense, defend all suits or proceedings instituted against Purchaser and pay any award of damages assessed against it in such suits or proceedings, so far as the same are based on any claim that the said equipment or any part thereof constitutes an infringement of any apparatus patent of the United States issued at the date of this Agreement, provided WesTech Engineering, LLC is given prompt notice in writing of the institution or threatened institution of any suit or proceeding and is given full control of the defense, settlement, or compromise of any such action; and Purchaser agrees to give WesTech Engineering, LLC needed information, assistance, and authority to enable WesTech Engineering, LLC so to do. In the event said equipment is held or conceded to infringe such a patent, WesTech Engineering, LLC shall have the right at its sole option and expense to a) modify the equipment to be non-infringing, b) obtain for Purchaser the license to continue using said equipment, or c) accept return of the equipment and refund to the Purchaser the purchase price thereof less a reasonable charge for the use thereof. WesTech Engineering, LLC will reimburse Purchaser for actual out-of-pocket expenses, exclusive of legal fees, incurred in preparing such information and rendering such assistance at WesTech Engineering, LLC's request. The foregoing states the entire liability of WesTech Engineering, LLC, with respect to patent infringement; and except as otherwise agreed to in writing, WesTech Engineering, LLC assumes no responsibility for process patent infringement.

17. SURFACE PREPARATION AND PAINTING: If furnished, shop primer paint is intended to serve only as minimal protective finish. WesTech Engineering, LLC will not be responsible for the condition of primed or finish painted surfaces after equipment leaves its shops. Purchasers are invited to inspect paint in shops for proper preparation and application prior to shipment. WesTech Engineering, LLC assumes no responsibility for field surface preparation or touch-up of shipping damage to paint. Painting of fasteners and other touch-up to painted surfaces will be by Purchaser's painting contractor after mechanism installation.

Motors, gear motors, and other components not manufactured by WesTech Engineering, LLC will be painted with that manufacturer's standard paint system. It is WesTech Engineering, LLC's intention to ship major steel components as soon as fabricated, often before drive, motors, and other manufactured components. Unless Purchaser can ensure that shop primed steel shall be field painted within thirty (30) days after arrival at the job site, WesTech Engineering, LLC encourages the Purchaser to order these components without primer.

WesTech Engineering, LLC's prices are based on paints and surface preparations as outlined in the main body of this proposal. In the event that an alternate paint system is selected, WesTech Engineering, LLC requests that Purchaser's order advise of the paint selection. WesTech Engineering, LLC will then either adjust the price as may be necessary to comply or ship the material unpainted if compliance is not possible due to application problems or environmental controls.

18. CANCELLATION, SUSPENSION, OR DELAY: After acceptance by WesTech Engineering, LLC, this proposal, or Purchaser's order based on this proposal, shall be a firm agreement and is not subject to cancellation, suspension, or delay except upon payment by Purchaser of appropriate charges which shall include all costs incurred by WesTech Engineering, LLC to date of cancellation, suspension, or delay plus a reasonable profit. Additionally, all charges related to storage and/or resumption of work, at WesTech Engineering, LLC's plant or elsewhere, shall be for Purchaser's sole account; and all risks incidental to storage shall be assumed by Purchaser.

19. FORCE MAJEURE: Neither party hereto shall be liable to the other for default or delay in delivery caused by extreme weather or other act of God, strike or other labor shortage or disturbance, fire, accident, war or civil disturbance, act of government, pandemic, delay of carriers, failure of normal sources of supply, complete or partial shutdown of plant by reason of inability to attain sufficient raw materials or power, and/or other similar contingency beyond the reasonable control of the respective parties. The time for delivery specified herein shall be extended during the continuance of such conditions, or any other cause beyond such party's reasonable control. Escalation resulting from a Force Majeure event shall be equitably adjusted per the escalation policy stated above.

20. RETURN OF PRODUCTS: No products may be returned to WesTech Engineering, LLC without WesTech Engineering, LLC's prior written permission. Said permission may be withheld by WesTech Engineering, LLC at its sole discretion.

21. BACKCHARGES: WesTech Engineering LLC will not approve or accept backcharges for labor, materials, or other costs incurred by Purchaser or others in modification, adjustment, service, or repair of WesTech Engineering LLC furnished materials unless such back charge has been authorized in advance in writing by a WesTech Engineering LLC purchase order, or work requisition signed by WesTech Engineering LLC.

22. INDEMNIFICATION: Purchaser agrees to indemnify WesTech Engineering, LLC from all costs incurred, including but not limited to court costs and reasonable attorney fees, from enforcing any provisions of this contract, including but not limited to breach of contract or costs incurred in collecting monies owed on this contract.

23. ENTIRE AGREEMENT: This proposal expresses the entire agreement between the parties hereto superseding any prior understandings and is not subject to modification except by a writing signed by an authorized officer of each party.

24. MOTORS AND MOTOR DRIVES: In order to avoid shipment delays of WesTech Engineering, LLC equipment, the motor drives may be sent directly to the job site for installation by the equipment installer. Minor fit-up may be required.

25. EXTENDED STORAGE: Extended storage instructions will be part of information provided to shipment. If equipment installation and start-up is delayed more than 30 days, the provisions of the storage instructions must be followed to keep WARRANTY in force.

26. LIABILITY: Professional liability insurance, including but not limited to, errors and omissions insurance, is not included. In any event, liability for errors and omissions shall be limited to the lesser of $100,000 USD or the value of the particular piece of equipment (not the value of the entire order) supplied by WesTech Engineering LLC against which a claim is sought.

27. ARBITRATION NEGOTIATION: Any controversy or claim arising out of or relating to the performance of any contract resulting from this proposal or contract issued, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator(s) may be entered to any court having jurisdiction.

