CONTRACT DOCUMENTS, SPECIFICATIONS & PLANS

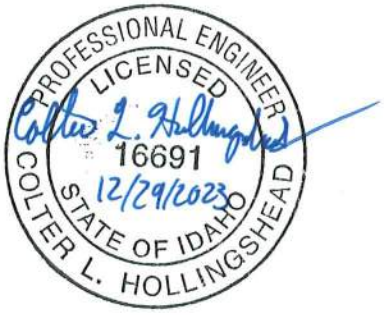
FOR

CITY OF POCATELLO

WELL #2R AND WELL #22R WELL HOUSES

Volume 1 of 3

Division 00 – Division 22



PROJECT NO. 221071-003
December 2023

CIVIL ENGINEER:

KELLER ASSOCIATES, INC.
305 NORTH 3RD AVE., SUITE A
POCATELLO, ID 83201
(T) 208.238.2146

GEOLOGIST:

CLEARWATER GEOSCIENCES, LLP
(T) 208.589.5555

OWNER:

CITY OF POCATELLO
911 NORTH 7TH AVENUE
POCATELLO, ID 83201
(T) 208.234.6582
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SECTION 00 11 16 - INVITATION TO BID

Separate sealed BIDS for construction of Well #2R and Well #22R Well Houses will be received by the City of Pocatello at the address indicated below. Bids should be clearly marked on the exterior of the envelope in which they are submitted with the following information:

BID ENCLOSED
CITY OF POCATELLO – WELL #2R AND WELL #22R WELL HOUSES
CONTRACTORS NAME

BIDS should be addressed to:

CITY OF POCATELLO – OFFICE OF THE CITY CLERK
911 N. 7TH AVENUE
POCATELLO, ID 83201

Or delivered in person to:

CITY OF POCATELLO – OFFICE OF THE CITY CLERK
911 N. 7TH AVENUE
POCATELLO, ID 83201

BIDS will be received until **2 P.M.** Local Mountain Daylight Time, on **January 30, 2024**, and then at said office publicly opened and read aloud shortly thereafter. A contract will be awarded or bids rejected within 45 days of the bid opening.

A pre-bid meeting will be held at Pocatello City Hall, Pocatello, ID at **10 A.M.** Local Mountain Daylight Time, on **January 18, 2024.** Representatives from the City of Pocatello (OWNER) and Keller Associates (ENGINEER) will be present to discuss the project.

The CONTRACT DOCUMENTS may be examined at:

KELLER ASSOCIATES, INC.
305 NORTH 3RD AVENUE, SUITE A
POCATELLO, ID 83201

The Work includes two new CMU well houses, sitework, installation of vertical turbine pumps, a backup emergency generator, associated piping, electrical, HVAC, and all associated components and appurtenance for the two well sites.

Copies of the Contract Documents and Bid Documents may be obtained at the office of KELLER ASSOCIATES, INC., at the location noted above. Contract Documents and Bid Documents will be issued in either a pdf format on compact disc (CD) or as a Paper Document version. Bidders will be required to pay a nonrefundable cost of $50 for the Paper Document version or $30 for the CD version. Bid Documents can also be purchased electronically at www.kellerassociates.com via QuestCDN for $30. Click on **'MENU'** in the upper righthand corner then click on '**Current Projects Bidding**' at the bottom, which will take you to a page that shows all of the projects which we have bidding at this time. Click on the **'City of Pocatello – Well #2R and Well #22R Well Houses'** hyperlink which will display information specific to the project.

All communications relative to this work shall be directed to the ENGINEER (Colter Hollingshead, Keller Associates, 208- 238-2146) prior to the opening of the Bid Proposals.

Each proposal must be submitted on the prescribed form and accompanied by a certified cashier's check or a corporate bid bond executed on the prescribed form, payable to the City of Pocatello in an amount not less than five percent (5%) of the amount bid. The successful Bidder will be required to furnish Performance and Payment Bonds each in the amount of not less than 100% of the contract price.

Any contract awarded under this Invitation to Bid is funded by the City of Pocatello. All ductile iron pipe, fittings, and valves associated with the project shall be cast within the United States or Canada in accordance with City of Pocatello Water Department Standards.

Each Bidder must have a Public Works Contractors license in the State of Idaho prior to bid opening in accordance with Idaho law.

The City of Pocatello reserves the right to reject any or all proposals, waive any nonmaterial irregularities in the bids received, and to accept the proposal deemed most advantageous to the best interest of the City of Pocatello.

ATTEST: Konni Kendell, City Clerk

Jeffrey Mansfield, PE, Public Works Director

Advertised: January 9, 2024
January 16, 2024

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.

B. *Bidder* – The individual or entity who submits a Bid directly to OWNER.

C. *Successful Bidder* – The lowest responsible Bidder submitting a responsive Bid to whom OWNER (on the basis of OWNER's evaluation as hereinafter provided) makes an award.

D. *Engineer* – Keller Associates, Inc., 305 North 3rd Street Suite A, Pocatello, ID 83201

ARTICLE 2—BIDDING DOCUMENTS

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

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

2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a plan 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 plan holders will receive Addenda issued by Owner.

2.04 Bidder may register as a plan holder and obtain complete sets of Bidding Documents, in the number and 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 plan holders will receive Addenda issued by Owner.

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 plan holders from the Bidding Documents Website or

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Issuing Office. Owner is not responsible for omissions in Bidding Documents or other documents obtained from plan rooms, 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 the Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader Version **2018** or later. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.06.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

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

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

a. **Contractor's Application for Payment**

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

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

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

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ARTICLE 3—QUALIFICATIONS OF BIDDERS

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

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

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

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

D. Subcontractor and Supplier qualification information.

E. Other required information regarding qualifications.

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

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

ARTICLE 4—PRE-BID CONFERENCE

4.01 A non-mandatory pre-bid conference will be held at the time and location indicated in the Invitation to Bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference; however, attendance at this conference is not required to submit a Bid.

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

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

5.01 *Site and Other Areas*

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

5.02 *Existing Site Conditions*

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

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

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

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

c. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

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

4. *Geotechnical Baseline Report/Geotechnical Data Report:* The Bidding Documents contain a Geotechnical Baseline Report (GBR).

a. As set forth in the Supplementary Conditions, the GBR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations ("Baseline Conditions"). The GBR is a Contract Document.

b. The Baseline Conditions in the GBR are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the Baseline Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the GBR, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are baselined.

c. Nothing in the GBR is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.

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. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

A. A Site visit is scheduled following the pre-bid conference.

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B. Bidders visiting the Site are required to arrange their own transportation to the Site.

C. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner or Engineer. Bidder must conduct the required Site visit during normal working hours and **provide a minimum of five business days' notice to the City**.

D. 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.

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

F. 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 noted in the Supplementary Conditions.

5.06 *Other Work at the Site*

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

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

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

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

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

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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. Contact information and submittal procedures for such questions are as follows:

A. **Bidders requirement clarification or interpretation of the Contract Documents shall make a written request to the Engineer, at least FIVE (5) WORKING DAYS prior to the date of receipts of Bids.**

B. Colter Hollingshead, P.E.
Keller Associates, Inc.
305 North 3rd Avenue, Suite A
Pocatello, ID 83201
chollingshead@kellerassociates.com

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than 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 Contract Documents.

ARTICLE 8—BID SECURITY

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

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

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the

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Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

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

ARTICLE 9—CONTRACT TIMES

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

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

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those "or-equal" or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an "or-equal" or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer within 10 days of the issuance of the Advertisement for Bids or invitation to Bidders. Each such request must comply with the requirements of Paragraphs 7.05 and 7.06 of the General Conditions, and the review of the request will be governed by the principles in those paragraphs. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all registered Bidders. Bidders cannot rely upon approvals made in any other manner.

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

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.01 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work with their Bid:

A. **Electrical**

B. **HVAC**

C. **Plumbing**

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

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the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

11.03 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions. The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 7.07A.

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 additive item is optional, and Bidder elects to not furnish pricing for such optional additive item, then Bidder may enter the words "No Bid" or "Not Applicable."

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

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

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

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

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

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

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

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

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

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

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

ARTICLE 13—BASIS OF BID

13.01 *Lump Sum*

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

13.02 *Unit Price*

A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity", which Owner or its representative has set forth in the Bid Form, for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

13.03 *Allowances*

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

ARTICLE 14—SUBMITTAL OF BID

14.01 The Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.

14.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and

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other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to the location designated in the Advertisement.

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

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

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

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

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

ARTICLE 16—OPENING OF BIDS

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

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

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

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

18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of

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the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

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

18.05 *Evaluation of Bids*

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

B. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

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

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

ARTICLE 19—BONDS AND INSURANCE

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

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

ARTICLE 20—SIGNING OF AGREEMENT

20.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 21—SALES AND USE TAXES

21.01 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. See Section 00 62 76.10.

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ARTICLE 22—CONTRACTS TO BE ASSIGNED – NOT USED

ARTICLE 23—ADDITIONAL REQUIREMENTS

23.01 The bidder must abide by City of Pocatello Standard Requirements for construction of waterlines (including pipelines, all fittings, and valves) in Division 400 including domestic steel requirements (cast within the United States or Canada). *City-of-Pocatello-Public-Works-Design-Principles-and-Standards-PDF*.

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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:

"Bid Enclosed"

CITY OF POCATELLO

Attn: Office of the City Clerk

911 North 7th Avenue

Pocatello, ID 83201

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 in the form of a Bid Bond or Certified Check (EJCDC No. C-430);

B. Completed Bid Schedule (Section 00 42 15);

C. List of Proposed Subcontractors; (Section 00 43 36);

D. List of Proposed Suppliers; (Section 00 43 36);

E. List three references for similar types of projects;

F. Written evidence and supporting documentation establishing Bidder's qualifications as indicated in Article 3 of Section C-200 – Instructions to Bidders.

G. 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;

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

3.01 *Lump Sum Bids*

A. Bidder will complete the Work in accordance with the Contract Documents for the lump sum (stipulated) price(s), together with any Unit Prices as indicated in **Section 00 42 15 – Bid Schedule** hereto attached:

3.02 *Unit Price Bids*

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A. Bidder acknowledges that:

1. Unit Prices have been computed in accordance with Paragraph 13.02 of the General Conditions.

2. 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

3. 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.

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 calendar 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.

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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.

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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.

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BIDDER hereby submits this Bid as set forth above:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

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

Attest: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

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

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SECTION 00 42 15 - BID SCHEDULE

BASE BID ITEMS

Item No.	Description	Quantity	Unit	Unit Price	Amount
BASE BID					
01 11 00 - 1.2.B.1	Well #2R - Structure A	1	LS	--	
01 11 00 - 1.2.B.2	Well #22R - Structure B	1	LS	--	
01 11 00 - 1.2.B.3	Imported Structural Fill **(Not Shown in the Plans)**	100	CY		
01 11 00 - 1.2.B.4	Boulder Excavation **(Larger than 1 CY)**	20	CY		

BASE BID PRICE (Lump Sum) $ _____

TOTAL BASE BID PRICE IN WORDS: _____

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BID BOND (PENAL SUM FORM)

Bidder	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Bid**
Name: **CITY OF POCATELLO**	Project *(name and location)*:
Address *(principal place of business)*:	**Well Houses #2R and #22R, Pocatello, ID**
911 N 7th Avenue, Pocatello, ID 83201	
	Bid Due Date:

Bond

Penal Sum:

Date of Bond:

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

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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.

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SECTION 00 43 36 – PROPOSED SUBCONTRACTORS AND SUPPLIERS

Bidder shall include in his or her Bid the name, address, and Idaho Public Works Contractor License Number of the Subcontractors who shall, in the event the Bidder secures the Contract, subcontract for the project in the areas listed below under the general Contract. Failure to name Subcontractors as required shall render any Bid submitted by the Bidder unresponsive and void.

(Insert "self" if properly licensed and so intended. Insert "Not required" if such specialty work is not required)

Subcontractor	Name/Address/Public Works License Number	% of Work Performed
Electrical Contractor:		
Address:		
License Number:		
Plumbing Contractor:		
Address:		
License Number:		
HVAC Contractor:		
Address:		
License Number:		
Address:		
License Number:		
Address:		
License Number:		
Address:		
License Number:		
Address:		
License Number:		
	Total % of Work Performed by Subcontractors	

The suppliers who will supply products and material for the project if the bidder is awarded a contract are:

Supplier Name	Products/Materials Supplied

CONTRACT DOCUMENTS

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NOTICE OF AWARD

Date of Issuance:			
Owner:	City of Pocatello	Owner's Project No.:	
Engineer:	Keller Associates, Inc.	Engineer's Project No.:	221071-003
Project:	Well Houses #2R and #22R		
Contract Name:	Well Houses #2R and #22R		
Bidder:			
Bidder's Address:			

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

[Describe Work, alternates, or sections of Work awarded]

The Contract Price of the awarded Contract is $_____. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

_____ 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.

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

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

1. Deliver to Owner **4** counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the 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 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: **City of Pocatello**

By *(signature)*: _____

Name *(printed)*: Brian Blad

Title: Mayor

Copy: Engineer

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

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

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

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

This Agreement is by and between **City of Pocatello** ("Owner") and _____ ("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 Work consists of public works construction of the City of Pocatello's Well #2R Well House and Well #22R Well House used for conveying potable water. Work includes construction of two CMU block well houses, installation of mechanical and site piping, electrical systems, control systems, HVAC, site work, and all associated components and appurtenances.

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows:

City of Pocatello – Well Houses #2R and #22R

ARTICLE 3—ENGINEER

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

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

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

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

4.02 4.03 *Contract Times: Days*

A. The Work will be substantially complete within **365 calendar** days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within **400 calendar** days after the date when the Contract Times commence to run. **A notice of award is planned to be issued in February or March 2024.**

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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 **$1,000** 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 **$750** for each day that expires after such time until the Work is completed and ready for final payment.

3. Liquidated damages for failing to timely attain 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 any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.

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

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

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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, at the prices stated in Contractor's Bid, attached hereto as an exhibit. The total contract price is ($ _____).

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the 15th day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

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

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

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

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **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 **200** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

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

6.04 *Consent of Surety*

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

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6.05 *Interest*

A. All amounts not paid when due will bear interest at the rate of **6.0** percent per annum.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

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

1. This Agreement.
2. Bonds:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual (copy of list attached).
6. Drawings (not attached but incorporated by reference) consisting of **102** sheets with each sheet bearing the following general title: **Well Houses #2R and #22R**.
7. Drawings listed on the attached sheet index.
8. Addenda (numbers _____ to _____, inclusive).
9. Exhibits to this Agreement (enumerated as follows):
    a. Contractor's Bid
10. 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.

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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.

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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.

5. Pursuant to Idaho Code §67-2346 (2), Contractor hereby certifies that it is not currently engaged in, and will not for the duration of this contract, engage in a boycott of goods or services from Israel or territories under its control.

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.

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

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

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

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NOTICE TO PROCEED

Owner:	City of Pocatello	Owner's Project No.:	
Engineer:	Keller Associates, Inc.	Engineer's Project No.:	221071-003
Contractor:		Contractor's Project No.:	
Project:	Well Houses #2R and #22R		
Contract Name:	Well Houses #2R and #22R		
Effective Date of Contract:			

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **_____, 2024** pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

The number of days to achieve Substantial Completion is **_____calendar days** from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of _____; and the number of days to achieve readiness for final payment is **_____calendar days** from the commencement date of the Contract Times, resulting in a date for readiness for final payment of **_____**.

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

***Provide a construction schedule.**

Owner:	**City of Pocatello**
By *(signature)*:	
Name *(printed)*:	
Title:	
Date Issued:	

Copy: Engineer

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PERFORMANCE BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **City of Pocatello**	Description *(name and location)*:
Mailing address *(principal place of business)*:	**Well Houses #2R & #22R, Pocatello, ID**
911 N. 7th Avenue, Pocatello, Idaho 83201	Contract Price:
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(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.

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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:

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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

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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"**

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PAYMENT BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **City of Pocatello**	Description *(name and location)*: **Well Houses #2R and #22R, Pocatello, ID**
Mailing address *(principal place of business)*: **911 N. 7th Avenue, Pocatello, Idaho 83201**	Contract Price:
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(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: _____	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.

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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.

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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;

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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"**

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Contractor's Application for Payment

Owner:	City of Pocatello	**Owner's Project No.:**	
Engineer:	Keller Associates, Inc.	**Engineer's Project No.:**	221071-003
Contractor:		**Contractor's Project No.:**	
Project:	Well Houses #2R and #22R		
Contract:			
Application No.:		**Application Date:**	
Application Period:	**From**	**to**	

1. Original Contract Price					$ -
2. Net change by Change Orders					$ -
3. Current Contract Price (Line 1 + Line 2)					$ -
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)					$ -
5. Retainage					
a.		X	$ -	Work Completed	$ -
b.		X	$ -	Stored Materials	$ -
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, including retainage (Line 3 - Line 4)					$ -

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: **Date:**

Recommended by Engineer		**Approved by Owner**	
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	
Approved by Funding Agency			
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	

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Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner:	City of Pocatello	**Owner's Project No.:**	
Engineer:	Keller Associates, Inc.	**Engineer's Project No.:**	221071-003
Contractor:		**Contractor's Project No.:**	
Project:	Well Houses #2R and #22R		
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
Original Contract								
			-			-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
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						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
	Original Contract Totals	$ -	$ -	$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner:	City of Pocatello	**Owner's Project No.:**	
Engineer:	Keller Associates, Inc.	**Engineer's Project No.:**	221071-003
Contractor:		**Contractor's Project No.:**	
Project:	Well Houses #2R and #22R		
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
Change Orders								
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
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						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
	Change Order Totals	$ -	$ -	$ -	$ -	$ -		$ -
Original Contract and Change Orders								
	Project Totals	$ -	$ -	$ -	$ -	$ -		$ -

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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner:	City of Pocatello	**Owner's Project No.:**	
Engineer:	Keller Associates, Inc.	**Engineer's Project No.:**	221071-003
Contractor:		**Contractor's Project No.:**	
Project:	Well Houses #2R and #22R		
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Original Contract											
					-		-		-		-
					-		-		-		-
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					-		-		-		-
					-		-		-		-
				Original Contract Totals	$ -		$ -	$ -	$ -		$ -

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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner:	City of Pocatello	**Owner's Project No.:**	
Engineer:	Keller Associates, Inc.	**Engineer's Project No.:**	221071-003
Contractor:		**Contractor's Project No.:**	
Project:	Well Houses #2R and #22R		
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Change Orders											
					-		-		-		-
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					-		-		-		-
					-		-		-		-
					-		-		-		-
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					-		-		-		-
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					-		-		-		-
				Change Order Totals	$ -		$ -	$ -	$ -		$ -
Original Contract and Change Orders											
				Project Totals	$ -		$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Stored Materials Summary

Contractor's Application for Payment

Owner:	City of Pocatello	**Owner's Project No.:**	
Engineer:	Keller Associates, Inc.	**Engineer's Project No.:**	221071-003
Contractor:		**Contractor's Project No.:**	
Project:	Well Houses #2R and #22R		
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored ($)	Amount Stored this Period ($)	Amount Stored to Date (G+H) ($)	Amount Previously Incorporated in the Work ($)	Amount Incorporated in the Work this Period ($)	Total Amount Incorporated in the Work (J+K) ($)	Materials Remaining in Storage (I-L) ($)
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
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								-			-	-
								-			-	-
								-			-	-
								-			-	-
					Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	City of Pocatello	Owner's Project No.:	
Engineer:	Keller Associates, Inc.	Engineer's Project No.:	221071-003
Contractor:		Contractor's Project No.:	
Project:	Well Houses #2R and #22R		
Contract Name:	Well Houses #2R and #22R		

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 Documents.

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.

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 must be as provided in the Contract, except as amended as follows:

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:

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

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

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SECTION 00 62 76.10 - IDAHO STATE TAX REQUIREMENTS

PART 1 - GENERAL

1.1 TAX REPORTING REQUIREMENTS

A. In accordance with the provisions of Sections 54-1904A and 63-3624(g) of the Idaho Code, the owner is required to report all Public Works Contracts to the State Tax Commission. Excerpts from these sections and appropriate Public Works Contract Report forms are included in this section. The Contractor shall be responsible for completing the Public Works Contract Report (Form WH-5) within 30 days of the award of the contract. This form is included in this section. Form WH-5 shall be submitted to the State Tax Commission with a copy given to the Owner and a copy to the Engineer. Said submittal shall be required as part of contract mobilization.

B. In addition, the Contractor will be required to complete the attached form "CONTRACTOR FOR PUBLIC WORKS TO PAY OR SECURE TAXES" at the time that the contract is awarded. Also, prior to releasing retainage, the Contractor shall be required to submit the attached "AFFIDAVIT OF PAYMENT OR SECUREMENT OF ALL TAXES" to the Engineer. At that time the Engineer will submit a "Request for Tax Release" to the State Tax Commission. Retainage cannot be released until the State Tax Commission issues a tax release stating that all taxes have been paid.

1.2 MATERIALS PURCHASED BY A PUBLIC WORKS AGENCY BUT INSTALLED BY THE CONTRACTOR

A. The Contractor owes use tax on materials purchased by a public works agency and installed by the Contractor according to Idaho Sales Tax Rule 12 and Idaho Code 63-3615(b).

B. The Contractor may qualify for certain tax exemptions associated with this project. Contact the Idaho Tax Commission for more information.

CONTRACTOR FOR PUBLIC WORKS TO PAY OR SECURE TAXES
(Idaho Code 63-1503)

"The Contractor, in consideration of securing the business of erecting or constructing public works in this State, recognizing that the business in which he is engaged is of a transitory character, and that in the pursuit thereof, his property used therein may be without the State when taxes, excises, or licenses fees to which he is liable become payable agrees:

1. To pay promptly when due all taxes (other than on real property) excises and license fees due to the State, its corporations therein, accrued or accruing during the term of this contract, whether or not the same shall be payable at the end of, such term;

2. That if the said taxes, excises and license fees are not payable at the end of said term, but liability for the payment thereof exists, even though the same constitute liens upon his property, to secure the same to the satisfaction of the respective officers charged with the collection thereof,

3 That, in the event of his default in the payment or securing of such taxes, excises and license fees, to consent that the Department, Officer, Board or Taxing Unit entering into this contract may withhold from any payment due him hereunder the estimated amount of such accrued and accruing taxing units to which said contractor is liable."

CONTRACTOR

_____

By:_____

Name:_____

Address:_____

(Seal)
ATTEST:

_____

Name:_____

AFFIDAVIT OF PAYMENT OR SECUREMENT OF ALL TAXES

STATE OF_____
}ss.
County of_____

The Contractor,_____, being first duly sworn, on oath deposes and says that he is in conformance with Idaho Code 63-1502; that he is authorized to do business in the State of Idaho and that he can furnish satisfactory evidence that he has paid or secured to the satisfaction of the respective taxing units all taxes for which he or his property is liable, now due or delinquent, including assessments, excises and license fees levied by the State of Idaho or any taxing unit within the State of Idaho.

DATED this_____day of_____ 20____.

SUBSCRIBED AND SWORN to before me this _____ day of _____, 20____.

Notary Public for _____

Residing at _____

Commission Expires _____

State of Idaho
DEPARTMENT OF REVENUE AND TAXATION
STATE TAX COMMISSION

PUBLIC WORKS CONTRACT TAX RELEASE

Section 54-1904A and G3-3624(f), Idaho Code, requires all Public Works Contracts to be reported to the State Tax Commission

EFO00234
04-27-11

Idaho State Tax Commission
REQUEST FOR TAX RELEASE

Date:_____

PART I -- AWARDING AGENCY INFORMATION:

Name of agency	Mailing address	City, state, and ZIP Code
Contact name	Phone number	Email address

PART II -- CONTRACTOR INFORMATION:

Name of contractor	Mailing address	City, state, and ZIP Code
Federal EIN	Contact name	Phone number	Email address

PART III -- CONSTRUCTION/CONTRACT MANAGER INFORMATION (if applicable):

Name of business	Mailing address	City, state, and ZIP Code
Federal EIN	Contact name	Phone number	Email address

Send a copy of the approved Tax Release to: Awarding Agency ☐ Contractor ☐ Construction Manager ☐

NOTE: *We will email all copies unless otherwise requested.*

PART IV -- PROJECT INFORMATION:

Name of project	Location of project
Description of project	
Project number assigned by awarding agency	Project start date	Project completion date	Final/closing contract amount (includes all change orders) $

Did any government entities supply materials which were installed by this contractor or its subs?: Yes ☐ No ☐

If YES, list these materials and their dollar values. (Attach additional information if needed.)

List materials	List dollar values of materials
	$
	$
	$

Send to: Contract Desk/Sales Tax Audit
Idaho State Tax Commission
PO Box 36
Boise ID 83722-0410

Phone: (208) 334-7618 • Fax: (208) 332-6619 • Email: **contractdesk@tax.idaho.gov**

NOTE: *Please allow 30 days to process a Tax Release Request. You must send a complete, signed Form WH-5 Public Works Contract Report to the Idaho State Tax Commission to complete this request.*

Refer to tax.idaho.gov for current form

Idaho State Tax Commission

WH-5 Public Works Contract Report

Ref. No. (State use only)

Idaho Code sections 54-1904A and 63-3624(g) require all public works contracts to be reported to the Tax Commission. This form must be filed with the Tax Commission within 30 days after a contract is awarded.

Contract awarded by (public body and address)

Contract awarded to (contractor's name and address)

State of incorporation	Federal Employer Identification Number (EIN)	Date qualifed to do business in Idaho
Business operates as ☐ Sole proprietorship ☐ Partnership ☐ Corporation ☐ LLC		Public Works contractor license number
Sole proprietor's Social Security number	Idaho sales/use tax permit number	Idaho withholding tax permit number
Awarding agency project number		Amount of contract $

Description and location of work to be performed

PROJECT DATES

Scheduled project start date: _____ Completion date: _____

If the following information is not available at this time, please indicate date it will be: _____

ALL SUBCONTRACTORS

Refer to tax.idaho.gov for current form

Name			Federal EIN
Address			Public works contractor number
City, State, ZIP	☐ LLC ☐ Sole proprietorship	☐ Corporation ☐ Partnership	Amount of subcontract $
Description of work			

Name			Federal EIN
Address			Public works contractor number
City, State, ZIP	☐ LLC ☐ Sole proprietorship	☐ Corporation ☐ Partnership	Amount of subcontract $
Description of work			

Name			Federal EIN
Address			Public works contractor number
City, State, ZIP	☐ LLC ☐ Sole proprietorship	☐ Corporation ☐ Partnership	Amount of subcontract $
Description of work			

Name			Federal EIN
Address			Public works contractor number
City, State, ZIP	☐ LLC ☐ Sole proprietorship	☐ Corporation ☐ Partnership	Amount of subcontract $
Description of work			

EFO00168 04-28-11

ALL SUBCONTRACTORS (CONTINUED)

Name			Federal EIN
Address			Public works contractor number
City, State, ZIP	☐ LLC ☐ Sole proprietorship	☐ Corporation ☐ Partnership	Amount of subcontract $
Description of work			

Name			Federal EIN
Address			Public works contractor number
City, State, ZIP	☐ LLC ☐ Sole proprietorship	☐ Corporation ☐ Partnership	Amount of subcontract $
Description of work			

Name			Federal EIN
Address			Public works contractor number
City, State, ZIP	☐ LLC ☐ Sole proprietorship	☐ Corporation ☐ Partnership	Amount of subcontract $
Description of work			

SUPPLIERS

Use the space below to report major suppliers of materials and supplies; items removed from inventory; equipment purchased, rented, or leased for use in project; materials provided by government agency. Please indicate sales or use tax w...

Name		Federal EIN	Total value $
Address		Materials and equipment purchased and used	
City, State, ZIP	Phone	☐ Tax paid to supplier ☐ Tax paid to state* ☐ No tax paid	

Name		Federal EIN	Total value $
Address		Materials and equipment purchased and used	
City, State, ZIP	Phone	☐ Tax paid to supplier ☐ Tax paid to state* ☐ No tax paid	

Name		Federal EIN	Total value $
Address		Materials and equipment purchased and used	
City, State, ZIP	Phone	☐ Tax paid to supplier ☐ Tax paid to state* ☐ No tax paid	

Name		Federal EIN	Total value $
Address		Materials and equipment purchased and used	
City, State, ZIP	Phone	☐ Tax paid to supplier ☐ Tax paid to state* ☐ No tax paid	

Refer to tax.idaho.gov for current form

* If tax was not paid to suppliers but **was** or **will be** reported as "items subject to use tax" under your permit number, indicate period of return on which payment **was** or **will be** reported: _____

If tax was paid to a state **other** than Idaho, name state next to "total value" box(es) above. If tax is due and has **not previously been reported**, attach payment to this form. **If you need more room, please photocopy this page.**

SIGN HERE Authorized signature	Print name	Phone number	Date

File with the Idaho State Tax Commission, PO Box 36, Boise ID 83722-2210.

For more information, call (208) 334-7618 • Fax: (208) 332-6619 • E-mail: Contractdesk@tax.idaho.gov.

CONDITIONS OF THE CONTRACT

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

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

NSPE
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed By

CSI
Building Knowledge
Improving Project Delivery

NUCA
We Dig America

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

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

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

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

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

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

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

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

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

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

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

10. *Claim*

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

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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

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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.

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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.

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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.

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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.

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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

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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.

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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

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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.

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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

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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.

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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.

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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

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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.

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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

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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;

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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

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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

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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

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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

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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

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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.

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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);

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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

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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.

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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.

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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;

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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

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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.

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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

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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:

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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.

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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

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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

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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

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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

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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.

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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

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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

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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.

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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,

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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,

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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

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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.

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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;

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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

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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

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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.

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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,

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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.

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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,

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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

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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.

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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.

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

SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, “Paragraph SC-4.05.”

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

No suggested Supplementary Conditions in this Article.

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 **4** printed copies of the Contract Documents (including one fully signed counterpart of the Agreement), and **one copy** in electronic portable document format (PDF).

2.06 *Electronic Transmittals*

SC-2.06 Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:

B. *Electronic Documents Protocol:* The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol (“EDP” or “Protocol”) for exchange of electronic transmittals.

1. *Basic Requirements*

a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.

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b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.

c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.

d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.

e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party's use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.

f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. *System Infrastructure for Electronic Document Exchange*

a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.

1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is **25** MB. Attachments larger than that may be exchanged using large file transfer functions or physical media.

2) Each Party assumes full and complete responsibility for any and all of its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software, for use with respect to this EDP.

b. Each party is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with the party's individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.

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c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.

d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.

e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.

f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.

g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.

C. *Software Requirements for Electronic Document Exchange; Limitations*

1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.

   a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this EDP.

2. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a

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software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

No suggested Supplementary Conditions in this Article.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.05 *Delays in Contractor's Progress*

SC-4.05 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 as scheduled.

b. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:

1) Every workday on which one or more of the following conditions exist will be considered a "bad weather day":

i) Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds **0.5 inches** of precipitation (as rain equivalent, based on the snow/rain conversion indicated in the table entitled Foreseeable Bad Weather Days; such table is hereby incorporated in this SC-4.05.C by reference.

ii) Ambient outdoor air temperature at 11:00 a.m. is equal to or less than the following low temperature threshold: **0** degrees Fahrenheit.

2) Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by **NOAA** weather monitoring station at **Pocatello Regional Airport (KPIH).**

4) 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.