ACCEPTED BY PURCHASER

Customer Name: _____

Customer Address: _____

_____

_____

Contact Name: _____

Contact Phone: _____

Contact Email: _____

Signature: _____

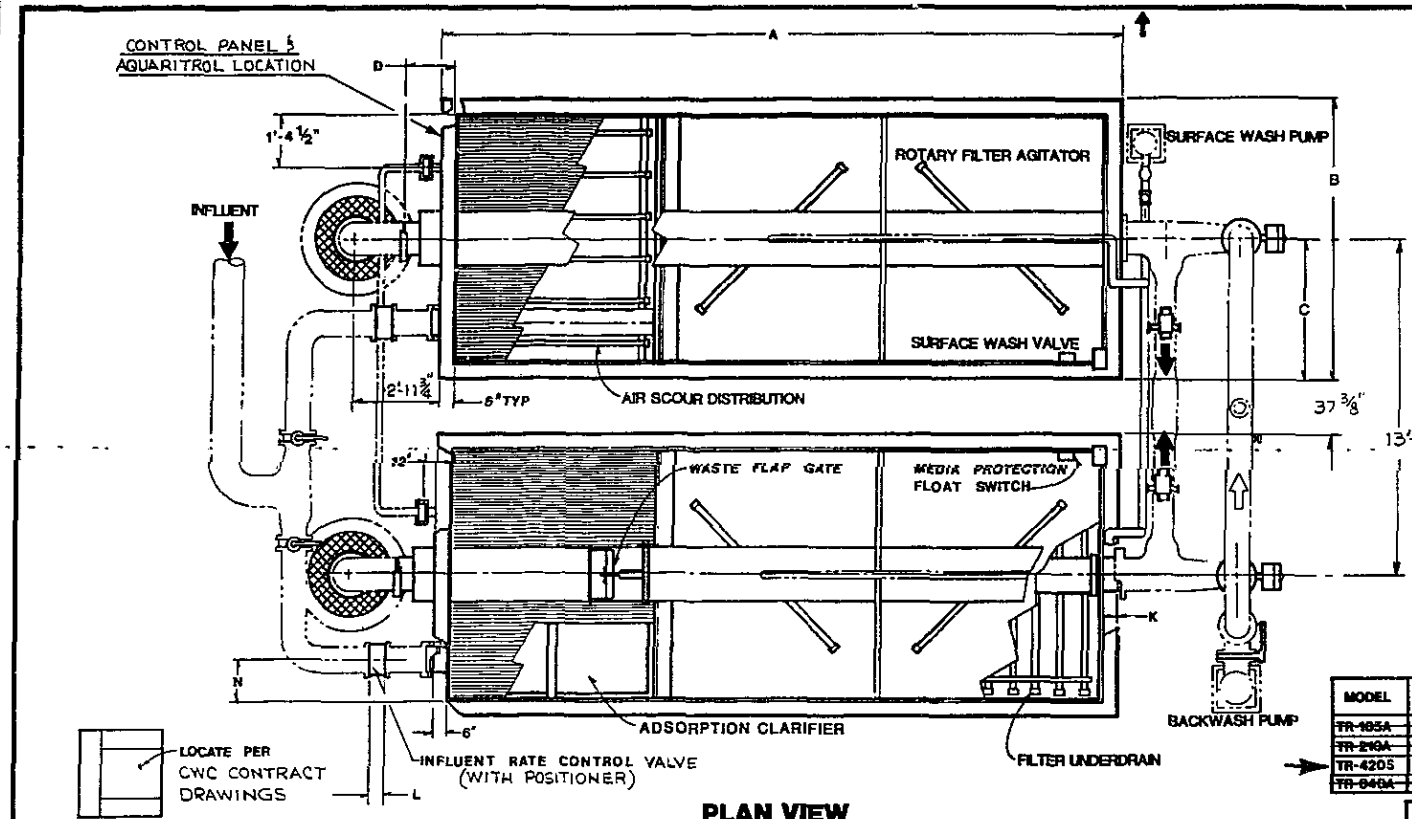
Printed Name: _____

Title: _____

Date: _____

APPENDIX B - RECORD SHOP DRAWINGS OF THE EXISTING FILTER TREATMENT UNITS

No	Zone	Revision	Appd	Date	Ett.
A	—	REVD FOR PG148			
B	—	CORRECTED DIM			



PLAN VIEW

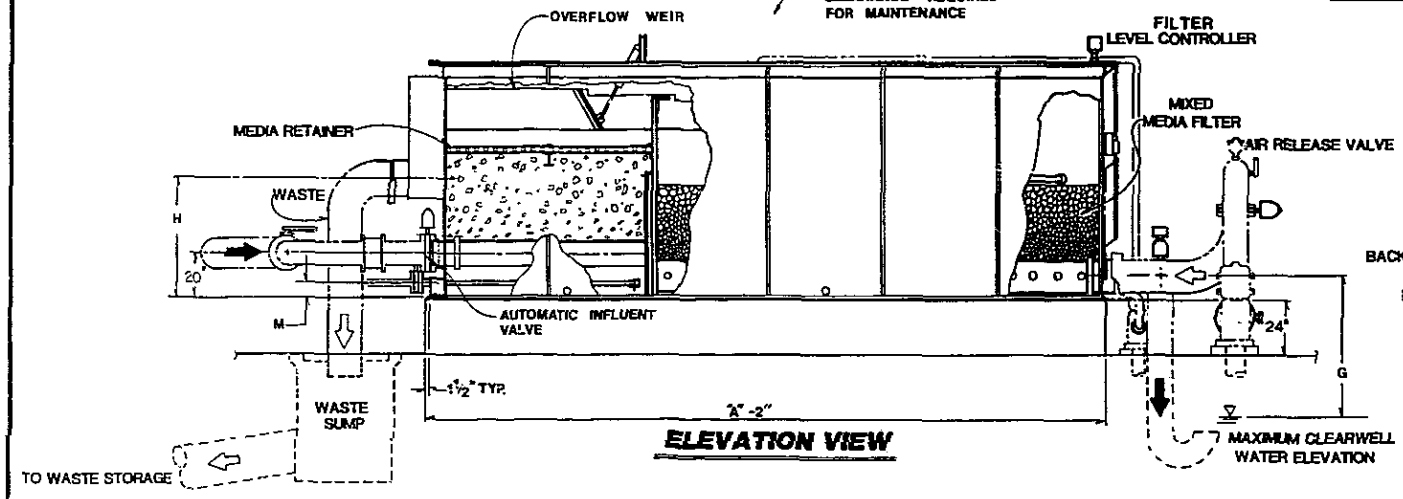
N

NOTES

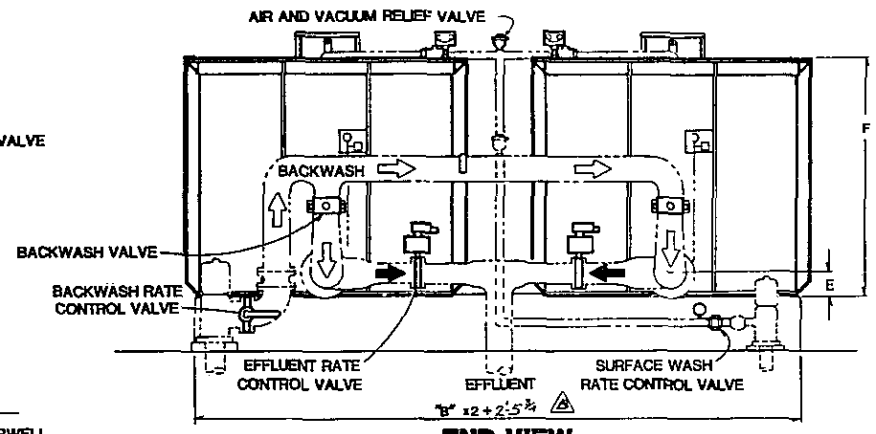
1. Tanks should be level within 1/8 inch at time of installation. Base pad design and installation by others.
2. Tanks are furnished with finish potable water protective coating on interior; universal primer on exterior; and bare bottom for installation on coal tar or asphaltic type base mastic compound.
3. REF CWC CONTRACT DRAWINGS FOR ADDITIONAL DETAILS.
4. ALL PIPING EXTERNAL TO UNITS IS BY OTHERS.

MODEL	DIMENSIONS "A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"K"	"L"	"M"	"N"
TR-105A	10'-1"	8'-10 5/16"	5'-5 5/16"	1'-0"	6½"	8'-5"	1'-0"	4'-0"	6"	7¼"	4"	12"
TR-210A	14'-5½"	8'-10 5/16"	4'-5 5/16"	1'-0"	6½"	4'-5"	1'-0"	4'-0"	6"	7¼"	4"	12"
TR-4205	27'-3"	9'-10 5/16"	4'-11 5/16"	2'-3¾"	8 3/4"	10'-1"	5'-8¾"	4'-0"	6"	2½"	5"	12"
TR-840A	55'-10"	11'-10 5/16"	5'-11 5/16"	2'-10¾"	12"	10'-1"	5'-0"	3'-10"	8"	8"	3½"	1'-5"

MODEL	TANK CONNECTIONS: INFLUENT (VICTAULIC)	EFFLUENT (VICTAULIC)	WASTE (VICTAULIC)	SURFACE WASH (FPT)	CLARIFIER AIR SUPPLY (FLG)
TR-105A	4"	8"	6"	2"	2"
TR-210A	6"	10"	10"	2"	2½"
TR-4205	8"	12"	14"	3" △A	3"
TR-840A	12"	20"	20"	3"	4"



ELEVATION VIEW



END VIEW

PATENT PENDING

SCALE

TOLERANCE

microfloc

DRAWN EG	DATE OCT 84
CHECKED	DATE NOV 86
ENGINEER'S —	DATE
PROJECT ENG.	DATE OCT 86

FORT BRAGG WTP FORT BRAGG, CA.