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

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Engineering Report – Well House #2 Pocatello, Idaho	April 4, 2022	Xcell Engineering, LLC– Well House #2
Geotechnical Engineering Report – Well #22 Pocatello, Idaho	March 20, 2023	Xcell Engineering, LLC– Well #22

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
NA	NA	**NA**

G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at **Keller Associates' Pocatello Office** during regular business hours, or may request copies from Engineer.

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
NA	NA	**NA**

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
NA	NA	**NA**

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Drawings Title	Date of Drawings	Technical Data

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. *Required Performance Bond Form:* The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond (2010, 2013, or 2018 edition).

2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2010, 2013, or 2018 edition).

6.02 *Insurance—General Provisions*

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

6.03 *Contractor's Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: **None.**

E. *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
Jones Act (if applicable)	
Bodily injury by accident—each accident	Not Required
Bodily injury by disease—aggregate	Not Required
Employer's Liability	

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Workers' Compensation and Related Policies	Policy limits of not less than:
Each accident	$1,000,000
Each employee	$1,000,000
Policy limit	$1,000,000
Stop-gap Liability Coverage	
For work performed in monopolistic states, stop-gap liability coverage must be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	Not Required in Idaho

F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.
5. Personal injury coverage.
6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

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H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
2. Any exclusion for water intrusion or water damage.
3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	**Policy limits of not less than:**
General Aggregate	$2,000,000
Products—Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000
Bodily Injury and Property Damage—Each Occurrence	$1,000,000

J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	**Policy limits of not less than:**
Bodily Injury	
Each Person	$1,000,000
Each Accident	$1,000,000
Property Damage	
Each Accident	$1,000,000
[or]	
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000

K. *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.

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Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$2,000,000
General Aggregate	$2,000,000

L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of $1,000,000 after accounting for partial attribution of its limits to underlying policies, as allowed above.

M. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	$1,000,000
General Aggregate	$1,000,000

N. *Contractor's Professional Liability Insurance:* If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	$1,000,000
Annual Aggregate	$1,000,000

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth

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movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.

b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.

2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).

4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

5. extend to cover damage or loss to insured property while in transit.

6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.

7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.

8. include performance/hot testing and start-up, if applicable.

9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.

10 include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds."

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11. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties.

12. If debris removal in connection with repair or replacement of insured property is subject to a coverage sublimit.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

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 **7AM to 6PM daily, Monday through Friday.**

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 without Owner's written consent."

SC-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:

D. **Contractor** shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer's services (including those of the Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-7.03 Add the following new subparagraph immediately after Paragraph SC-7.03.D:

1. For purposes of administering the foregoing requirement, additional overtime costs are defined as **wages earned by employee in excess of 40 hours per week.**

ARTICLE 8—OTHER WORK AT THE SITE

8.02 *Coordination*

SC-8.02 Add the following new Paragraph 8.02.C immediately after Paragraph 8.02.B:

C. Owner intends to contract with others for the performance of other work at or adjacent to the Site.

1. **The Prime Contractor** shall have authority and responsibility for coordination of the various contractors and work forces at the Site to ensure a safe and efficient working environment.;

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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" 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 paragraphs immediately after Paragraph 10.03.B:

C. The Part-Time Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:

1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

3. *Liaison*

   a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.

4. *Review of Work; Defective Work*

   a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

   b. Observe whether any Work in place appears to be defective.

   c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

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5. *Inspections and Tests*

    a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

    b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. *Payment Requests:* Review Applications for Payment with Contractor.

7. *Completion*

    a. Participate in Engineer's visits regarding Substantial Completion.

    b. Assist in the preparation of a punch list of items to be completed or corrected.

    c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

    d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11—CHANGES TO THE CONTRACT

No suggested Supplementary Conditions in this Article.

ARTICLE 12—CLAIMS

No suggested Supplementary Conditions in this Article.

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

13.01 *Cost of the Work*

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SC-13.01 Supplement Paragraph 13.01.B.5.c.(2) by adding the following sentence:

The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of **Rental Rate Blue Book for Construction Equipment.**

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than $500.

13.03 *Unit Price Work*

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

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 extended price of a particular item of Unit Price Work amounts to **5** percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than **25** percent 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 ACCCEPTANCE OF DEFECTIVE WORK

No suggested Supplementary Conditions in this Article.

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

SC-15.01 Add the following new Paragraph 15.01.F:

F. For contracts in which the Contract Price is based on the Cost of Work, if Owner determines that progress payments made to date substantially exceed the actual progress of the Work (as measured by reference to the Schedule of Values), or present a potential conflict with the Guaranteed Maximum Price, then Owner may require that Contractor prepare and submit a

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plan for the remaining anticipated Applications for Payment that will bring payments and progress into closer alignment and take into account the Guaranteed Maximum Price (if any), through reductions in billings, increases in retainage, or other equitable measures. Owner will review the plan, discuss any necessary modifications, and implement the plan as modified for all remaining Applications for Payment.

15.03 *Substantial Completion*

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

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

No suggested Supplementary Conditions in this Article.

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

17.02 *Arbitration*

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

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 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 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 arbitrators 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.

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D. The Arbitrators 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.

E. The award of the arbitrators 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.

F. 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.

G. 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.

H. 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.

I. 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.

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.

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ARTICLE 18—MISCELLANEOUS

No suggested Supplementary Conditions in this Article.

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WORK CHANGE DIRECTIVE NO.:

Owner:	City of Pocatello	Owner's Project No.:	
Engineer:	Keller Associates	Engineer's Project No.:	221071-003
Contractor:		Contractor's Project No.:	
Project:	Well Houses #2R and #22R		
Contract Name:			
Date Issued:		Effective Date of Work Change Directive:	

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

Description:

Attachments:

Purpose for the Work Change Directive:

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

Notes to User—Check one or both of the following

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

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

Contract Price: $ _____ **[increase] [decrease] [not yet estimated]**.

Contract Time: _____ days **[increase] [decrease] [not yet estimated]**.

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

	Recommended by Engineer	Authorized by Owner
By:		
Title:		
Date:		

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CHANGE ORDER NO.: _____

Owner:	City of Pocatello	Owner's Project No.:	
Engineer:	Keller Associates	Engineer's Project No.:	221071-003
Contractor:		Contractor's Project No.:	
Project:	Well Houses #2R and #22R		
Contract Name:	Well Houses #2R and #22R		
Date Issued:		Effective Date of Change Order:	

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

Description:

Attachments:

Change in Contract Price	**Change in Contract Times [State Contract Times as either a specific date or a number of days]**
Original Contract Price: $ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] from previously approved Change Orders No. 1 to No._____ $ _____	**[Increase] [Decrease]** from previously approved Change Orders No.1 to No. _____ Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: $ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] this Change Order: $ _____	**[Increase] [Decrease]** this Change Order: Substantial Completion: _____ Ready for final payment: _____
Contract Price incorporating this Change Order: $ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for final payment: _____

	Recommended by Engineer (if required)	Accepted by Contractor
By:	_____	_____
Title:	_____	_____
Date:	_____	_____
	Authorized by Owner	Approved by Funding Agency (if applicable)
By:	_____	_____
Title:	_____	_____
Date:	_____	_____

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FIELD ORDER NO.: _____

Owner:	City of Pocatello	Owner's Project No.:	
Engineer:	Keller Associates, Inc.	Engineer's Project No.:	221071-003
Contractor:		Contractor's Project No.:	
Project:	Well Houses #2R and #22R		
Contract Name:	Well Houses #2R and #22R		
Date Issued:		Effective Date of Field Order:	

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

Attachments:

Issued by Engineer

By: _____

Title: _____

Date: _____

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SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Work to be performed under this Contract shall consist of furnishing tools, equipment, materials, supplies, and manufactured articles, and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all work or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The Work shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the Work in good faith shall be provided by the Contractor as though originally so indicated, at no increase in cost to the Owner.

B. The Contractor is responsible to follow the provisions of these Contract Documents, including but not limited to: the following of Plans and Specifications; the timely, complete, and accurate submittal of shop drawings; the work of and correlation with his subcontractors and suppliers, timely performance of the Contract, and timely payment of suppliers and subcontractors. Nothing stated in the Contract Documents or Specifications shall be construed to relieve the Contractor of these basic responsibilities.

C. The Contractor shall provide an internet-based construction management software package for submitting and tracking project related documents such as RFI's and Submittals. Access to and the use of this internet-based construction management site will be provided at no cost to the Engineer and Owner.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Overview: The Work of this Contract comprises the construction of the Pocatello Well Houses #2R and #22R the City of Pocatello, Idaho specified and shown with all appurtenances.

B. Project Elements – The major project elements for the Well Houses construction project are listed below:

1. **Well House #2R, Generator Enclosure, and Transmission Line (Structure A)**

Well House

a. Mobilization/Demobilization of the prime contractor, including all necessary permits.

b. Traffic Control plans are the Contractor's responsibility and will need to be submitted to the Engineer and City for approval.

c. Clearing and grubbing followed by earthwork excavation for the well house including cobble and boulder removal where required.

d. Backfill and compaction under well house foundations slabs and around Structure A per the geotechnical report and specifications.

e. Final grading of the entire Well #2R site

f. Concrete foundation and slab for the well house and generator enclosure area.

g. Concrete masonry unit (CMU) exterior and interior walls.

h. Miscellaneous metal work within the well house and outside of the well house.

i. All carpentry work, reinforcement, and insulation of the well house.

j. Roofing system consisting of wood trusses, standing seam metal roof, removable skylight, HVAC equipment, venting, roof penetrations, all fascia and eave items where specified.

k. All plumbing in the well house including: drains, drainage piping, sump, and piping/accessories associated with utility water system.

l. Electrical items including lighting, building power, control panels, outlets, generator, ATS, manual transfer switch, load bank testing connections, and related accessories.

m. All penetrations in the roof and walls.

n. All HVAC equipment, controls, and connections including but not limited to: heaters, HVAC control panel, ventilation fan, cooling louver and vents.

o. All mechanical piping in the well house including but not limited to: valves, piping and fittings as shown.

p. Installation of Owner Provided Well Pump and Motor.

q. Power feed from the ATS in the well house to the generator.

r. All rough electrical (conduit runs for equipment).

s. Wiring installation and termination to all electrical equipment.

t. Utility power coordination.

u. Primary Switchgear.

v. Power and communication conduits and wire.

w. Power panels including main service disconnect, motor disconnects, and wire all equipment and valves.

x. All wiring and conduits required between the well house and generator enclosure.

y. Coordinate work with all utility companies. Contractor will be responsible for all associated power utility installation costs after the site transformer.

z. All wiring, conduits, and installation from the site transformer to the Well House #2R.

aa. All wiring, conduits, and installation from Well House #2R to Well House #3R.

bb. All miscellaneous equipment and electrical controls for the Well.

cc. Installation and wiring of all instrumentation and control panel.

dd. Protective coatings for all CMU block and interior mechanical piping.

ee. Acoustical gate system for generator enclosure.

ff. Startup of the facility.

Generator Enclosure

gg. Earthwork excavation for the generator enclosure including cobble and boulder removal where required.

hh. Backfill and compaction under the generator foundation footings and slabs per the geotechnical report and the drawings with free draining rock.

ii. Final backfill around the generator foundation per the geotechnical report.

jj. Purchase, install, connection and load testing of the generator. Provide concrete anchors and anchor the generator to the isolated concrete pad.

kk. Concrete foundation and slab for the generator enclosure.

ll. Miscellaneous metal work within the generator enclosure.

mm. All column work, reinforcement, and sound panel installation of the generator enclosure.

nn. Wire and test the standby generator and the automatic transfer switch.

Site Work

a. Installation of all piping, valves, fittings, and manholes from the well house to the distribution tie-in point indicated in the plans on 2nd Avenue.

b. Installation of all landscaping, weed barrier, landscaping rock, and site fencing as required.

c. All finish grading, concrete sidewalks, and asphalt driveways.

d. Surface restoration as indicated in drawings, including placement of sod where grass is currently growing.

Transmission Line

e. Installation and testing of all 12" transmission line as shown on Sheets CU-201-A through CU-202-A in accordance with ISPWC and City of Pocatello requirements.

2. Well House #22R and Site Work (Structure B)

Well House

a. Mobilization/Demobilization of the prime contractor, including all necessary permits.

b. Traffic Control plans are the Contractor's responsibility and will need to be submitted to the Engineer and City for approval.

c. Clearing and grubbing followed by earthwork excavation for the well house including cobble and boulder removal where required.

d. Backfill and compaction under well house foundations slabs and around Structure A per the geotechnical report and specifications.

e. Final grading of the entire Well #22R site

f. Concrete foundation and slab for the well house area.

g. Concrete masonry unit (CMU) exterior and interior walls.

h. Miscellaneous metal work within the well house.

i. All carpentry work, reinforcement, and insulation of the well house.

j. Roofing system consisting of wood trusses, standing seam metal roof, removable skylight, HVAC equipment, venting, roof penetrations, all fascia and eave items where specified.

k. All plumbing in the well house including: drains, drainage piping, sump, and piping/accessories associated with utility water system.

l. Electrical items including lighting, building power, control panels, outlets, mobile generator camlock plugs, manual transfer switch, and related accessories.

m. All penetrations in the roof and walls.

n. All HVAC equipment, controls, and connections including but not limited to: heaters, HVAC control panel, ventilation fan, cooling louver and vents.

o. All mechanical piping in the well house including but not limited to: valves, piping and fittings as shown.

p. Installation of Owner Provided Well Pump and Motor.

q. All rough electrical (conduit runs for equipment).

r. Wiring installation and termination to all electrical equipment.

s. Utility power coordination.

t. Primary Switchgear.

u. Power and communication conduits and wire.

v. Power panels including main service disconnect, motor disconnects, and wire all equipment and valves.

w. All miscellaneous equipment and electrical controls for the Well.

x. Installation and wiring of all instrumentation and control panel.

y. Coordinate work with all utility companies. Contractor will be responsible for all associated power utility installation costs after the site transformer.

z. Protective coatings for all CMU block and interior mechanical piping.

aa. Startup of the facility.

Site Work

bb. Installation of all piping, valves, fittings, and manholes from the well house to the distribution tie-in point indicated in the plans Cedar Street.

cc. Installation of all landscaping, irrigation lines and controllers (including connection in Willard Avenue), plants, weed barrier, and landscaping rock as required.

dd. All finish grading, concrete sidewalks, and asphalt driveways.

ee. Surface restoration as indicated in drawings.

3. Imported Structural Fill

a. This item is only for imported structural fill material **NOT** shown in the plans. All import structural fill material shown in the plans and as described in the geotechnical report should be included with the Contractor's base bid lump sum items. The unit price for this imported structural fill material will only be used with Approval from the Engineer, the Owner, and the Geotechnical Engineer during construction. Imported structural fill material shall be in accordance with the requirements listed in the specifications and geotechnical report. This structural fill material item has been included in case the native material cannot be recompacted to achieve the 95% compaction under the buildings or site civil structures as required in the plans and specifications. This unit price should include all material, labor, equipment costs for the import/placement of structural fill and the removal and disposal of unsuitable native soil the import material would replace. Per the geotechnical report, it is anticipated that moisture conditioning and wet weather conditions will likely exist during construction and this does not relieve the Contractor from using/recompacting the native soils under the buildings. If reasonable effort and good construction practices are used to compact the native soils under the building, but compaction requirements cannot be met and the Engineer, Owner and Geotechnical Engineer agree, additional import structural fill material can be used in place of recompacted native soils under the building. Measurement for this item will be on a per Cubic Yard (CY) basis.

4. Boulder Excavation (Larger than 1 CY)

a. This item consists of all labor, materials, and equipment required for excavation and disposal of boulders larger than 1 Cubic Yard (CY). There is a potential for large cobbles and boulders to be excavated as part of this project. All individual boulders excavated that are less than 1 Cubic Yard will be incidental to the project cost and NOT be paid as part of this item. If the Engineer is not onsite at the time of excavation, this pay item can only be used with photographs and measurements provided to the Engineer as evidence that large boulders have been removed. A 0.75 CY boulder will not be paid for. An excavated 1 CY boulder will be paid for 1 CY. A 1.5 CY boulder will be paid 1.5 CY.