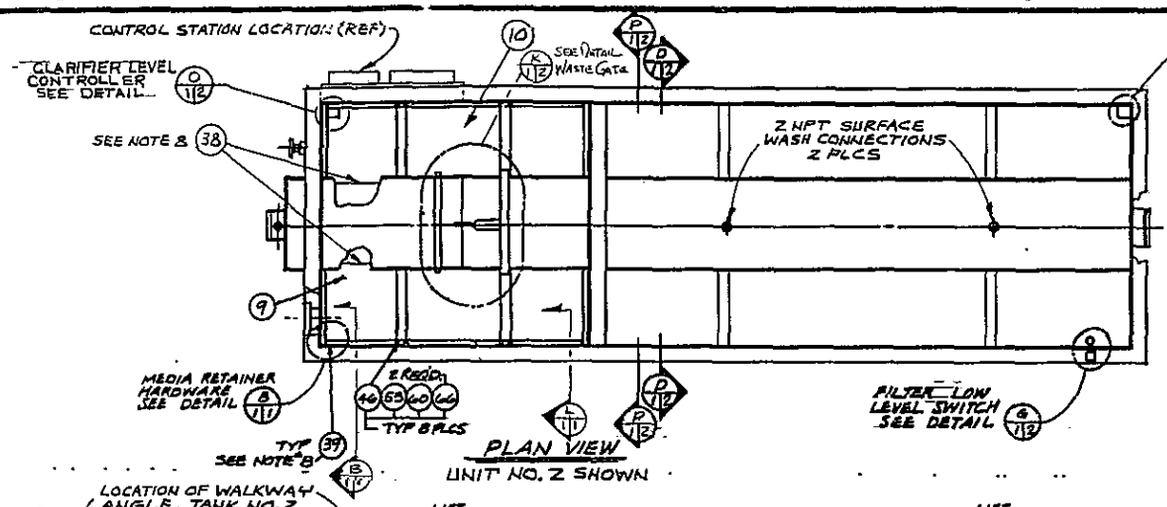
FOUNDATION & LAYOUT DIMENSIONS

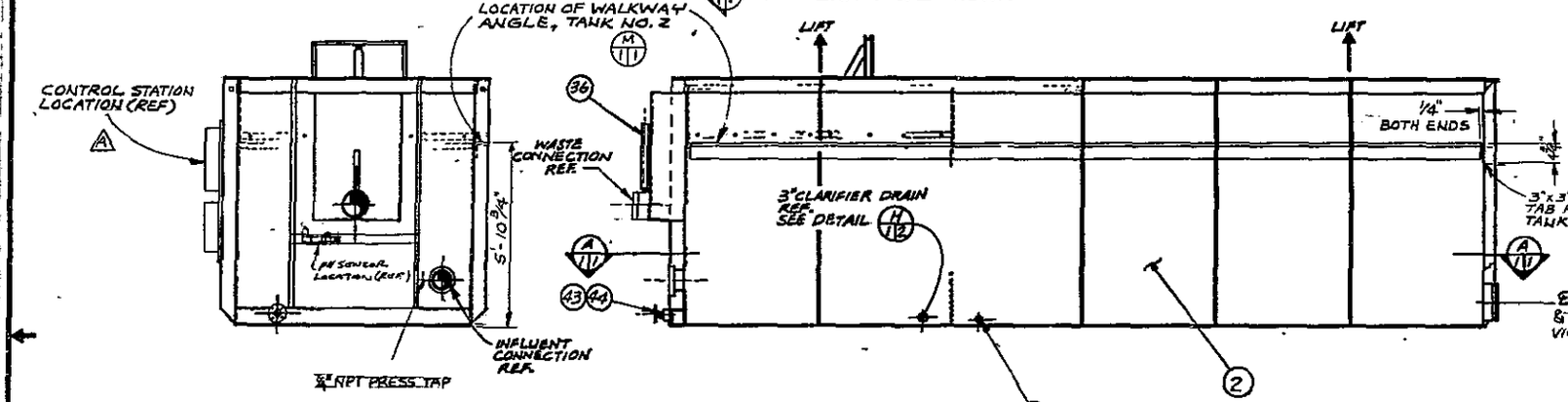
TRIDENT WATER SYSTEMS

DRAWING NO	REV
P6148-1	E
M2184	1

SHEET 1 OF 1

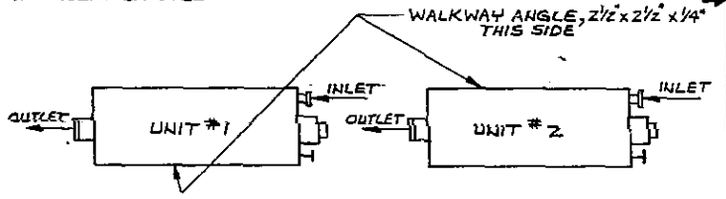
No.	Zone	Revision	Appd	Date	Eff.
A		REV'D TO P6148	[illegible]	NOV 86	
B	—	REV'D TO CURRENT STANDARDS	[illegible]	" 9 "	

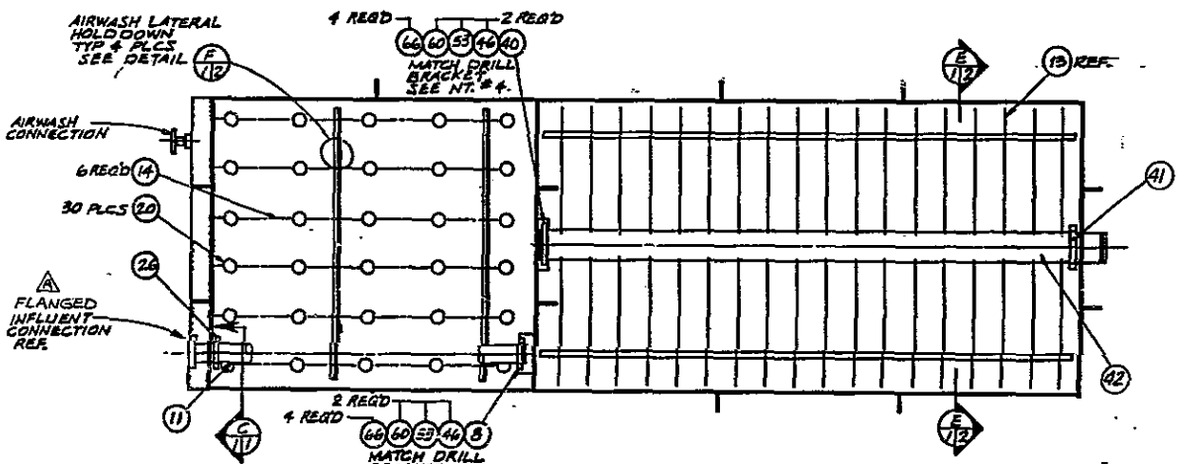




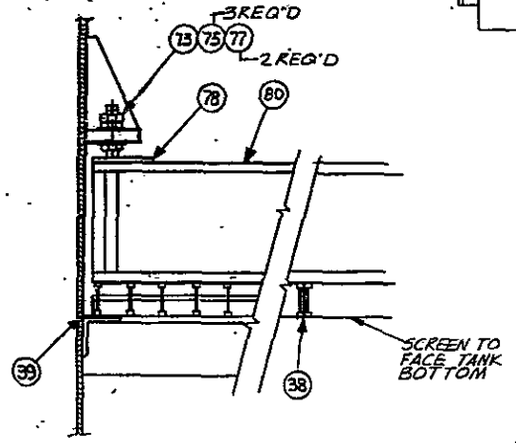
NOTES:

1. ALL BOLTS AND NUTS SHALL BE INSTALLED WITH A FLAT WASHER NEXT TO THE PAINTED SURFACE. ALL FASTENERS SHALL BE INSTALLED AND TIGHTENED IN ACCORDANCE WITH GOOD ASSEMBLY PRACTICES. DO NOT OVER TIGHTEN.
2. ALL EQUIPMENT TO BE ASSEMBLED AT THE JOBSITE BY OTHERS.
3. SEE BILL OF MATERIAL FOR QUANTITIES OF ALL ITEMS.
4. REMOVE ALL FOREIGN MATERIAL (METAL CHIPS, SAND, GRAVEL, ETC.) FROM TANK INTERIOR PRIOR TO MEDIA INSTALLATION.
5. MEDIA SHOULD BE PLACED IN ADSORPTION CLARIFIER AFTER ALL AIR WASH LATERALS AND SUPPORTS HAVE BEEN ASSEMBLED AND PRIOR TO INSTALLATION OF MEDIA RETAINER COVER. THERE IS TO BE NO UNSCREENED OPENINGS IN MEDIA RETAINING COVER. SEE O&M MANUAL FOR MEDIA INSTALLATION PROCEDURES.
6. TANK BOTTOM IS TO BE SET IN COAL TAR OR ASPHALTIC BASE MASTIC COMPOUND FURNISHED AND APPLIED TO BASE PAD BY OTHERS.
7. SEE EQUIPMENT ADJUSTMENT PROCEDURE IN THE OWNERS MANUAL.
8. GASKET MATERIAL (ITEM 38) TO BE INSTALLED BETWEEN MEDIA RETAINER SCREENS. GASKET MATERIAL (ITEMS 39 & 40) TO BE INSTALLED UNDER EDGES OF MEDIA RETAINER SCREENS AND ON BACK SIDE OF WASTE GATE TO SEAL AGAINST LEAKAGE.
9. CARE SHOULD BE TAKEN TO INSURE THAT ALL CAP-PLUGS AND FIBERGLASS TAPE ARE REMOVED FROM AIR WASH AND UNDERDRAIN LATERALS AT TIME OF INSTALLATION.
10. FOR LAYOUT DIMENSIONS, SEE DRAWING P6148-1 REV. C
11. ALL HYDROSPHERES ITEM 20 MUST BE LEVELED TO WITHIN 1/8" OF EACH OTHER.
12. SPRAY 3M ADHESIVE #77, PROVIDED, ONE ONE EDGE OF GRATING PRIOR TO AFFIXING GASKET MATERIAL.

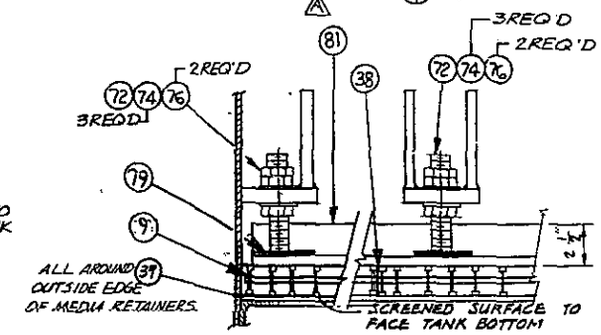




SECTION A



SECTION L/11
6 PLCS
SEE NOTE 8



SECTION B/11
4 PLCS
SEE NOTE 8

SEE SEPARATE BILL OF MATERIALS

SCALE	NONE
NOTE	DO NOT SCALE FROM THIS DRAWING TO OBTAIN DIMENSIONS.
TOLERANCE	
LINEAR	± 1/4"
ANGULAR	± 1/2°

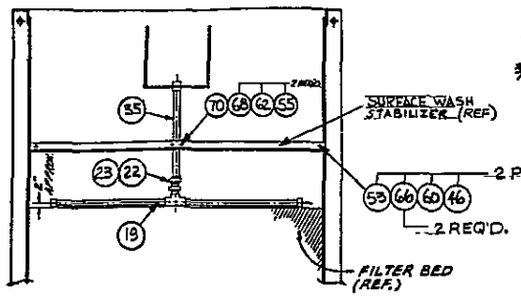
Microfloc

DRAWN: D. Martin	DATE: 6/20/85	FORT BRAGG WTP FORT BRAGG, CA
ENGRD	DATE:	TRIDENT™ WATER SYSTEMS
STANDARDS	DATE:	ASSEMBLY, EQUIPMENT, CLARIFIER & FILTER, 12 TR 420-5"
PROJECT ENG: PFD	DATE: 6/20/85	

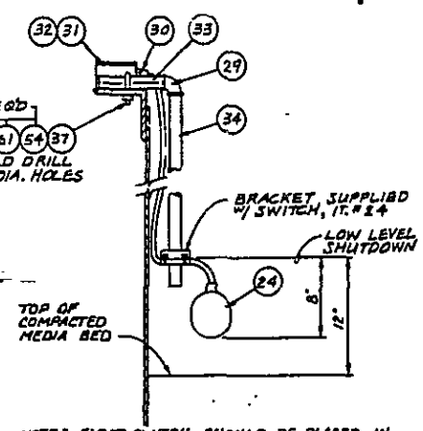
DRAWING NO.	REV.
P6148-4	B
L5A-1	X
SHEET 1 OF 2	

D.C.N. NO.

No	Zone	Revision	Appd.	Date	Eff.
1		SEE SHT NO. 1	—	—	—
8	—	SEE SHEET #1			

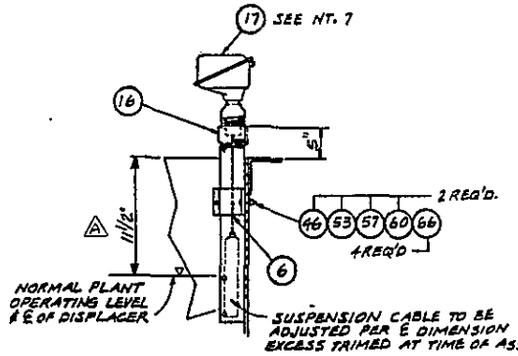


SURFACE WASH AGITATOR INSTALLATION SECTION (B 1/2)
2 PLCS

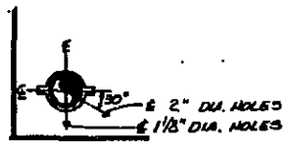


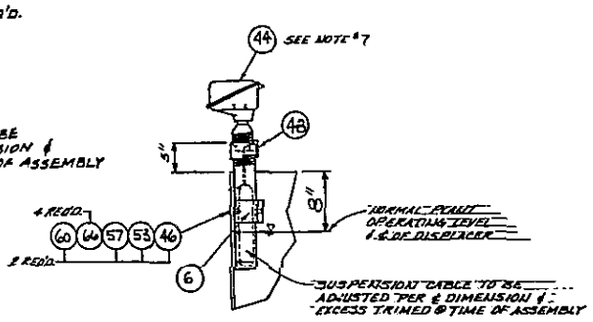
NOTE: FLOAT SWITCH SHOULD BE PLACED IN THE CORNER OF THE FILTER AND ADJUSTED TO INSURE AMPLE CLEARANCE BETWEEN FLOAT SWITCH TRAVEL AND SURFACE WASH ARM.