1.3 CONTRACT METHOD

A. The Work hereunder will be constructed under lump sum for each well house and unit price for Items #3 and #4 above.

1.4 WORK BY OTHERS

A. The Contractor's attention is directed to the fact that work will be conducted at the site by other contractors during the performance of the Work under this Contract. The Contractor shall conduct its operations so as to cause a minimum of interference with the Work of such other contractors, and shall cooperate fully with such contractors to provide work under their respective contracts. At a minimum, Work by Contractor will include the following construction projects or activities at or adjacent to the project site:

1. The City of Pocatello (Owner) is pre-purchasing the vertical turbine pumps and motors and will provide the pumps and motors for both Well #2R and Well #22R to the Contractor for installation.

2. Owner will directly pay for costs associated with running permanent power to the new site transformers at Structures A and B.

3. Owner will pay for costs associated with building permits from City of Pocatello. Contractor will still need to pull the building permits from City of Pocatello.

B. Interference with Work on Utilities: The Contractor shall cooperate fully with all utility forces of the Owner or forces of other public or private agencies engaged in the construction, relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the Work, and shall schedule the Work so as to minimize interference with said construction.

1.5 **CITY OF POCATELLO WATER DEPARTMENT MATERIAL SPECIFICATIONS**

A. Ductile Iron Pipe

Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51 specifications, latest revision, thickness and classes as follows, and nominal laying lengths of 18 or 20-ft. All pipe sections shall be marked as prescribed by AWWA C151 and NSF/ANSI 61. Pipe joints shall be "push-on" conforming to ANSI/AWWA C111/A21.11 specifications, latest revision, employing a single gasket to effect the joint seal. Pipe shall include all joint lubrication necessary for proper installation. All pipe shall be of domestic make, and cast within the United States or Canada. **All ductile iron pipe on this project to be wrapped with V-bio enhanced polyethylene wrap or equivalent.**

B. Ductile Iron Boltless Flexible Locked Joint River Crossing Pipe

Centrifugally cast ductile iron boltless flexible locked joint river crossing pipe shall meet the requirements of ANSI/AWWA C151/A21.51 specifications, latest revision. Pipe barrel shall be 60-42-10 ductile iron. Retainer bell and ball shall be 70-50-5 ductile iron. Pipe shall be as manufactured by Clow or U.S. Pipe. **All ductile iron pipe on this project to be wrapped with V-bio enhanced polyethylene wrap or equivalent.** American Flex-Ring Joint Pipe is an acceptable alternative for the Ductile Iron River Crossing Pipe.

C. Polyethylene Pipe

Polyethylene pipe shall conform to ANSI/AWWA C906 specifications, latest revisions for 4" to 63" class 250-psi (DR9). C906 pipe sizes 4" to 12" shall be Ductile Iron Size (DIPS). C906 pipe sizes larger than 12" shall be Steel Pipe Size (IPS). Laying lengths shall be 40 feet. Pipe is to be joined by heat fusion, flanges or other mechanical joint systems proven for HDPE and is approved by the Water Superintendent and Engineer. Polyethylene pipe shall be made from prime virgin resins exhibiting a cell classification of PE 345434C as defined in ASTM D3350 with an established hydrostatic-design-basis of 1,600-psi for water at 73° F. The resin shall be listed by the I\PPI in its pipe grade registry "TR-4". All pipe sections shall be marked as prescribed by AWWA C906 and NSF/ANSI 61.

D. Ductile Iron Fittings

Ductile iron fittings shall conform to ANSI/AWWA C110/A21.10 specifications, latest revision, with all joints conforming to ANSI/AWWA C111/A21.11 specifications, latest revision. Working pressure shall be 250-psi. All ductile iron fittings shall be NSF/ANSI 61 certified. All mechanical joint fittings shall be supplied with accessory kits. Flanged joint fittings shall be supplied with accessory kits including full face gasket, nuts and bolts. All fittings shall be of domestic make, and cast within the United States or Canada. Fittings to be wrapped with polyethylene.

E. Ductile Iron Compact Fittings

Ductile iron compact fittings sizes through 24” shall conform to ANSI/AWWA C153/A21.53 specifications, latest revision, with all joints conforming to ANSI/AWWA C111/A21.11 specifications, latest revision, and shall be complete with gaskets. Working pressure shall be 350-psi. Sizes greater than 24” shall conform to ANSI/AWWA C110/A21.10. All ductile iron fittings shall be NSF/ANSI 61 certified. All mechanical joint fittings shall be supplied with accessory kits. Flanged joint fittings shall be supplied with accessory kits including full face gasket, nuts and bolts. All fittings shall be of domestic make, and cast within the United States or Canada. Fittings to be wrapped with polyethylene.

F. Polyethylene Fittings

Polyethylene fittings shall conform to ANSI/AWWA C906 specifications, latest revisions for 4" to 63" class 250-psi, derated by 25%. C906 fitting sizes 4" to 24" shall be Ductile Iron Size (DIPS). C906 fitting sizes larger than 24" shall be Steel Pipe Size (IPS). Polyethylene pipe fittings shall be made from prime virgin resins exhibiting a cell classification of PE 345434C as defined in ASTM D3350 with an established hydrostatic-design-basis of 1,600-psi for water at 73 deg. F. The resin shall be listed by the I\PPI in its pipe grade registry "TR-4". All pipe sections shall be marked as prescribed by AWWA C906 and NSF/ANSI 61. All mechanical joint fittings shall be supplied with accessory kits.

G. Fire Hydrants

Fire hydrants shall conform to ANSI/AWWA C502 specifications, latest revision, for minimum 150-psi working pressure. Supplemental details are as follows; the hydrant will be of the compression type closing with line pressure, a sidewalk flange construction type with "break-away" hollow steel bolts or "Safety or Traffic Flange" shall be used in the barrel connection, the main valve shall be of synthetic rubber reinforced with steel or bronze, one piece bonnet, sealed oil or grease reservoir, no flat gaskets, O-Ring seals only, safety stem coupling, bronze drain valve facings, all bolts shall be electroplated zinc, mechanical attached tamper resistant nozzles. Bottom connections as noted, with one 5" diameter pumper nozzle, and two 2½" diameter opposite facing hose nozzles. Hose nozzle threads in conformity with ASA specifications B-26 for American Standard Fire Hose coupling screw thread, open left (counterclockwise). Pumper nozzle equipped with Storz-type, quick-connect fitting and cap, open left (counterclockwise). Storz couplings shall be constructed of A-356 high strength aluminum alloy and shall be equipped with a set of Type 302 stainless steel butterfly vanes designed to automatically open with water flow and automatically close by use of stainless steel torsion springs. Each coupling shall be supplied with an aluminum blind cap, rubber gasket and thread set screw. Storz couplings shall be Hydra-Storz or approved equal. Bury depth and foot joint connection as noted. Fire hydrant shall have epoxy coated shoe, and color of finish paint above ground line, safety yellow. Fire hydrant shall have a ductile iron protection device over bronze operating nut. Protection device and cap nuts shall conform to National Standard pentagon shaped nut, nut measures 1½" from point to flange. Hydrants must be complete with corrosion resistant bolts and mechanical joint accessory kits. Accessory kits shall be domestic make, cast within the United States or Canada. Only fire hydrant products such as the Kennedy Valve Co. Guardian, the Mueller Centurion 200, Waterous Pacer 100, Clow Valve Co. Medallion and EJ Co. Watermaster 5CD250, are currently approved in Pocatello system.

H. Resilient-Seated Gate Valves

Resilient-seated gate valves shall conform to ANSI/AWWA C509 or C515, latest revision, ductile iron body, epoxy coated inside, non-rising stem 2" square operating nut, left or counter-clockwise opening, working pressure 200-psi for 4" to 12", cold water end, ends as specified. All gate valves shall be NSF/ANSI 61 certified. Mechanical joint ends shall conform to ANSI A21.11 (AWWA C111), latest revision, and flange ends shall be in accordance with ANSI B16.1 (AWWA C500), latest revision. Valves shall be equipped with "O" ring type packing consisting of two synthetic rubber rings, set in grooves in the seal plate. Mechanical joint valves shall be complete with corrosion resistant bolts and accessory kits. Mechanical joint by flange valves shall be complete with full face gasket, corrosion resistant bolts, and an accessory pack. Accessory kits shall be domestic make, cast within the United States or Canada. Products made by Kennedy Valve Co., Mueller, and Clow Valve Co., or approved equal are currently approved in our system.

I. Plugs and Caps

Plugs and caps shall be AWWA class D, mechanical joint or push-on joint as specified, 250-lb class (solid, not tapped).

J. Repair Clamps

Repair clamps shall be single band, full circle (unless otherwise specified), type 304 stainless steel, complete with gasket and bolts. Ductile iron bolts and lugs are acceptable. Only products made by Ford, Romac, Mueller or Smith-Blair are currently accepted in our system.

K. Couplings

Couplings, 4" through 24", shall be of standard length and shall be made of ductile iron. End rings shall be cast from ductile iron per ASTM A536. End rings shall be color coded for easy identification. Couplings shall be complete with high strength, low alloy bolts and heavy hex nuts and shall meet the requirements of ANSI/AWWA C111, latest revision.

1. Straight Coupling. Only Romac 501, Ford FC1, and Smith-Blair 441 are accepted in our system.

2. Flanged Coupling Adapter. Only Romac FCA501, Ford FFCA, and Smith-Blair 912 are accepted in our system.

3. Transition Coupling. Only Romac 501, Ford FC2A, and Smith-Blair 441 are accepted in our system.

4. Reducing Coupling. Only Romac RC501, Ford FCR, and Smith-Blair R441 are accepted in our system.

L. Valve Box

Valve boxes shall be cast iron slip type as manufactured by D & L Supply, catalog number M-8042, Tyler/Union 6855 Series, East Jordan Iron Works 8555 Series, or equivalent items made by Olympic Foundry. Boxes shall be complete with drop-in type valve box covers (without locks) lettered "WATER". Riser rings shall be D & L Supply catalog number M-8048 through M-8055 or equivalent.

M. Polyethylene Water Tube

Polyethylene water service tubing shall conform to ANSI/AWWA C901 specifications, latest revisions, for ½" to 3" class 200-psi (SDR9). All tubing shall be of the Copper Tubing Size-OD (CTS) and shall conform to ASTM D-2737. Polyethylene tubing shall have a blue exterior and shall be made from prime virgin resins exhibiting a cell classification of PE 3408 and ASTM D3350. All pipe sections shall be marked as prescribed by AWWA C901 and NSF/ANSI 61. Stainless steel insert stiffeners are required. Polyethylene pipe shall be supplied in 300’ rolls or as otherwise specified.

N. Service Line Saddles

Service line saddles, ¾" through 2", shall conform to ANSI/AWWA C800, latest revision. Saddles shall be single stainless steel band design with tapered gasket. Outlet shall be AWWA (CC) type thread. They shall be as manufactured by Ford catalog number FS313, or Romac, catalog number 306.

O. Service Line Fittings

Service line fittings shall conform to ANSI/AWWA C800, latest revision, compliant with NSF/ANSI 61, "No-Lead Brass" requirement. Products made by Ford and A.Y. McDonald are currently approved for use in our water system. Compression connection type shall be Ford "Pack Joint", or approved equal, unless otherwise noted.

1. Ball Type Corporation Stop. Ball type corporation stops shall have TFE coated ball with nitrile (BUNA-N) rubber seats and blow-out proof stem with O-ring seal. Inlet shall be AWWA (CC) type thread. Outlet shall be copper compression. They shall be as manufactured by Ford catalog number FB1000 or A.Y. McDonald 74701B-22.

2. Angle Ball Meter Valve. Angle ball meter valves shall have TFE coated ball with nitrile (BUNA-N) rubber seats, blow-out proof stem with O-ring seal and shall be equipped with lockwings. Inlet shall be copper compression for ¾" and 1", and FIP for 1½" and 2". Outlet shall be swivel nut meter connection with meter support lip for ¾" and 1", and flanged meter connection for 1½" and 2".

3. Angle Dual Check Valve. Angle dual check valve shall meet or exceed the requirements of ASSE 1024 standard. They shall have dual independently acting checks, 175 PSIG pressure rating and access cap with O-ring seal for maintenance and inspection. Inlet shall be swivel nut meter connection with meter support lip for ¾" and 1", and flanged meter connection for 1½" and 2". Outlet shall be copper compression for ¾" and 1", and FIP for 1½" and 2".

4. Copper Meter Setter Assembly. Copper meter setter assemblies required for 1½" and 2" services. They shall have horizontal inlet and outlet with FIP thread ends and no bypass. They shall be as manufactured by Mueller, catalog number B-2422-2, or Ford catalog number for 1½" VBHH76-18-11-66 or for 2" VBHH77-18-11-77, or approved equal. All meter setter assemblies shall have **NO** by-passes.

P. Water Meter Box Adjusting Ring

Cast iron water meter pit adjusting ring as manufactured by D & L Supply, catalog number L-2334, or approved equal.

1.6 CONSTRUCTION PROGRESS SCHEDULE

A. Work under the contract shall be scheduled and performed in such a manner as to result in the least possible disruption to the operation of the existing facilities. Contractor shall not operate any existing valves, pumps, or motors. The Contractor shall submit to the Engineer a construction schedule covering the entire work before any work is commenced. The schedule shall be as described in Section 01 32 16 – Construction Progress Schedule, complete with estimated dates for start and finish of each item of work. The construction constraints are as described in Section 01 35 13 - Special Project Procedures. The construction sequences described therein are suggested methods to accomplish the work. The Contractor shall remain responsible for the successful completion of all work.

B. To minimize the period of disruption of facility operation, all new piping and/or facilities should be constructed and all preparations shall be made for fast connection to existing piping and facilities.

C. Submit preliminary construction progress schedules as required in the General Conditions within ten (10) days after the award of the contract. The progress schedule is to be in reproducible form and subject to the approval of the Engineer.

D. Commence work on or before a date to be specified in a written "Notice to Proceed" and complete all phases of the work as specified in C-550.

E. The time is computed on a calendar basis. The contractor acknowledges that construction during the winter at the project site will require cold weather construction methods.

1.7 PUBLIC WORKS CONTRACTOR'S LICENSE

A. Any Contractor, Subcontractor, or Specialty Contractor is required to have a current license as a Public Works Contractor in the State where the work is to be completed in order to submit a bid or proposal on this contract.

1.8 CODES AND STANDARDS

A. Where codes and standards are referred to, they are the current approved codes. It is the duty of the Contractor to obtain from its supplier any material on this work to submit evidence, if requested, that provided material is in compliance with the applicable codes and standards.

1.9 STATE AND LOCAL LAWS

A. Conform to all applicable State and local laws in carrying out obligations under the contract.

B. Meet the requirements and recommendations of the Manual of Accident Prevention in Construction; Associated General Contractors of America, Inc., and Occupational Safety and Health Act.

1.10 PREDETERMINED EQUIPMENT COSTS

A. The following methods of determination of construction equipment costs apply to all Change Orders and other adjustments of contract price except for Article 15, Suspension of Work and Termination, outlined in the General Conditions.

1. Allowable ownership and operating expense costs for construction equipment in sound workable conditions owned and furnished by the Contractor for work requiring adjustments in contract price shall be based on the applicable provisions of the U.S. Army Corps of Engineers North Pacific Division (NPD) "Equipment Ownership and Operating Expense Schedule." If, for any reason, the schedule referred to above is discontinued or becomes otherwise unavailable, the Owner and the Contractor shall agree upon another schedule or method of price adjustment which, in their opinion, will result in an equitable adjustment of contract price. For forwarding pricing, the issue of NPD Schedule in effect at the time of negotiations shall apply. For retrospective pricing, the issue of the NPD Schedule in effect as of the time work was performed shall apply.

2. For the purpose of determination of the hourly rates to be applied under this contract, working conditions shall be considered to be average unless otherwise determined by the Owner. Rate for equipment not in the schedule may be used for unlisted equipment of comparable horsepower and auxiliary features.

3. For rented equipment, the Owner will accept rates actually paid (substantiated by certified reproduced copies of invoices or bills), but in no event shall they exceed the rates contained in the current "Rental Rate Blue Book for Construction Equipment," published by Equipment Guide-Book Company, 3980 Fabian Way, Palo Alto, California 94303. When the "Blue Book" rates are applied, fuel, lubricants and operating expendables will be computed in accordance with NPD Schedule. Additional shifts or fractions thereof for rented equipment will be computed at 50 percent of the base rate in the "Blue Book" or invoices, as applicable. Rates for equipment under lease-purchase or sale-leaseback arrangements will be determined in accord with NPD Schedule. Rates for equipment rented from an organization under common control will be determined in accord with the NPD Schedule, and no markup will be permitted. A copy of the NPD Schedule will be provided to the successful bidder upon request.

1.11 PRODUCT SUBSTITUTIONS

A. Where equipment and/or materials are specified by name in these Specifications or on the Plans, it is the intention of the Engineer for these items to be used in completion of the Work. Product substitutions will be considered as indicated in Paragraph 7.05 and 7.06 of the General Conditions.

B. Request approval for substitutions by submitting written evidence and convincing Engineer of equality of item and suitability for the service and/or construction conditions anticipated.

C. If alternative equipment or materials are approved, make required changes in structures, buildings, piping, systems, etc., necessary to accommodate alternate items without additional cost to the Owner except as specifically noted for Owner furnished materials.

1.12 PERMITS

A. The Contractor shall be responsible to obtain and pay for all construction and inspection permits required by the State of Idaho, Bannock County, and the City of Pocatello and shall include permit fees as required for all aspects of the project.

1. It is the intention of the Owner to pay for City of Pocatello building permits associated with the new facility and have the Contractor pull the permits prior to initiating work. Project is in Pocatello, Idaho.

B. Mechanical permit (HVAC) shall be obtained from regulating authority.

C. Electrical and plumbing permits shall be obtained from the Idaho Division of Building Safety, and the State will charge a permit fee based on the cost of materials and labor for the plumbing work and the electrical work. State permits may be obtained online and additional information is available at dbs.idaho.gov.

1.13 WAGE RATES

A. The general prevailing rate of wages, as determined by the Secretary of Labor, is NOT a requirement of this project.

1.14 SURVEYING

A. Surveying: The Contractor shall provide all engineering surveys for the work including any additional reference points needed for construction of the project. Engineering survey includes scheduling, coordinating, and providing all construction surveying, staking and calculations essential for the completion of the project and to properly control the work in its entirety. Provide quantity measurements and computations for pay items. Perform all work in accordance with the plans and specifications and standard Engineering and Surveying practices under the responsible charge of a Professional Land Surveyor duly and properly registered in the State of Idaho. The Contractor is responsible for survey and control of the work and for correcting Contractor errors at no additional cost, whether the errors are discovered during the actual survey work or in subsequent phases of the project. The Contractor is responsible for replacement of any survey monument disturbed by the Contractor during construction.

B. Personnel: Furnish technically qualified survey crews and crew supervisor capable of performing in a timely and accurate manner and experienced in construction surveying and layout. The qualified crew supervisor shall be on the project whenever surveying/staking is in progress.

C. Equipment: Furnish survey instruments and supporting equipment capable of achieving the specified results and accuracy in the survey work.

D. Submittals: All submittals shall be signed and sealed by a Professional Land Surveyor duly and properly registered in the State of Idaho. Resubmittals may be required depending on completeness and correctness of the work. Submittals shall not relieve the Contractor of the responsibility for maintaining the survey work and for correcting errors, whether the errors are discovered during the actual survey work or in subsequent phases of the project. Keep all field notes, diaries and books according to Standard Surveying practice. Submit quantity measurement and quantity calculations at least once per month covering the work completed by the Contractor since the pervious progress payment request submitted by the Contractor. Loose-leaf books will not be accepted. Make available the field notebooks and forms used for the work to the Engineer upon request (either verbally or in writing) at any time.

E. Costs: The Contractor shall include the costs of providing engineering survey services in other work items. No separate payment will be made to the Contractor for providing engineering surveys during construction.

F. Record Documents: Locations of all installed items including buried utilities shall be recorded by the Contractor. It is expected that horizontal offsets from monuments along the utility lines shall be recorded in the record drawings. GPS coordinates of the installed lines are not required. Upon completion of the project, two (2) sets of reproducible "as-staked" drawings and one (1) electronic copy of reproducible "as-staked" drawings which clearly show all final dimensions, all utility lines, tie-ins, and deviations from contract plans will be submitted to Engineer. The costs for providing these location services to complete the "as-staked" drawings shall be incidental to the work.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 11 00

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SECTION 01 14 13 - ACCESS TO SITE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the Work. It shall be the Contractor's responsibility to construct and maintain any haul roads required for its construction operations.

1.2 TEMPORARY CROSSINGS

A. General: Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, and hospitals. Safe and adequate public transportation stops and pedestrian crossings at intervals not exceeding 300 feet shall be provided. The Contractor shall cooperate with parties involved in the delivery of mail and removal of trash and garbage so as to maintain existing schedules for such services. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time.

B. Temporary Bridges: Wherever necessary, to maintain vehicular crossings, the Contractor shall provide suitable temporary bridges or steel plates over unfilled excavations, except in such cases as the Contractor shall secure the written consent of the responsible individuals or authorities to omit such temporary bridges or steel plates, which written consent shall be delivered to the Engineer prior to excavation. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case, and the Contractor shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.

C. Street Use: Nothing herein shall be construed to entitle the Contractor to the exclusive use of any public street, alleyway, or parking area during the performance of the Work hereunder, and it shall conduct its operations to not interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No street shall be closed to the public without first obtaining permission of the Engineer and proper governmental authority. Where excavation is being performed in primary streets or highways, one lane in each direction shall be kept open to traffic at all times unless otherwise indicated. Toe boards shall be provided to retain excavated material if required by the Engineer or the agency having jurisdiction over the street or highway. Fire hydrants on or adjacent to the Work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the Contractor to assure the use of sidewalks and the proper functioning of all gutters, storm drain inlets, and other drainage facilities.

1.3 CONTRACTOR'S WORK AND STORAGE AREA

A. The Owner will designate and arrange for the Contractor's use, a portion of the property adjacent to the Work for its exclusive use during the term of the Contract as a storage and shop area for its construction operations on the Work. At completion of Work, the Contractor shall return this area to its original condition, including grading and landscaping.

B. The Contractor shall make its own arrangements for any necessary off-Site storage or shop areas necessary for the proper execution of the Work.

C. The Contractor shall construct and use a separate storage area for hazardous materials used in constructing the Work as specified in Section 01 57 12 - Construction Site Discharge.

1. For the purpose of this paragraph, hazardous materials to be stored in the separate area are all products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, Flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, two-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.

2. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.

3. The Contractor shall develop and submit to the Engineer a plan for storing and disposing of the materials above.

4. The Contractor shall obtain and submit to the Engineer a single EPA number for wastes generated at the Site.

5. The separate storage area shall meet all the requirements of all authorities having jurisdiction over the storage of hazardous materials.

6. The separate storage area shall be inspected by the local Fire Chief prior to construction of the area, upon completion of construction of the area, and upon cleanup and removal of the area.

7. All hazardous materials which are delivered in containers shall be stored in the original containers until use. Hazardous materials which are delivered in bulk shall be stored in containers which meet the requirements of authorities having jurisdiction.

1.4 PARKING

A. The Contractor shall:

1. Provide temporary parking areas for its employees and construction equipment.

2. The Contractor shall direct its employees to park in areas indicated.

3. Traffic and parking areas shall be maintained in a sound condition, free of excavated material, construction equipment, mud, and construction materials. The Contractor shall repair breaks, potholes, low areas which collect standing water, and other deficiencies.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 14 13

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SECTION 01 25 13 - PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This document describes the requirements for submission of product information and procedures for consideration of substitutions by Owner, including products proposed to be used by Contractor under "or equal" or "acceptable alternate" provisions.

B. Where equipment, materials or process have been specifically named, it is the intention of the Engineer to use these items. If a Contractor desires to have an alternate considered, they are to provide the following information. It will be the responsibility of the Contractor to convince the Engineer that the alternate materials are equal and will perform the intended function at or above that of the specified equipment. The burden of proof is on the Contractor to convince the Engineer that the product is equal for the purpose of a particular function.

C. Substitution or Alternative Product Options: The alternative materials shall be submitted to Engineer no less than 10 business days before the bid opening. Engineer shall evaluate the materials, and if Engineer approves the substitution, an addendum shall be issued allowing the equipment alternatives.

1.2 DEFINITIONS

A. The word “Products,” as used herein, is defined to include purchased items form incorporation into the work, regardless of whether specifically purchased for the project or taken from Contractor’s stock of previously purchased products. The word “Materials,” is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of work. The word “Equipment” is defined as products with operation parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including “specialties”, “system”, “structure”, “finishes”, “accessories”, “furnishings”, “special construction”, and similar items, which are self-explanatory and have recognized meanings in the construction industry.

B. Neither “Products” nor “Materials” nor “Equipment” includes machinery and equipment used for preparation, fabrication, conveying and erection of the Goods.

1.3 CONTRACTOR’S OPTIONS

A. For products specified only by reference standards, select any product meeting standards, by any manufacturer.

B. For products specified by naming several products or manufacturers, select any product and manufacturer named.

C. For products specified by naming one or more products, but indicating the option of selecting equivalent products by stating "or equal" or "acceptable alternate" after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.

1. "Or-Equal" Items: if in the Engineer's sole judgment an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related work will be required, it may be considered by the Engineer as an "or-equal" item, in which case review and approval of the proposed item may in the Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purpose of the paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. It is at least equal in quality, durability, appearance, strength and design characteristics.

b. It will reliably perform at least equally well the function imposed by the design concept of the complete project as a functioning whole;

c. There is no increase in cost to the Owner, and

d. It will conform to the detailed requirements of the item named in the Contract Documents.

D. For products specified by name, brand, model, etc., the Contractor shall provide information as required below for the Engineer to review and determine under their sole discretion that the product is acceptable.

1.4 SUBSTITUTIONS

A. If in the Engineer's sole judgment an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, it will be considered a proposed substitute item and subject to the review process.

B. If Contractor wishes to furnish or use a substitute item of material or equipment, Contractor shall first make written application to the Engineer for review of a proposed substitute item of material or equipment. The application shall certify that the proposed substitute will perform adequately the function and achieve the results called for by the general design, be similar in substance to the specified and be suited to the same use that is specified.

C. The procedure for review by the Engineer will include the following:

1. If the Contractor wishes to provide a substitution item, the Contractor shall make written application to the Engineer.

2. Unless otherwise provided by law or authorized in writing by the Engineer, the request shall be submitted within a 35-day period after award of the Contract.

3. Wherever a proposed substitution item has not been submitted within said 35-day period, or wherever the submission of a proposed substitution material or equipment has been judged to be unacceptable by the Engineer, the Contractor shall provide the material or equipment indicated in the Contract Documents.

4. The Engineer will evaluate each proposed substitution within a reasonable period of time.

5. As applicable, no shop drawing submittals shall be made for a substitution item nor shall any substitution item be ordered, installed, or utilized without the Engineer's prior written acceptance of the Contractor's request.

6. The Engineer will record the time required by the Engineer in evaluating substitutions proposed by the Contractor and in making changes by the Contractor in Contract Documents occasioned thereby.

D. Contractor shall submit sufficient information as provided below to allow the Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and therefore an acceptable substitute therefore. Requests for review of proposed substitute items of materials or equipment will not be accepted by the Engineer from anyone other than the Contractor. Include the following minimum information in the application:

1. The Contractor shall certify that the proposed substitution will perform adequately the functions and achieve the results called for by the general design, and be similar and of equal substance to that indicated, and be suited to the same use as the specified.

2. For products:

   a. Product identification, including manufacturer's name and address.

   b. Manufacturer's literature:

      1) Product description

      2) Performance and test data

      3) Reference standards

3. Samples.

4. Name and address of similar projects on which product was used and date of installation.

5. All variations of the proposed substitute item for the specified shall be identified in the application and available engineering, sales, maintenance, repair and replacement service shall be indicated.

6. The application shall state the extent, if any, to which the use of the proposed substitute will prejudice Contractor's achievement of delivery on time, whether or

not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provision of any other direct contract with Owner for work on the project) to adapt the design to the proposed substitute item and whether or not incorporation or use of the substitute in connection with the work is subject to payment of any license fee or royalty.

7. Relation to separate contracts.

8. The application shall also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other sellers affected by any resulting change, all of which will be considered by the Engineer in evaluating the proposed substitute item.

E. In making request for substitution, Contractor shall:

1. Investigate proposed product or method and determine that it is equal or superior in all respects to that specified.

2. Provide the same guarantee for substitution as for product or method specified.

3. Coordinate installation of accepted substitution into work, making such changes as may be required for work to be complete in all respects.

4. Waive all claims for additional costs related to substitution which consequently become apparent.

5. Ensure cost data is complete and includes all related costs under this contract, but excludes:

a. Costs under separate contracts

b. Engineer's redesign

F. Substitutions will not be considered if:

1. They are indicated or implied on shop drawings or project data submittals without formal request submitted in accord with Paragraph 1.05.

2. Acceptance will require substantial revision of work.

G. Contractor shall provide all data in support of any proposed substitute or “or-equal” at Contractor’s expense.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 25 13

SECTION 01 29 00 – PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Measurement and payment will be made as specified in this Section and in accordance with the provisions of the General Conditions.

B. The Contractor is informed that 2% of the total Contract Price will be deducted from any money due the Contractor as progress payments until the Original CPM Schedule Submittal outlined in Section 01 32 16 (Construction Progress Schedule) has been completed as specified. The aforementioned amount will be retained by the Owner as agreed, estimated value of completing the original schedule. Any such retention of money for failure to complete all such mobilization items as a lump-sum item shall be in addition to the retention of any payments due to the Contractor as specified in the General Conditions of the Contract.

C. The Contractor is alerted to the provisions in Section 3.1 of Section 01 71 13 regarding payment provisions for Mobilization.

D. The Contractor is alerted to the provisions in Section 1.4 of Section 01 78 23 regarding payment provisions as it relates to the Owner's Manual submittal.

1.2 SCHEDULE OF VALUES

A. The Contractor shall prepare and submit a detailed Schedule of Values to the Engineer within 30 days from the date of Notice to Proceed. The detailed Schedule of Values shall be based on the values listed in the Bid Schedule. Because the ultimate requirement is to develop a detailed Schedule of Values, sufficient detailed breakdown shall be provided to meet this requirement. The Engineer shall be the sole judge of acceptable numbers, details and description of values established. If, in the opinion of the Engineer, a greater number of Schedule of Values items than proposed by the Contractor is necessary, the Contractor shall add the additional items so identified by the Engineer.

B. The minimum detail of breakdown of the major Work components is indicated.

1. Mobilization and demobilization 2% of contract time - no breakdown required.

2. Construction schedule.

3. Civil site Work shall be broken down into individual drainage piping, drainage structures, site concrete, paving, excavation cut and fill, removal of existing pipe, clearing and grubbing, demolition, and any other items determined to be necessary for the establishment of pay items.

4. Concrete structures shall be broken down into excavation, subgrade preparation, and appurtenant prefoundation Work, concrete foundation construction, slabs on grade, walls/columns, suspended slabs, stairs, etc., hydrostatic structure testing and backfill.

5. Buildings shall be broken down into walls, roofs, decks, insulation, doors/windows/louvers and any other items determined to be necessary for establishment of pay items.