FILTER LEVEL SWITCH INSTALLATION DETAIL (G 1/2)

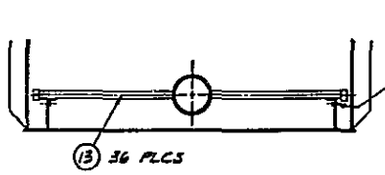


FILTER LEVEL CONTROLLER INSTALLATION DETAIL (J 1/2)

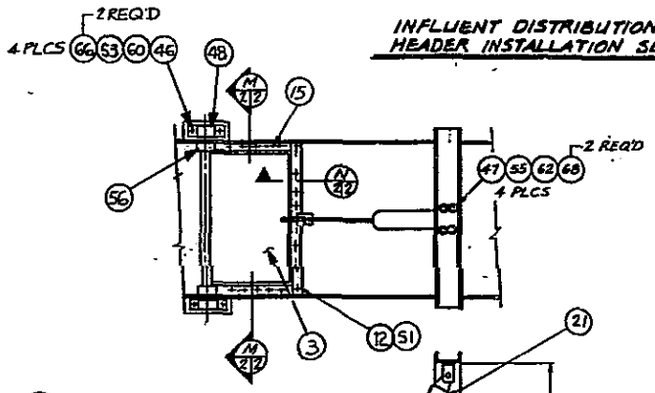




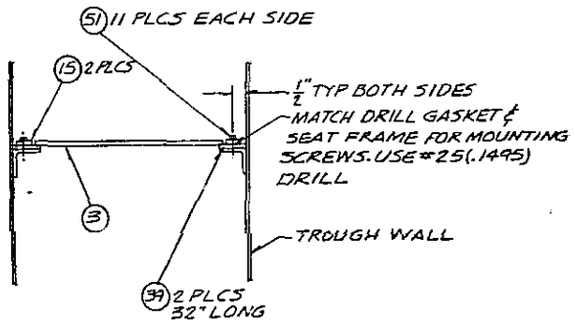
CLARIFIER LEVEL CONTROLLER INSTALLATION DETAIL (O 1/2)



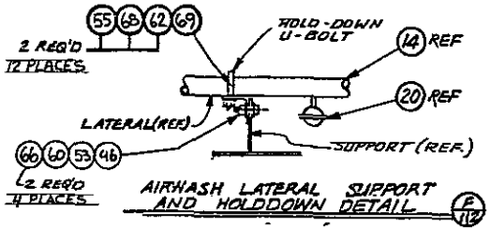
UNDERDRAIN LATERAL INSTALLATION SECTION (E 1/2)



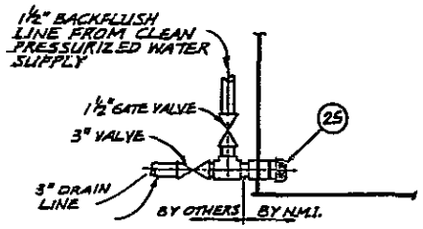
INFLUENT DISTRIBUTION HEADER INSTALLATION SECTION (C 1/2)



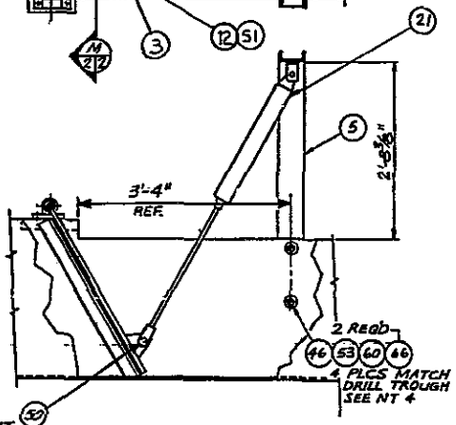
SECTION (M 2/2)



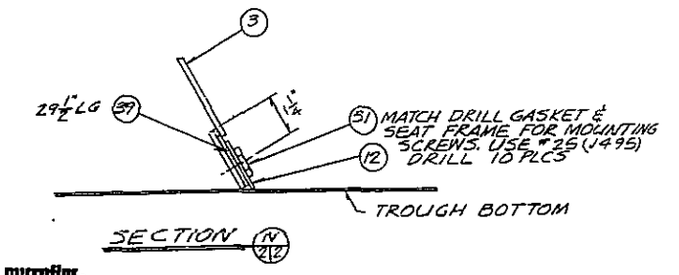
AIRWASH LATERAL SUPPORT AND HOLDDOWN DETAIL (F 1/2)



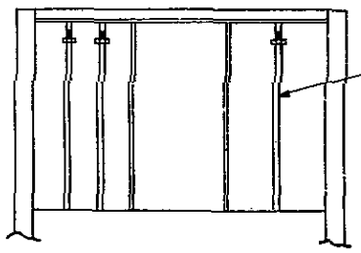
CLARIFIER DRAIN DETAIL (H 1/2)



WASTE GATE INSTALLATION DETAIL (K 1/2)



SECTION (N 2/2)



70 5 PLACES, 3 AS SHOWN & 2 IN CLARIFIER SECTION UNDER CENTER CROSS BEAM. INSTALL WITH CARE. INSTALL IN FILTER SECTION AFTER MEDIA IS PLACED.

MAGNESIUM ANODE INSTALLATION DETAIL (P 1/2)

microflor PRODUCTS
Johnson Division
P.O. Box 64118
St. Paul, MN 55164
(612) 636-3900

NOTE

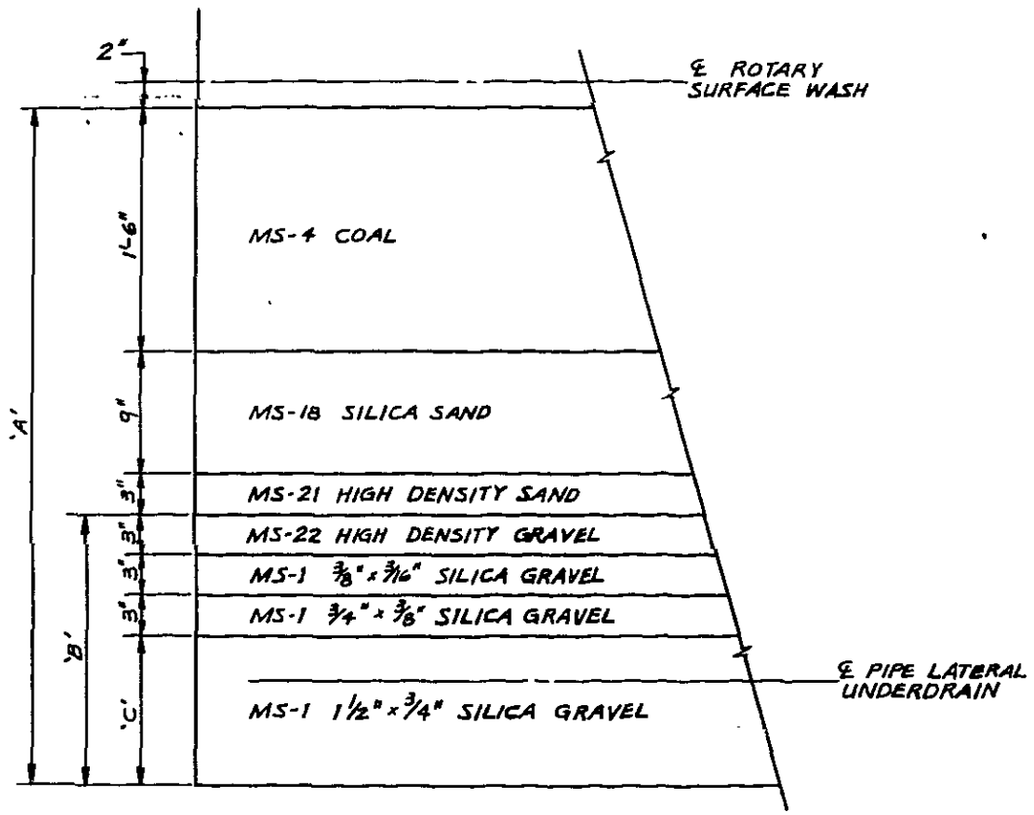
TOLERANCE
.XX
.XXX
ANG. ± 0.5°

/microflor

FORT BRAGG WTP FORT BRAGG, CA	DRAWING NO. P6148-4 REV. B
TRIDENT™ WATER SYSTEMS	LSA 1 1
ASSEMBLY, EQUIPMENT, CLARIFIER & FILTER, ½ TR420S	SHEET 2 OF 2

DCN NO

NO.	ZONE	REVISION	APP'D.	DATE	EFF.
A	—	REV'D PER P6148		NOV 86	



B.O.M. QUANTITIES ARE FOR ONE TANK ONLY

B.O.M. NUMBER	LOC-50A	LOC-50B		
UNIT DESIGNATION	½ TR105A	½ TR210A	½ TR420S	
BED AREA (SQ. FT. EACH FILTER)	35	70	154	
VOLUME OF UNDERDRAIN HEADER WITHIN THE 3/4" x 3/8" MS-1 LAYER (FT^3)	0.5	2.25	4.3	
VOLUME OF UNDERDRAIN WITHIN THE 1½" x 3/4" MS-1 LAYER (FT^3)	2.5	7.5	18.6	
BACKWASH RATE AT 60°F. (SEE NOTE 5)	15 GPM/FT^2			

DIMENSIONAL DATA

DIM	½ TR105A	½ TR210A	½ TR420A	
'A'	41½"	49½"	49"	
'B'	17½"	19½"	19"	
'C'	8½"	10½"	10"	

NOTES;

1A. FILTER MEDIA AND GRAVEL BAGS MUST BE PROTECTED FROM THE WEATHER AND STACKED NOT MORE THAN 5 (FIVE) HIGH TO PRECLUDE BREAKAGE.

1B. WHEN BULK SHIPMENT IS USED, FILTER MEDIA AND GRAVEL MUST BE PROTECTED FROM THE WEATHER AND COVERED TO PREVENT WIND-BLOWN LOSS.

2. DURING MEDIA PLACEMENT, APPROXIMATELY FIVE BACKWASH AND SKIMMING OPERATIONS WILL BE REQUIRED. EACH BACKWASH WILL BE ABOUT 10 MINUTES DURATION.

3. FILTER MEDIA AND GRAVEL PLACEMENT MUST BE DONE UNDER NMI TECHNICAL DIRECTION AFTER ALL ELECTRICAL, HYDRAULIC AND CONTROL SYSTEMS ARE INSTALLED AND/OR REPAIRED AND OPERABLE PRIOR TO ARRIVAL OF TECHNICAL DIRECTOR.

4. PLACEMENT TOLERANCE:
THE FOLLOWING TOLERANCES SHALL APPLY TO MEDIA AND GRAVEL PLACEMENT.
1-1/2" LAYERS ± 1/4"
3" LAYERS ± 1/2"
9" & DEEPER ± 1"
FINISHED GRAVEL DEPTH ± 1"
FINISHED FILTER BED ± 1"

ALL LAYERS OF MEDIA AND GRAVEL TO BE LEVEL IN ACCORDANCE WITH NMI MEDIA AND GRAVEL PLACEMENT SPECIFICATIONS.

5. THIS RATE FOR BACKWASH DURING MEDIA PLACEMENT AND DOES NOT INCLUDE SURFACE WASH FLOW RATE OF APPROXIMATELY .75 TO 2.0 GPM/SQ.FT. TOTAL RISE RATE WITH SURFACE WASH ON AFTER MEDIA PLACEMENT APPROXIMATELY 27 IN./MIN.

6. FILTER GUARANTEE REQUIRES NMI TECHNICAL DIRECTION DURING MEDIA PLACEMENT.

SEE SEPARATE BILL OF MATERIAL

SCALE: —

NOTE: DO NOT SCALE FROM THIS DRAWING TO OBTAIN DIMENSIONS.

TOLERANCE
LINEAR: —
ANGULAR: —

microfloc

DRAWN SLH DATE 16APRIL 84
CHECKED ECG JUL 84 DATE
STANDARDS ECG JUL 84 DATE
PROJECT ENG. JRL DATE 7-26-84

FORT BRAGG WTP
FORT BRAGG, CA.
TRIDENT™ WATER SYSTEMS
MEDIA DESIGN - FILTER TR420"S"

DRAWING NO P6148-10 REV A
LOC-50 /
SHEET 1 OF 1

D.C.N. NO.

SECTION 46 33 44
PUMPING EQUIPMENT: CHEMICAL METERING PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Chemical metering pumps.
      a. The metering pumps shall be hydraulically balanced diaphragm type, wherein a piston reciprocates within a cylinder and causes hydraulic fluid to deflect a flat diaphragm.
      b. Packaged pump skids, associated piping valves and accessories, control panel and pumps.

1.2 DEFINITIONS

A. System Integrator: Pump distributor and service company capable of providing a complete skid mounted chemical metering pump and accessories per this Section.

1.3 QUALITY ASSURANCE

A. Referenced Standards
   1. American Gear Manufacturers Association (AGMA)
   2. American National Standards Institute (ANSI)
   3. American Society for Testing Materials (ASTM)
      a. A48, Standard Specification for Gray Iron Castings
      b. A126, Gray Iron Castings for Valves Flanges, and Pipe Fittings
   4. American Bearing Manufacturers Association (ABMA)

B. Coordinate and integrate entire system including, but not limited to, metering pumps, electrical equipment, controls, hardware, valving, piping, gauges, and complete skid mounted system through the System Integrator.

C. System integrator shall have had and shall provide written confirmation of a minimum of 5 years of operational experience with at least three installations of pumping equipment applications similar to the systems described herein and on the Drawings and within the past three years.

D. Package Chemical Feed System(s) shall be supplied complete. Manufacturer will have a local authorized service center in their territory to provide service and support to the package system. The service center will have and maintain factory-authorized service technicians for installation, maintenance and repair as necessary and specified.