6. Protective Coating Work shall be broken down by structure area and yard. Where specific coating Work at structure areas or yard may be critical to performing the Work to meet milestone and Contract dates, such Work shall be included as individual pay items.

7. Mechanical Work shall be broken down to identify individual piping systems, equipment installation by equipment name and number, and equipment testing and checkout.

8. The electrical Work shall be broken down by yard facilities and structures. Yard facilities shall be broken down by duct bank designation and substations. Structures electrical Work shall be broken down into conduit and raceway installation, cable and wire installation, electrical equipment installation, terminations and lighting.

9. Instrumentation and Control Work.

10. All other Work not specifically included in the above items shall be broken down as necessary for establishment of pay items.

C. The Contractor and Engineer shall meet and jointly review the detailed Schedule of Values within 35 days from the date of Notice to Proceed. The value allocations and extent of detail shall be reviewed to determine any necessary adjustments to the values and to determine if sufficient detail has been proposed. Any adjustments deemed necessary to the value allocation or level of detail shall be made by the Contractor and a revised detailed Schedule of Values shall be submitted within 40 days from the date of Notice to Proceed.

1.3 CHANGES TO SCHEDULE OF VALUES

A. Changes to the schedule of values shall be made to reflect Owner approved change orders.

B. In the event that the Contractor and Engineer agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values.

1.4 TECHNICAL MANUAL SUBMITTAL

A. Potentially up to two percent of the Contract Price will be retained from any monies due the Contactor, if at the 75 percent construction completion point, technical manuals have not been submitted as required by Section 01 78 23 – Operation and Maintenance Data.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 29 00

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SECTION 01 31 19 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contractor shall attend all Project meetings. Contractor's representative shall include Supervisor or Superintendent and shall have the required authority to commit the Contractor to solutions agreed upon. Other Contractor and subcontractor representatives may attend Project meetings as desired.

B. Contractor shall provide all pertinent Work-related reports or documents for each meeting as requested by the Owner.

C. Engineer will record minutes of all meetings and will furnish one (1) copy to the Contractor. Recipients of copies may make and distribute such other copies as they wish.

D. Contractor shall advise the Engineer of any inaccuracies, discrepancies, objections, or missing items in the minutes within five (5) calendar days of receipt of the minutes.

1.2 PRECONSTRUCTION CONFERENCE

A. A preconstruction conference will be convened to designate responsible personnel, discuss scheduling, shop drawing procedures, pay applications processing, project supervision, coordination, progress reports, payrolls, labor provisions, and to establish a working understanding among the parties as to the Work. The Contractor will be responsible to have all subcontractors and major suppliers represented at the preconstruction meeting.

B. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to the Contractor prior to the meeting date. However, the Contractor should be prepared to discuss all of the items listed below.

1. Status of Contractor's insurance and bonds.

2. Issuance of Notice to Proceed

3. Contractor's tentative schedules.

4. Transmittal, review, and distribution of Contractor's submittals.

5. Processing applications for payment.

6. Maintaining record documents.

7. Critical work sequencing.

8. Field decisions and Change Orders.

9. Use of Site, office and storage areas, security, housekeeping, and Owner's needs.

10. Major equipment deliveries and priorities.

11. Contractor's assignments for safety and first aid.

12. Daily Report Form.

13. Submittal Transmittal Form which the Engineer will furnish.

C. Unless previously submitted to the Engineer, the Contractor shall bring to the conference one copy each of the following:

1. A preliminary schedule of Shop Drawings, Samples, and proposed Substitute or Equal submittals listed in the Bid.

2. A list of all permits and licenses the Contractor shall obtain indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.

3. A preliminary schedule of values in accordance with the bid schedule.

4. A 60-day plan of operation in accordance with Section 01 32 16 – Construction Progress Schedule.

5. Procurement schedule of major equipment and materials and items requiring long-lead time.

D. The Engineer will preside at the preconstruction conference and will arrange for keeping and distributing the minutes to all persons in attendance.

E. The Contractor and its subcontractors should plan on the conference taking no more than 1 full working day.

1.3 PROGRESS MEETINGS

A. The Engineer will arrange and chair **biweekly** progress meetings. These meetings will be held at the project site and held throughout the course of active construction. The Contractor is to ensure that an authorized representative, having authority to act for and on behalf of the Contractor and having full knowledge of the Work and the contract schedule attend the meetings.

B. Representatives of the Contractor's suppliers and subcontractors, and parties providing services for the same, may attend the meeting if the Contractor elects to invite them to assist the Contractor's representatives at the meetings.

C. Relay agenda items to Engineer at least 24 hours prior to meeting.

D. Suggested Agenda

1. Review of Work progress

2. Field observations, problems, and conflicts

3. Problems that impede construction schedules

4. Review of off-site fabrication and delivery schedules

5. Corrective measure and procedures to regain projected schedules

6. Revisions to construction schedules

7. Plan progress schedules during succeeding work period

8. Coordination of schedules

9. Review submittal schedules, field orders, change orders, RFIs, and pay applications; expedite as required

10. Maintenance of quality standards

11. Review proposed changes for effect on construction schedules and on completion dates

12. Other business

1.4 OTHER MEETINGS

A. Other meetings will be held from time to time as may be requested by the Owner or Contractor. Time and place of meeting shall be as mutually agreed upon. Those required to be in attendance at meetings shall be as requested.

B. Other meetings shall also include meetings with regulatory agencies. When requested, the Contractor shall attend meetings held or required by governmental regulatory agencies having jurisdiction of the Work.

C. Other meetings also include Post-Construction Conference. The Post-Construction Conference will be held prior to initial acceptance of the Work to discuss and resolve all unsettled matters.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 31 19

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SECTION 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Scheduling of the Work shall be performed by the Contractor in accordance with the requirements of this Section. The purpose of the Construction Schedule is to allow the Contractor to prepare an orderly plan to aid in the timely completion of the project.

B. Development of the schedule and project status reporting requirements of the Contract shall employ computerized Critical Path Method (CPM) scheduling.

C. The approved Construction Schedule shall be used to plan and execute the Work, to measure the progress of the Work, and to aid in evaluating time extensions.

D. Failure to maintain the Construction Schedule in an approved status may result in the Owner withholding a monetary penalty against the responsible Contractor(s) until the schedule is approved as set forth in 3.4 of this Section.

PART 2 - PRODUCTS

2.1 CONSTRUCTION SCHEDULE

A. Prepare a detailed construction schedule in graphic form showing duration and proposed dates of starting and completing each major division of the Work. The schedule is to be consistent with the time and order of Work requirements of the specifications, and is to be the basis of the Contractor’s operations. Prepare the schedule utilizing a Gantt chart (bar type) or similar method that connects related activities.

B. Sufficient detail shall be included for the identification of subdivisions of the major components listed below. The major components should be broken in into activities such as excavation, foundation subgrade preparation, foundation concrete, completion of all structural concrete, CMU, roof, pump/equipment, mechanical and plumbing installation, electrical power and controls, coatings, and other activities as required.

1. Site Work
2. Yard Piping
3. Site Grading
4. Well #2R Well House
5. Well #22R Well House
6. System Testing and Startup (Specification 01 75 16)

C. Submit a horizontal bar chart with separate line for each section of Work, identifying first work day of each week.

D. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration. Clearly indicate critical path and activities/items on the critical path.

E. Indicate estimated percentage of completion for each item of Work at each submission.

F. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates.

PART 3 - EXECUTION

3.1 INITIAL SCHEDULE SUBMITTAL

A. The Contractor shall submit two short-term schedule documents at the Pre-construction Conference which shall serve as the Contractor's Plan of Operation for the initial 60-day period of the Contract Time, and to identify the manner in which the Contractor intends to complete all Work within the Contract Time.

B. The bar chart shall show the accomplishment of the Contractor's early activities (mobilization, permits, submittals necessary for early material and equipment procurement, and long lead, CPM submittals, initial site work and other submittals and activities required in the first 60 days).

C. Following the Contractor’s receipt of the Engineer’s review comments, the Contractor shall correct the schedule to identify missing activities and relationships relevant to the Scope of Work. No time extensions will be granted to complete activities not initially included in the Contractor’s Construction Schedule.

D. To the extent that there are any conflicts between the approved Construction Schedule and the requirements of the Contract Documents, the Contract Documents shall govern.

3.2 FINAL CONSTRUCTION SCHEDULE SUBMISSION

A. The Final Construction Schedule shall be submitted for approval within 60 calendar days after Notice to Proceed is issued. It shall provide a reasonable level of detail and a reasonable sequence of activities which represent Work through the entire project.

B. The Construction Schedule shall show the sequence and interdependence of activities required for complete performance of the Work, beginning with Contractor’s receipt of the Notice to Proceed and concluding with the date of Final Completion of the Contract. The Project Schedule shall show all activities in workdays, with allowance for holidays and the effects of normal weather conditions on outside work.

C. The Construction Schedule shall comply with all limits imposed by the Scope of Work, with all contractually specified intermediate milestones and completion dates, and with all constraints, restraints, or sequences included in the Contract.

D. Procurement Activities: Prepare the schedule in chronological order of submittals. Show specification section of the submittal, name of contractor and generic description of work

covered. Include activities to cover the complete procurement process to include but not limited to: submittal, review, approval, resubmittal, procurement, fabrication, delivery, permits, and similar pre-construction work.

E. Manpower:

1. All activities shall have an estimate of the average number of workers per day that are expected to be used during the execution of the activity.

2. Identification of any manpower, material or equipment restrictions, as well as any activity requiring unusual shift work, such as two (2) shifts per day, six (6) day work week, specified overtime, or work at times other than regular days or hours, shall clearly be identified in the Project Schedule.

3. Critical or near Critical Paths resulting from the use of manpower or equipment restraints shall be kept to a minimum. (Near Critical Paths are defined as paths having 10 workdays or less of total float.)

F. Responsibility: All activities shall be identified in the Construction Schedule by the party responsible to perform the Work. Responsibility includes, but is not limited to, the Contracting Firm, the Subcontracting Firm, Contractor Workforce, or Agency performing a given task. Activities shall not belong to more than one responsible party.

G. Work Areas:

1. Arrange the schedule to show each major area of construction for each major category or unit of Work.

2. All activities shall be identified in the Construction Schedule by the Work area in which the activity occurs. Activities shall not be allowed to cover more than one work area.

H. Modification or Claim Number: Any activity that is added or changed by a change order or used to justify any claimed time, shall be identified by change order code that changed the activity. Activities shall not belong to more than one change order.

I. Milestones: The Construction Schedule shall start no earlier than the date that the Notice to Proceed (NTP) was issued. Milestone dates are defined in calendar days following the date set forth in the Notice to Proceed and are required to be met by all Contractors. Time is of the essence for the completion of Milestones and for the Contract Completion date.

3.3 PERIODIC SCHEDULE UPDATES

A. Submit revised schedule with each Application for Payment, identifying changes since previous version.

B. Provide recommendations for adjusting the Construction Schedule to meet milestone completion and Contract completion dates (include why the schedule needs adjusting, i.e., change order, weather, contractor resources, etc.).

C. The Contractor shall prosecute the Work in accordance with the approved Construction Schedule. Out of sequence construction, defined as a change from the Construction Schedule in the Contractor's actual operation, requires prior approval from the Engineer.

D. Upon the approval of a change order or the issuance of a unilateral change order by the Owner the agreed-upon change order activities, activity durations, logic and impacts shall be reflected in the next schedule submittal by the Contractor.

3.4 PAYMENT FOR CPM SCHEDULES

A. The Contractor's attention is directed to the condition that 2% of the total Contract Price will be deducted from any money due the Contractor as progress payments until the Original CPM Schedule Submittal listed above has been completed as specified. The aforementioned amount will be retained by the Owner as agreed, estimated value of completing the original schedule. Any such retention of money for failure to complete all such mobilization items as a lump-sum item shall be in addition to the retention of any payments due to the Contractor as specified in the General Conditions of the Contract.

B. Approval of subsequent monthly pay requests may be delayed unless accompanied by a copy of the monthly update to the CPM schedule as described above. Extensive delays in submission of the monthly update may constitute sufficient basis for the Engineer to recommend withholding of some or all of any payment.

END OF SECTION 01 32 16

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Wherever submittals are required hereunder, all such submittals by the Contractor shall be submitted to the Engineer as delineated in this Section.

B. At the Pre-Construction Conference, the Contractor shall submit the following items to the Engineer for review:

1. A preliminary construction schedule.

2. A preliminary schedule of Shop Drawings, Samples, and proposed Substitutes ("Or-Equal") submittals listed in the Bid.

C. The Contractor shall provide an internet-based construction management software package (ConDoc, ProCore, or equal) for submitting and tracking project related documents such as RFI's and Submittals. Access to and the use of this internet-based construction management site will be provided at no cost to the Engineer and Owner.

1.2 ENGINEER'S REVIEW PERIOD

A. For planning purposes, the Contractor shall assume a minimum of 14 days for review by the Engineer following receipt of submittal/resubmittal. If an expedited review is requested by the Contractor, the submittal shall identify the requested expedited review. The Engineer will attempt to accommodate the expedited review.

1.3 SUBMITTAL PROCEDURES

A. Verify that the material or equipment described in each submittal conforms to all requirements of the Specifications and drawings. Where the detailed specifications require specific submittal data, submit all data at the same time. The submittals are to be accompanied by the transmittal form attached at the end of this Section. The Engineer will return for resubmittal any information not accompanied by the specified transmittal form, properly completed.

B. Indiscriminate submittal of only manufacturer's literature is unacceptable and will be rejected.

C. The submittals shall be numbered as XXXXXX-YY-z., where XXXXXX is the specification section number, YY is the sequential number of the submittal, and Z is used for re-submittal labeled a through z. For example, the first submittal of an item from Section 32 13 13 – Concrete for Exterior Improvements would be numbered "32 13 13-01"; the first re-submittal of the submittal would be numbered "32 13 13-01-A".

D. A separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be rejected. A multiple page submittal shall be collated

into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the Engineer.

E. Identify Project, Contractor, subcontractor or supplier, pertinent Drawing sheet and detail number(s), and specifications section number, as appropriate.

F. All Contractor shop drawings submittals shall be carefully reviewed by an authorized representative of the Contractor, prior to submission to the Engineer. Each submittal shall be dated, signed, and certified by the Contractor, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. No consideration for review by the Engineer of any Contractor submittals will be made for any items which have not been so certified by the Contractor. All non-certified submittals will be returned to the Contractor without action taken by the Engineer, and any delays caused thereby shall be the total responsibility of the Contractor.

G. Do not mark the submittals in red. Ensure that any marks are duplicated on all copies submitted. Outline the marks on reproducible transparencies in a rectangular box.

H. Coordinate submission of related items.

I. Identify variations from Contract Documents and product or system limitation which may be detrimental to successful performance of the completed Work.

J. Provide space for Contractor and Engineer Review stamps.

Submit electronic submittals to:
Keller Associates, Inc.
c/o Colter Hollingshead
305 North 3rd Ave
Pocatello, ID 83201
chollingshead@kellerassociates.com

K. Electronic submittals:

1. Electronic submittals shall be submitted in PDF format and combined into a single file.

2. Engineer will return comments only.

3. Contractor is responsible for distributing copies of the submittal and Engineer's comments to concerned parties.

4. Engineer may require hard copies in lieu of an electronic submittal if, in the opinion of the Engineer, the electronic submittal is difficult to read.

L. Revise and resubmit submittals as required, identify all changes made since previous submittals.

M. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.4 DEVIATIONS FROM CONTRACT

A. If the Contractor proposes to provide material or equipment which does not conform to all of the Specifications and Drawings, the transmittal form accompanying the submittal copies shall indicate under "comments" the deviations.

1.5 SHOP DRAWINGS

A. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, list, graphs, catalog sheets, data sheets, and similar items. Whenever the Contractor is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state wherein the project is to be built, unless otherwise directed.