1.4 SYSTEM DESCRIPTION

A. The following systems are required.
   1. Polymer metering pumps (two).
   2. Polyphosphate metering pumps (two).

B. Pump description:
   1. Pump capacity shall be adjustable through 100% of the range by an electric stroke control on a 4-20 ma position signal while the pump is running or stopped. Pump stroking speed shall not exceed 120 spm. All parts of the power train must operate submerged in oil.
   2. Pump shall be sized to deliver the required capacity at 85% of maximum stroke length. Stroke adjustment shall be variable oil bypass type mechanism with the plunger powered through its entire travel. Mechanical lost motion designs are not acceptable.
   3. Pump shall include an automatic vent and refill mechanism on the hydraulic side, which operates once each stroke. The pump shall have an internal relief valve, which is externally adjustable.

4. Double ball check valves shall be provided in both the suction and discharge to insure accurate repeatable metering. The pump valves shall be removable for cleaning or replacement without the need to disconnect the suction or discharge piping.

C. System shall be supplied through a single System Integrator and shall include:
   1. Mounting skid and back panel.
   2. Chemical metering pumps.
   3. Calibration column.
   4. Strainer
   5. Back pressure valves
   6. Pressure relief valves.
   7. Pulsation damper.
   8. Junction box.
   9. Isolation valves.
   10. Pipe fittings.
   11. Piping.
   12. Controls.
   13. Electrical components.

1.5 SUBMITTALS

A. Shop Drawings:
   1. See Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements specified.
      b. Manufacturer's installation instructions.
      c. Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70. Include any required calculations per Section 01 61 03.
   3. For each system, submit schematic showing valves, piping chemical handling and feeding equipment, utilities and related work.
      a. Acknowledge assigned equipment, valve, piping and instrumentation tag numbers when so designated.
      b. Information on schematic shall include but not necessarily be limited to itemization of components and equipment specified.
      c. Acknowledge and justify need for deviations from system included in Drawings and Specification Sections.

B. Contract Closeout Information:
   1. Operation and Maintenance Data:
      a. See Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

C. Miscellaneous Submittals:
   1. System Integrator’s written confirmation of minimum of 5 years of successful operation of proposed pump equipment in above mentioned chemical applications. Provide references, including phone numbers, for at least three packaged, skid-mounted installations the above chemicals.
   2. System Integrator’s certificate of proper installation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Ship equipment and tubing in clearly marked containers.

1.7 WARRANTY

A. The equipment furnished under this Section shall be free of defects in materials and workmanship for a period of 24 months from Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pumps:
      a. Model Number: NS1830-2C1C1P Nimble Skid Package by Neptune Chemical Pump Co, Inc.
         1) Model 500-A-N3 for Polyphosphate with electrical stroke control,
         2) Model 515-A-N3 for Neat Polymer with electrical stroke control.

2.2 DESIGN REQUIREMENTS

A. Chemical Metering Pumps:
   1. Polyphosphate:
      a. 1 gph at 100 psi
      b. Piston diameter: 0.5 inch
      c. Strokes per minute: 37
      d. Power: 1 PH, 120 V
      e. Skid mounted
      f. One duty, one standby arrangement
   2. Neat Polymer:
      a. 3 gph at 100 psi
      b. Piston diameter: 0.5 inch
      c. Strokes per minute: 117
      d. Power: 1 PH, 120 V
      e. Skid mounted
      f. One duty, one standby arrangement

2.3 MATERIALS

A. Materials shall be corrosion resistant and suitable for the intended service conditions.

B. General:
   1. Pump body non-wetted parts: 316 stainless steel.
   2. Pump body wetted parts: 316 stainless steel.
   3. Ball valves: Viton.
   4. Valve seats: 316 stainless steel.
   5. Diaphragms: Viton.
   6. Hardware: 316 stainless steel.
   7. Enclosure: Designed for wet conditions.

2.4 FABRICATION

A. Pump:
   1. Coat all steel and cast iron materials with a factory-applied epoxy.
   2. Pump to be capable of running dry indefinitely without damage.
   3. Repeatable accuracy: 0.1 percent of maximum output or better.
   4. Nameplate showing chemical, capacity in gallons per hour and pressure ratings.
   5. Motor shall be UL listed.
   6. Pump wetted materials shall be approved for use with potable water.

B. Controls:
   1. Control panel:
      a. One 120VAC power circuit input for the coagulant pumps and one for the polyphosphate pumps.
      b. For each chemical, the operator can select the pump to operate.
      c. The pumps will be flow paced by a 4-20 ma signal from the WesTech process control panel (PCP).

d. Each pump will be stopped and started by an isolated digital output (DO) contact from the WesTech PCP.
e. Control panel shall be mounted on chemical feed skid and shall be NEMA 4X and have the following features:
    1) Pump 1-Pump 2 lead switch to select the lead-standby pump for each chemical when systems is in automatic.
    2) Hand-off-automatic switch for each feeder pump. When in hand that pump will run continuously, when in off pump shall not run and when in automatic pump will run based on the start/stop command from the WesTech PCP and the position of the Pump 1-Pump 2 lead switch.
    3) 4-20 ma pacing system signal for each feed pump from WesTech PCP.
    4) Run light and isolated run contact for Owner's use for each pump.
    5) Final on-off control device for each pump shall be horsepower rated relay/contactor suitable for the meter.
    6) Provide engraved laminated nameplates fore each front panel device and a panel nameplate "Chemical Feed Control Panel".
    7) See Specification Section 40 98 00 for control panel construction standards.
    8) 20A, 1 pole circuit breaker inside panel with cover mounted operating handle marked "120VAC Disconnect".

2.5 ACCESSORIES

A. Provide chemical metering skid.
    1. Skid:
        a. Minimum 3/4 IN thick rigid polypropylene.
        b. Solid base, back panel, side panels, open front and top.
        c. Pedestals to elevate metering pumps.
        d. Skid assembled using thermal welding.
    2. Each skid to include:
        a. Chemical metering pumps.
            1) Isolation valves on pump suction and discharge.
        b. Inlet valve.
        c. Calibration column:
            1) Provide a calibration cylinder for mounting in each pump suction line.
            2) Each calibration cylinder shall be sized for a 30 second minimum test, graduated in milliliters and labeled to allow easy conversion to gallons per hour.
            3) Construction shall be clear, PVC and shall include a vent connection.
        d. Strainer:
            1) Each pump suction shall be supplied with a 40-60 mesh "Y "-strainer to prevent foreign material from getting into the ball checks of the metering pump.
            2) The strainer shall be constructed of material suitable for the chemical service.
        e. Back Pressure Valve:
            1) Provide a diaphragm-type back pressure valve to be mounted in each pump discharge line.
            2) Valve construction shall be suitable for the chemical service with a Teflon diaphragm.
            3) Valve shall be field adjustable.
        f. Pressure relief valves:
            1) Provide a relief valve for installation in the pump discharge line.
            2) Valve construction shall be suitable with the chemical service.
            3) Safety relief valve shall be field adjustable.
        g. Pulsation Dampener:
            1) A pulsation dampener shall be provided in each pump discharge line sized to provide a 90% or 95% degree of dampening.
            2) The pulsation dampener shall be hydropneumatic vertical- type with two chambers separated by a single, elastomeric bladder.

3) Pulsation dampener shall be supplied with a gas charge valve and 2 1/2" pressure gauge. Material of construction shall be suitable for the chemical service.

h. Piping: Schedule 80 PVC.
i. Isolation valves: See valves specification sections and suitable for chemicals mentioned.
j. All necessary control/signal cables for metering pumps.
k. Skid and all piping as shown on Drawings.
l. Control Panel.