B. Except as may otherwise be indicated herein, the Engineer will return submittal to the Contractor with comments. The Contractor shall make a complete and acceptable submittal to the Engineer by the second submission of a submittal item.

C. If submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.

D. If submittal is returned to the Contractor marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal will not be required.

E. If submittal is returned to the Contractor marked "AMEND-RESUBMIT," the Contractor shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the Engineer.

F. If submittal is returned to the Contractor marked "REJECTED-RESUBMIT," the Contractor shall revise said submittal and shall resubmit the required number of copies of, said revised submittal to the Engineer.

G. Fabrication of an item shall be commenced only after the Engineer has reviewed the pertinent submittals and returned copies to the Contractor marked either "NO EXCEPTIONS TAKEN" or “MAKE CORRECTIONS NOTED". Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements.

1.6 ORGANIZATION

A. A single submittal transmittal form shall be used for each technical specification section or item or class of material or equipment for which a submittal is required. A single submittal covering multiple sections will not be acceptable, unless the primary specification references other sections for components..

B. On the transmittal form, index the components of the submittal and insert tabs in the submittal to match the components. Relate the submittal components to specification paragraph and subparagraph, drawing number, detail number, schedule title, room number, or building names, as applicable.

C. Unless indicated otherwise, terminology and equipment names and numbers used in submittals shall match those used in the Contract Documents.

1.7 EFFECT OF ACCEPTANCE OF CONTRACTOR INFORMATION

A. Acceptance by the Engineer of any drawings, method of work, or any information regarding materials or equipment the Contractor proposes to provide shall not relieve the Contractor of his responsibility for any errors therein and shall not be regarded as an assumption of risk or liability by the Engineer or Owner, or by any officer or employees thereof, and the Contractor shall have no claim under the contract on account of the failure or partial failure or inefficiency of any plan or method of work or material or equipment so accepted. Such acceptance shall be considered to mean merely that the Engineer has no objection to the Contractor using, upon his own full responsibility, the plan or method of work proposed, or providing the materials or equipment proposed.

B. Approval of shop drawings by the Engineer is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the Plans and Specifications. The Contractor is responsible for dimensions which shall be confirmed and correlated at the job site, fabrication process and techniques of construction, coordination of his work with that of all other trades and the satisfactory performance of his work.

1.8 PRODUCT DATA AND SAMPLES

A. Where required in the Specifications and as determined by the Engineer, test specimens or samples of materials, appliances and fittings to be used or offered for use in connection with the Work shall be submitted to the Engineer at the Contractor's expense. Specimen or sample submittals shall be made with information as to their sources, with all cartage charges prepaid, and in such quantities and sizes as may be required for proper examination and tests to establish the quality or equality thereof, as applicable.

B. All samples and test specimens are to be submitted in ample time to enable the Engineer to make any tests or examinations necessary, without delay to the Work. The Contractor will be held responsible for any loss of time due to the neglect or failure to deliver the required samples to the Engineer as specified.

C. Samples are also to be taken during the course of the Work, as required by the Engineer.

D. Laboratory tests and examinations that the Owner elects to make will be made at no cost to the Contractor, except that, if a sample of any material or equipment proposed for use by the Contractor fails to meet the Specifications, the cost of testing subsequent samples will be borne by the Contractor.

E. All tests required by the Specifications to be performed by an independent laboratory are to be made, and the samples therefore furnished shall be at the sole expense of the Contractor.

F. Material used in the Work is to conform to the submitted samples and test certificates as approved by the Engineer.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 33 00

STANDARD SUBMITTAL FORM

Transmittal of Shop Drawing or Submittal

CONTRACTOR: <CONTRACTOR NAME>

Tracking No. XXXXXX

Item covered by this submittal

Refer to the following attachment(s) for a detailed description of the item.

Applicable specification section(s)

☐ First Submittal OR ☐ Resubmittal No. _____

☐ This item is as specified OR ☐ This item is a substitution/or equal

☐ Supplier/Subcontractor certifies:

- ☐ Conforms to contract
- ☐ Minor deviations as specifically noted
- ☐ Major deviations as specifically noted

Review Priority: ☐ 1 ☐ 2 ☐ 3

Due Date: XX-XX-XX (Engineer's standard review period is 14 days)

Notes to Engineer:

Date Received by Contractor: _____ Date Returned to Subcontractor/Supplier _____

Contractor Comments:

Deviations Specifically Noted

SECTION 01 35 53 – SECURITY PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall implement security procedures to ensure existing facilities and new construction are protected from vandalism, theft, and unauthorized entry. The Contractor shall:

1. Initiate security program in coordination with Owner's existing security system during mobilization.

2. Maintain program throughout construction period until Substantial Completion.

1.2 ENTRY CONTROL

A. The Contractor shall:

1. Restrict entry of persons and vehicles into construction areas.

2. Allow entry to construction area only to authorized persons with proper identification.

3. Keep all Contractor employees out of existing facilities that are not being modified under the Work.

4. Coordinate with Owner entry control to existing facilities that are not being modified under the Work.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 35 53

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SECTION 01 42 13 - ABBREVIATIONS AND ACRONYMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these Specifications, the following acronyms or abbreviations which may appear in these Specifications shall have the meanings indicated herein.

1.2 ABBREVIATIONS

1.3 ACRONYMS

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association, Inc.
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AI	The Asphalt Institute
AlA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANS	American Nuclear Society

ANSI	American National Standards Institute, Inc.
APA	American Plywood Association (or) American Parquet Association, Inc.
API	American Petroleum Institute
APWA	American Public Works Association
ARI	Air-Conditioning and Refrigeration Institute
ASA	Acoustical Society of America
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society of Nondestructive Testing
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWCI	American Wire Cloth Institute
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators
BHMA	Builders Hardware Manufacturer's Association
CBM	Certified Ballast Manufacturers
CDA	Copper Development Association
CEMA	Conveyors Equipment Manufacturer's Association
CGA	Compressed Gas Association

CLFMI	Chain Link Fence Manufacturer's Institute
CLPCA	California Lathing and Plastering Contractors Association
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DCDMA	Diamond Core Drill Manufacturer's Association
DEQ	Department of Environmental Quality
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
DOE	Department of Ecology
DWR	Department of Water Resources
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
EPA	Environmental Protection Agency
FCI	Fluid Controls Institute
FM	Factory Mutual System
FPL	Forest Products Laboratory
HI	Hydronics Institute (or) Hydraulics Institute
HPMA	Hardwood Plywood Manufacturers Association
IAPMO	International Association of Plumbing and Mechanical Officials
IBC	International Building Code
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IFC	International Fire Code
IME	Institute of Makers of Explosives
IP	Institute of Petroleum (London)

IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ISDSI	Insulated Steel Door Systems Institute
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ISPWC	Idaho Standards for Public Works Construction
ITE	Institute of Traffic Engineers
MBMA	Metal Building Manufacturer's Association
MIL	Military Standards (DoD)
MPTA	Mechanical Power Transmission Association
MSS	Manufacturers Standardization Society
MTI	Marine Testing Institute
NAAMM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NAGDM	National Association of Garage Door Manufacturers
NB	National Board of Boiler and Pressure Vessel Inspectors (alternate NBBPVI)
NBS	National Bureau of Standards (Now NIST)
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association (or) National Fluid Power Association (or) National Forest Products Association
NISO	National Information Standards Organization
NLGI	National Lubricating Grease Institute
NMA	National Microfilm Association
NSF	National Sanitation Foundation

NWMA	National Woodwork Manufacturers Association
NWWDA	National Wood Window and Door Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PPI	Plastics Pipe Institute
RCRA	Resource Conservation and Recovery Act
RIS	Redwood Inspection Service
RMA	Rubber Manufacturers Association
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Makers Association
SDI	Steel Door Institute
SMA	Screen Manufacturers Association
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPI	Society of the Plastics Industry, Inc.
SPIB	Southern Pine Inspection Bureau
SPR	Simplified Practice Recommendation
SSA	Swedish Standards Association
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Steel Structures Painting Council
SSPWC	Standard Specifications for Public Works Construction
TAPPI	Technical Association of the Pulp and Paper Industry
TFI	The Fertilizer Institute
TIA	Telecommunications Industries Association
UBC	Uniform Building Code

UFC	Uniform Fire Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WEF	Water Environment Federation
WIC	Woodwork Institute of California
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 42 13

SECTION 01 42 19 - REFERENCE STANDARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Titles of Sections and Paragraphs: Captions accompanying specification sections and paragraphs are for convenience of reference only, and do not form a part of the Specifications.

B. Applicable Publications: Whenever Specification references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Work is advertised for bids shall apply. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.

C. Specialists' Assignments: In certain instances, specification text requires specific work be assigned to specialists or expert entities who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements over which the Contractor has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the Work. In addition, these requirements are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of contract requirements remains with the Contractor.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all work specified herein shall conform to or exceed the requirements of applicable codes and the applicable requirements of the following documents:

1. References herein to "Building Code" shall mean current International Building Code (IBC).

2. References to "Mechanical Code" or "Uniform Mechanical Code," "Plumbing Code" or "Uniform Plumbing Code," "Fire Code" or "Uniform Fire Code," shall mean International Mechanical Code, Uniform Plumbing Code and International Fire Code of the International Conference of the Building Officials (ICBO).

3. "Electric Code" or "National Electric Code (NEC)" shall mean the National Electric Code of the National Fire Protection Association (NFPA).

4. The latest edition of the codes as approved by the Municipal Code and used by the local agency as of the date that the Work is advertised for bids, as adopted by the

agency having jurisdiction, shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

B. In case of conflict between codes, reference standards, drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Engineer for clarification and directions prior to ordering or providing any materials or furnishing labor. The Contractor shall bid for the most stringent requirements.

C. The Contractor shall construct the Work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed herein.

D. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

E. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

F. Applicable Standard Specifications: References in the Contract Documents to "Standard Specifications" shall mean the Idaho Standards for Public Works Construction, latest Edition.

1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

A. The Contractor shall be responsible that all work included in the Contract Documents, regardless if shown or not, shall comply with all EPA, OSHA, RCRA, NFPA, and any other Federal, State, and Local Regulations governing the storage and conveyance of - hazardous materials, including petroleum products.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 42 19

SECTION 01 45 00 - QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Specific quality control requirements for the Work are indicated throughout the Contract Documents. The requirements of the Section are primarily related to performance of the Work beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements.

B. The Work shall be inspected and tested according to the requirements stated in Article 14 of the General Conditions and as amended by the Supplementary Conditions.

1.2 SUBMITTALS

A. Submit testing results in accordance with Section 01 33 00 – Submittal Procedures.

B. For Engineer and Owner approval, the Contractor shall submit testing laboratory's qualifications and certifications prior to entering into a contractual agreement to perform quality control testing and inspection work.

C. Reports of testing will be submitted to the Engineer indicating observations and results in test and indicating compliance or non-compliance with Contract Documents. It is the responsibility of the Contractor to ensure these submittals are provided in a timely manner to reduce cost impact of potential removal of defective work.

1.3 SAMPLING AND TESTING

A. When not otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current ASTM standards, as applicable to the class and nature of the article or materials considered; however, the Owner reserves the right to use any generally-accepted system of inspection which, in the opinion of the Engineer will ensure the Owner that the quality of the workmanship is in full accord with the specifications.

B. Any waiver of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any technical or qualitative requirements of the specifications.

C. Notwithstanding the existence of such waiver, the Engineer shall reserve the right to make independent investigations and tests as specified in Subparagraph 1.3.D, following; and, upon failure of any portion of the Work to meet any of the qualitative requirements of the specifications, shall be reasonable cause for the Engineer to require the removal or correction and reconstruction of any such work.

D. In addition to any other inspection or quality assurance provisions that may be specified, the Engineer shall have the right to independently select, test, and analyze, at the expense of the Owner, additional test specimens of any or all of the materials to be used. Results of such tests and analyses shall be considered along with the tests or analyses made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed; provided, that wherever any portion of the work is discovered, as a result of such independent testing or investigation by the Engineer, which fails to meet the requirements of the specifications, all cost of such independent inspection and investigation, and all costs of removal, corrections, and reconstruction or repair of any such work shall be borne by the Contractor.

1.4 TESTING SERVICES

A. The **CONTRACTOR** shall hire an independent testing lab to perform quality control tests as specified in each specification. **All tests shall be paid for by the Contractor.**

Item	Reference for testing requirements
Earthwork	See Section 31 00 00 – Earthwork
Trench Backfill	See Section 31 23 33 – Trenching and Backfilling and ISPWC & City of Pocatello Standards
Asphalt Pavement	See Section 32 12 16 – Asphalt Paving and See Section ISPWC & City of Pocatello Standards
Cast-in-Place Concrete	City of Pocatello Standards and Section 03 30 00 – Cast-in-Place-Concrete
Masonry	See Section 04 22 00 – Concrete Unit Masonry
Grout	See Section 03 30 00 – Cast-in-Place-Concrete and Section 04 22 00 – Concrete Unit Masonry, as applicable

B. Testing company shall meet the following qualifications:

1. Basic requirements of ASTM E329, “Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials as Used in Construction” and ASTM D3666, “Standard Specification for Minimum Requirements for Agency Testing and Inspecting Bituminous Paving Materials”, as applicable.

2. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

C. The Contractor shall notify Engineer 24 hour prior to the expected time for operations requiring inspection and laboratory test services. Failure of the Contractor to notify the Engineer at least 24 hours in advance of any such inspections shall be reasonable cause for the Engineer to order a sufficient delay in the Contractor's schedule to allow time for such inspections and any remedial or corrective work required, and all costs of such delays, including its effect upon other portions of the Work, shall be borne by the Contractor.

D. Samples and test specimens required under these specifications shall be furnished and prepared for testing in ample time for the completion of the necessary tests and analysis before said articles or materials are to be used. The Contractor shall furnish and prepare all required test specimens at his own expense.

E. Should any tests fail the specified requirements, the work shall be redone and retested at the Contractor's expense.

1.5 REGULATORY REQUIREMENTS

A. General

1. Comply with all Federal, State, and local Codes as referenced herein. Such regulations apply to activities including, but not limited to, sitework and zoning, building practices and quality, on and offsite disposal, safety, sanitation, nuisance, and environmental quality.

2. Contractor designed structural systems are subject to the same overall inspection requirements as all other work.

B. Special Inspection

1. Special Inspection is in addition to, but not replacing, other inspections and quality control requirements herein.

2. Contractor will contract with and pay for the services of an independent Special Inspection Agency. Contractor shall coordinate with the designated Special Inspector to schedule the timing of site visits to perform the inspections in a timely manner.

3. A schedule of required Special Inspections is provided in the Contract Drawings.

C. Structural Observation

1. Inspect framework, shoring, pipe supports, and other Contractor-designed systems for adequacy.

2. Engineer will provide structural observation in addition to the inspection performed by the Special Inspection Agency.

1.6 RIGHT OF REJECTION

A. The Engineer may reject portions of the Work as provided in Article 14 of the General Conditions.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION

A. Inspection: The Contractor shall inspect materials or equipment upon their arrival on the job site and immediately prior to installation and reject damaged and defective items.

B. Measurements: The Contractor shall verify measurements and dimensions of the work as an integral step of starting each installation.

C. Manufacturer's Instructions: Where installation includes manufactured products, the Contractor shall comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in Contract Documents.

3.2 SITE INVESTIGATION AND CONTROL

A. Contractor shall verify all dimensions in the field and shall check field conditions continuously during construction. The Contractor shall be solely responsible for any inaccuracies built into the Work due to his failure to comply with this requirement.

B. Contractor shall inspect related and appurtenant work and shall report in writing to the Engineer any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair or replacement caused by unsuitable conditions shall be performed by the Contractor at his sole cost and expense.

END OF SECTION 01 45 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall be responsible to provide all equipment including that required for office, sanitation, signage, lighting, etc., as per requirements in paragraph 7.04 in Section C-700 – General Conditions.