2.6 SOURCE QUALITY CONTROL

A. Each pump shall have factory run-in test prior to shipment.

2.7 MAINTENANCE MATERIALS

A. Provide the following spare parts per each pump size specified:
   1. Furnish Owner the following extra parts for each pump service category:
      a. Two diaphragms.
      b. Complete set of O-rings
      c. Two check valves

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. See Section 43 21 00.

C. Install flexible couplings on suction and discharge of pumps.

3.2 FIELD QUALITY CONTROL

A. See Section 43 21 00.

B. Ensure that the metering pump equipment supplier has a factory-trained representative at the site during the startup of the metering pump equipment. The representative shall schedule the visit to the site to allow review of the installation prior to startup, observe and assist with startup, and provide training in the operation and maintenance of the pumps for the Owner's staff. A minimum of 12 hours on site shall be provided by the manufacturer's representative during a minimum of 2 visits for startup and training.

END OF SECTION

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SECTION 46 41 13
INLINE RAPID MIXER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Inline rapid mixer.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with the requirements and recommendations of the following references, except as otherwise specified:
   1. National Electric Code (NEC)
   2. National Electrical Manufacturers Association (NEMA)
   3. American Bearing Manufacturers Association (ABMA).
   4. American Gear Manufacturers Association (AGMA):
      a. 390.03a, Gear Handbook - Gear Classification, Materials and Measuring Methods for Bevel, Hypoid, Fine Pitch Wormgearing and Racks Only as Unassembled Gears.
   5. American Iron and Steel Institute (AISI).
   6. American National Standards Institute (ANSI)
   7. ASTM International (ASTM)

B. All equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the OWNER that the quality is equal to equipment made by the Manufacturer(s) specifically named herein.

C. Provide a factory operational and performance test on the pre-assembled system and documentation of results prior to shipment.

1.3 WARRANTY:

A. Provide a one (1) year warranty on all equipment from date of start-up. Warranty shall cover defects in workmanship, design, and materials. If any component should fail during the warranty period, it shall be corrected and the unit restored to service at no expense to the OWNER.

1.4 SUBMITTALS

A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. Product technical data including:
   1. Shop Drawings:
      a. Detailed drawings showing component and assembly dimensions, location of mechanical and electrical connections, weights of all equipment, installation details, and accessory details.
      b. Power wiring connection diagram, including terminals and numbers.
   2. Product Data:
      a. Descriptive literature, specifications, and engineering data.
      b. Materials of construction for all components and accessories.
      c. Impeller type, number, and size.
      d. Mixer weight, motor weight, and complete assembly weight.
      e. Complete motor nameplate data, as defined by NEMA.
      f. Factory finish system.

3. Quality Control Submittals:
    a. A list of any and all instances where the equipment proposed deviates from these specifications.
    b. Names and addresses of the factory authorized service organization nearest the project site.
    c. Upon approval of Shop Drawings, Manufacturer shall provide printed installation instructions.
    d. Upon completed installation, manufacturer shall provide Certificate of Proper Installation.

C. Contract Closeout Information:
1. Operation and Maintenance Data:
    a. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All equipment and accessories shall be properly protected during shipment such that no damage or deterioration shall occur between shipment and installation.
1. Finished surfaces shall be protected by wooden blanks.
2. Finished ferrous metal surfaces not painted shall be protected from corrosion.
3. Each box and package shall be clearly marked with the contents and total weight.

B. Manufacturer shall provide any special storage and handling instructions.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Hayward Gordon LTD Model HIS-30-12.
2. Or Approved Equal.

2.2 SERVICE CONDITIONS AND PERFORMANCE

A. Water Quality: Chemically treated surface water.
1. Flow: 350 to 1680 gpm.
2. Specific Gravity: 1.0.
3. Viscosity: 1.0 centipoise.
4. Temperature: Less than 250 DegF.
5. Chemicals Injected Upstream of Mixer:
    a. Coagulant
    b. Sodium Hypochlorite

B. Performance: Inline rapid mixer shall provide near instantaneous dispersion of the applied chemicals.

C. Operational Characteristics:
1. Constant Speed.
2. Operating Speed: 1200 rpm maximum.
3. Maximum pressure drop: 1.0 psi.

2.3 COMPONENTS

A. Mixer Tube:
1. 150 PSIG minimum design pressure.
2. Test Pressure: 225 psig.
3. Flange Connections:
    a. 12-inch ANSI 150# flanges for piping connection conforming to AWWA C-207 Class D sizes for 12-inch diameter pipe.

b. ANSI 150# flange connection for mixer mounting.
4. Provide internal baffling for mixing pattern optimization.
5. Provide two (2) plugged 3/4-inch female NPT connections on upstream side of mixer tube.
6. Material: Type 316 stainless steel.

B. Drive:
1. Direct drive bearing-frame support.
2. All drive bearings shall be antifriction type, roller or ball bearings.
3. The frame bearing shall be rated for a minimum B10 life of 100,000 hours.

C. Seal:
1. The mixer shall be sealed by a stuffing box fitted with John Crane C1050 Teflon packing and a Teflon lantern ring.
2. 1/4-inch NPT ports shall be provided for addition of packing flush water and a 3/8- inch NPT packing drain port is provided.

D. Impellers:
1. Two (2) turbines shall be provided.
2. Minimum impeller diameter: 5.75 inches.
3. Material: Type 316 stainless steel.
4. Blades shall be welded to the hub.
5. Hub shall be fixed to the shaft using hook key and set screws.
6. Maximum combined stress shall not exceed 11,000 PSI under maximum operating load.

E. Shaft:
1. Overhung design, underwater bearings shall not be allowed.
2. Operating speed shall not exceed 70 percent of first lateral critical speed.
3. Material: Type 316 stainless steel.
4. Shaft Diameter: 2-inch minimum.
5. Maximum combined stress shall not exceed 9,000 PSI under maximum operating load.

F. Motor:
1. Squirrel cage induction type, 3.0 HP, 3 PH, 60 HZ, 460 V.
2. Synchronous speed shall be 1200 rpm.
3. TEFC.
4. 1.15 SF.
5. Class F insulation.
6. Design B.

G. Spare Parts and Special Tools: Provide the following:
1. One complete stuffing box.
2. Any special tools required for assembly, disassembly, or adjustment of the mixer drive, shaft, and impellers.

H. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in an easily visible location.

I. Lifting Lugs: Provide for all equipment assemblies weighing in excess of 100 pounds.

J. Finishing:
1. Vessel Interior:
a. 316 stainless steel vessel interiors to remain unpainted.
2. Exterior Surfaces:
a. Provide finish painting, without exception, per Specification Section 09 91 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with Manufacturer’s written instructions.

B. Connections to piping shall be properly aligned so as not to impose strain on the connection. All piping and valves shall be supported in accordance with Specification Section 40 05 07 – Pipe Support Systems. Support piping independent of inline rapid mixer.

C. Check and align motor, vessel, and piping, etc. after mixer is installed to ensure alignment and assembly has been unchanged from factory assembly conditions. Make adjustments required to place system in proper operating condition.

D. Installation shall include furnishing and applying an initial supply of grease and oil, recommended by Manufacturer.

E. Unit as furnished and installed shall not vibrate or produce noise in excess of mixer Manufacturer’s recommendations.

F. Motor vibration shall not exceed limits as required by latest revision of NEMA MG 1 standards.

3.2 MANUFACTURER'S FIELD SERVICES

A. A factory trained Manufacturer’s Representative shall be provided for installation supervision, start-up and test services, and operation and maintenance personnel training services. The representative shall make one (1) visit to the site to inspect the installation, assist with startup, and instruct operations and maintenance personnel.

END OF SECTION