1.2 SAFETY

A. The Contractor shall comply with "Safety and Protection" requirements as described in paragraphs 7.13, 7.14, 7.15 in Section C -700 – General Conditions.

B. Appropriate first aid facilities and supplies shall be kept and maintained by the Contractor at the site of the work. All persons within the construction area shall be required to wear protective helmets and eye protection. In addition, all employees of the Contractor and his subcontractors shall be provided with, and required to use, personal protective and life saving equipment as set forth in "Subpart E" of the OSHA Safety and Health Standards for Construction (29CFR 1926) including all of its amendments.

C. During the performance of the Work, the Contractor shall erect and maintain temporary railings and barriers and shall take all other necessary precautions and place proper guards for the prevention of accidents and the Contractor shall erect and maintain suitable and sufficient lights and other signals.

1.3 TEMPORARY UTILITIES

A. Types: The types of utility services required for general temporary use at the Site include the following:

1. Water service (potable for certain uses, including fire protection)

2. Sanitary sewer

3. Electric power service

B. Scheduled Uses: The Contractor shall, in conjunction with establishment of job progress schedule, establish a schedule for implementation and termination of service for each temporary utility at the earliest feasible time, and when acceptable to Owner and Engineer, change over from use of temporary utility service to permanent service.

1.4 TEMPORARY FACILITIES

A. Contractor shall obtain all necessary permits, arrange for connection of utilities, and pay all required fees and utility costs associated with the work site during the construction activities.

B. Suitable areas for on-site materials storage shall be maintained by Contractor as specified in Section 01 14 13 – Access to Site. Locations of storage areas shall be subject to Owner's approval, but shall remain the responsibility of the Contractor. Location shall not interfere with drainage, traffic, or private property.

C. Contractor shall set up and maintain in a neat and orderly manner all temporary construction facilities. Locations shall be subject to Owner's approval, but shall remain the responsibility of the Contractor.

1.5 CULTURAL RESOURCES

A. The Contractor's attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800 which provides for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called cultural resources.).

B. The Contractor shall conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources.

C. In the event potential cultural resources are discovered during subsurface excavations at the site of construction, the following procedures shall be instituted:

1. The Engineer will issue a Field Order directing the Contractor to cease all construction operations at the location of such potential cultural resources find.

2. Such Field Order shall be effective until such time as a qualified archaeologist can be called to assess the value of these potential cultural resources and make recommendations to the Engineer.

D. If the archaeologist determines that the potential find is a bona fide cultural resource, at the direction of the Idaho State Historical Society, the Contractor shall suspend work at the location of the find under the provisions for changes contained in Section C-700 – General Conditions.

1.6 DUST ABATEMENT

A. The Contractor shall prevent its operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity. The Contractor shall be responsible for any damage resulting from dust originating from its operations. The dust abatement measures shall be continued until the Contractor is relieved of further responsibility by the Engineer.

1.7 RUBBISH CONTROL

A. During the progress of the Work, the Contractor shall keep the Site and other areas used by it in a neat and clean condition, and free from any accumulation of rubbish. The Contractor shall dispose of all rubbish and waste materials of any nature occurring at the Site, and shall establish regular intervals of collection and disposal of such materials and waste. The Contractor shall also keep its haul roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the Site in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.

1.8 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer. In addition, see the requirements set forth in Section 01 57 12 – Construction Site Discharge – SWPP Idaho.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The Contractor shall provide either new or used materials and equipment, which are in substantially undamaged condition and without significant deterioration and which are recognized in the construction industry, by compliance with appropriate standards, as being suitable for intended use in each case. Where a portion of temporary utility is provided by utility company, the Contractor shall provide the remaining portion with matching and compatible materials and equipment and shall comply with recommendations of utility company.

PART 3 - EXECUTION

3.1 INSTALLATION OF TEMPORARY UTILITY SERVICES

A. Wherever feasible, the Contractor shall engage the utility company to install temporary service to project, or as a minimum, to make connection to existing utility service; locate services where they will not interfere with total project construction Work, including installation of permanent utility services; and maintain temporary services as installed for required period of use; and relocate, modify or extend as necessary from time to time during that period as required to accommodate total project construction Work.

B. Temporary connections for electricity shall be subject to approval of the Engineer and the power company representative, and shall be removed in like manner at the Contractor's expense prior to final acceptance of the Work.

C. Separation of Circuits: Unless otherwise permitted by the Engineer, circuits used for power purposes shall be separate from lighting circuits.

D. Construction Wiring: Wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. Electrical facilities shall conform to the requirements of Subpart K of the OSHA Safety and Health Standards for Construction.

3.2 INSTALLATION OF POWER DISTRIBUTION SYSTEM

A. Power: The Contractor shall provide power required for its operations under the Contract, and shall provide and maintain all temporary power lines required to perform the Work in a safe and satisfactory manner.

B. Temporary Power Distribution: The Contractor shall provide a weatherproof, grounded, temporary power distribution system sufficient for performance of entire Work of project, including temporary electrical heating where indicated, operation of test equipment and test operation of building equipment and systems which cannot be delayed until permanent power connections are operable, temporary operation of other temporary facilities, including permanent equipment and systems which must be placed in operation prior to use of permanent power connections (pumps, HVAC equipment, elevators, and similar equipment), and power for temporary operation of existing facilities (if any) at the Site during change-over to new permanent power system.

1. Provide circuits of adequate size and proper power characteristics for each use;

2. Run circuit wiring generally overhead, and rise vertically in locations where It will be least exposed to possible damage from construction operations and will result in minimal interference with performance of the Work;

3. Provide rigid steel conduit or equivalent raceways for wiring which must be exposed on grade, floors, decks, or other exposures to damage or abuse.

3.3 WATER SUPPLY

A. The Contractor shall coordinate with the Utility he is obtaining water service connection from. The Contractor shall provide all facilities necessary to convey the water from the source to the points of use in accordance with the requirements of the Contract Documents; this includes back flow prevention in accordance with the Utilities requirements.

B. The Contractor shall provide and operate all pumping facilities, pipelines, valves, hydrants, storage tanks, and all other equipment necessary for the adequate development and operation of the water supply system. Water used for domestic purposes shall be free of contamination and shall conform to the requirements of the State and local authorities for potable water. The Contractor shall be solely responsible for the adequate functioning of its water supply system and shall be solely liable for any claims arising from the use of same, including discharge or waste of water there from.

C. The Contractor shall not make connection to or draw water from any fire hydrant or pipeline without first obtaining permission of the Owner. For each such connection made, the Contractor shall first attach to the fire hydrant or pipeline a valve, meter, and backflow prevention device acceptable to the Owner.

3.4 STORM WATER

A. All storm water runoff and control of soil erosion shall be managed as outlined in Specification Section 01 57 12 – Construction Site Discharge – SWPP Idaho.

3.5 INSTALLATION OF SANITARY FACILITIES

A. Fixed or portable chemical toilets shall be provided wherever needed for the use of Contractor's employees. Toilets at construction job sites shall conform to the requirements of Subpart C Section 1926.51 of the OSHA Standards for Construction.

B. The Contractor shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of away from the Site in a manner satisfactory to the Engineer and in accordance with all laws and regulations pertaining thereto.

C. The Contractor shall coordinate with the Owner for obtaining sewer connection and shall pay all permit and sewer usage charges. The sewer capacity charges will be paid by the Owner.

3.6 INSTALLATION OF COMMUNICATIONS

A. Telephone Services: The Contractor shall provide and maintain at all times during the progress of the Work not less than one telephone in good working order at its own field construction office at or near the Site.

B. Telephone Use: The Contractor shall permit the Engineer, the Owner, or their authorized representatives or employees free and unlimited use of said telephone facilities for all calls.

3.7 OPERATIONS AND TERMINATIONS

A. Prior to placing temporary utility services into use, the Contractor shall inspect and test each service and arrange for governing authorities' required inspection and tests, and obtain required certifications and permits for use thereof.

B. The Contractor shall maintain distinct markers for underground lines, and protect from damage during excavating operations.

C. When need for a temporary utility service or a substantial portion thereof has ended, or when its service has been replaced by use of permanent services, or not later than time of substantial completion, the Contractor shall promptly remove installation unless requested by Engineer to retain it for a longer period. The Contractor shall complete and restore Work which may have been delayed or affected by installation and use of temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces.

D. Before final acceptance of the Work on the project, all temporary connections and piping installed by the Contractor shall be entirely removed, and all affected improvements shall be restored to original condition or better, to the satisfaction of the Engineer and to the Owner.

END OF SECTION 01 50 00

SECTION 01 57 12 - CONSTRUCTION SITE DISCHARGE (SWPPP)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Construction activities that disturb one acre or more are regulated under the Idaho Pollutant Discharge Elimination System (IPDES) Regulations for Storm Water Discharges. The Idaho Department of Environmental Quality (IDEQ) has created a Construction General Permit (CGP) which outlines a set of provisions construction operators must follow to comply with the requirements of the IPDES storm water regulations.

B. The IPDES through the CGP governs the construction activities to prevent and control soil erosion, transport, sedimentation, and further water and air pollution that may degrade receiving waters including rivers, streams, lakes, reservoirs, groundwater and wetlands. The control measures contained herein shall be installed and maintained through the construction contract and coordinated with any permanent or temporary pollution control feature specified elsewhere on the plans and in the specifications to assure effective and continuous water pollution control throughout the construction and post construction periods. The controls may include silt fences, straw wattles, rock berms, diversion dikes, interceptor swales, sodding, mulching, soil retention blankets, or other structural or non-structural stormwater pollution controls. Any and all erosion control structures and stabilization practices will be inspected, maintained by the Contractor on a weekly basis, and after any storm event of 0.25 inches or greater. The Contractor will all keep a detailed record of inspections, maintenance and discharge events.

C. The Owner reserves the right to have required temporary erosion sedimentation and water pollution prevention and control work performed by others should the Contractor fail to perform required temporary erosion, sedimentation, and water pollution prevention and control work in a timely fashion or should the Contractor fail to prevent and control soil erosion, sedimentation, and water pollution which may degrade receiving water. All costs, including engineering, for the work required shall be borne by the Contractor.

1.2 REFERENCES

A. Agency Documents:

1. Construction General Permit and Related Documents: https://www.deq.idaho.gov/water-quality/wastewater/storm-water/

2. Catalog of Stormwater Best Management Practices for Idaho Cities and Counties: https://www2.deq.idaho.gov/admin/LEIA/api/document/download/14968

3. Construction General Permit Resources, Tools, and Templates: https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates#swppp

B. Other guidance documents:

1. Customizable SWPPP template for construction site operators in unauthorized states including Idaho. This SWPPP template is in Microsoft Word format: https://www.epa.gov/sites/production/files/2017-04/sw_cgp2017_swppptemplate-4-5-17.docx

1.3 SUBMITTALS

A. Stormwater Pollution Prevention Plan (SWPPP): Prior to submitting a Notice of Intent, the Contractor shall create and submit the SWPPP that details how the Contractor proposes to comply with CGP. The Contractor's SWPPP will be subject to review by the Engineer prior to commencement of Work.

B. Notice of Intent (NOI): Prior to commencement of any work, the Contractor shall submit an NOI with IDEQ. The NOI must be submitted through the E-Permitting System to the IDEQ at least 14 calendar days prior to commencing earthwork. An executed NOI from IDEQ shall be submitted to the Engineer prior to commencing work.

1. E-Permitting System website:

a. https://www2.deq.idaho.gov/water/IPDES/

C. Notice of Termination (NOT): Upon completion of all work, the Contractor shall submit a complete NOT with IDEQ through the E-Permitting System. The NOT shall be submitted to the Engineer.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. The Owner and Contractor shall be co-permittees of the General Construction Permit (CGP) and, as such, both are responsible for the implementation of the SWPPP. If the Contractor fails to prevent pollutants from leaving the construction site, the Owner shall have the right to take corrective measures and withhold monies from the Contractor for such cost incurred by the Owner for corrective actions.

1. Prior to the Owner withholding costs for corrective actions. The Owner or Engineer will notify the Contractor of pollutants leaving the site. The Contractor shall have 8 hours to take corrective actions.

2. If the Contractor fails to take corrective actions, within 8 hours of notification, to prevent the pollutants from leaving the site, the Owner may take corrective actions and all costs incurred by the Owner for the corrective actions shall be withheld from payments owed to the Contractor.

B. A copy of the SWPPP, NOI and the IPDES Stormwater General Construction Permit shall be kept on site at all times.

C. Copies of the required site inspection reports shall be made as an appendix to the SWPPP.

D. All documents shall be maintained and available for public review anytime during the project including up to three years after substantial completion.

3.2 MAINTENANCE & INSPECTION PROCEDURES

A. Any and all erosion control structures and stabilization practices will be inspected by the Contractor on a weekly basis at a minimum and after any storm event of 0.25 inches or greater. During the winter when the ground is frozen and runoff is unlikely to occur, such inspections shall be conducted at least every two weeks.

1. The SWPPP shall be modified as necessary to include additional or modified Best Management Practices (BMPs) designed to correct problems identified. Revision to the SWPPP shall be made within 7 calendar days following any identified correction. Copies of the revised SWPPP shall be provided to the Owner and Engineer.

2. All areas that undergo temporary and final stabilization with seeding or sodding shall be inspected; areas that have lack of growth and bare spots shall be reseeded by the Contractor to ensure healthy growth.

3. All erosion control structures and stabilization practices shall be maintained in good working condition throughout the duration of the construction project.

4. Repair of the damage to any structural erosion control structure shall be completed by the Contractor within 24 hours of discovery of the damage.

5. In locations where silt fences or wattles are used around catch basins, trapped sediment shall be removed by the Contractor when one-third of the height of the silt fence or wattle is covered by sediment.

6. Hard surfaces shall be swept at the end of each day’s work.

B. If a detention/retention ponds are employed, the depth of the detention/retention ponds shall be measured monthly by the Contractor and the depth shall be provided to the Owner within one day of measuring. The Contractor shall remove sediment buildup in the pond if the buildup begins to interfere with the proper operation of the pond. The detention/retention ponds shall be excavated to design profile depths and slopes at the end of the project, if sediment buildup has significantly altered the pond profile.

1. Excavated material from any detention/retention ponds or swales shall not be used as structural fill and shall be disposed of as spoil material, in a location selected by the Contractor and approved by the Engineer. Once placed, the excavated material shall be stabilized using one of the suggested BMPs listed in IDEQ's Catalog of Stormwater BMPs.

3.3 CLEAN UP AND REMOVAL OF BMPS

A. After final stabilization, remove all temporary BMPs and dispose of off-site at no cost to the Owner.

B. After removal of temporary BMPs, sweep all sediment accumulated on project hard surfaces, including asphalt, sidewalks, and adjacent roadways.

END OF SECTION 01 57 12

SECTION 01 71 13 - MOBILIZATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Mobilization consists of preparatory work and operations including, but not limited to those necessary for the movement of personnel, movement of equipment, temporary construction facilities, supplies and incidentals to the project site. Included is the establishment of all necessary offices, buildings, signs, utilities, acquisition of permits, preconstruction submittals, and all other work which must be performed and costs incurred prior to beginning work on the various items of the contract.

B. Mobilization shall include the following principal items:

1. Moving onto the site all Contractor's plant and equipment required for first month operations.

2. Providing all necessary temporary on-site utilities per Section 01 50 00 – Temporary Facilities and Controls.

3. Arranging for and erection of Contractor's work and storage yard in accordance with Section 01 14 13 – Access to Site.

4. Constructing and implementing security features and requirements complying with Section 01 35 53 – Security Procedures.

5. Installing proper stormwater pollution prevention measures as specified in the Stormwater Pollution Prevention Plan developed in accordance with Section 01 57 12 – Construction Site Discharge.

6. Obtaining all required permits and property insurance.

7. Having all OSHA required notices and establishment of safety programs.

8. Having the Contractor's superintendent at the job site full-time.

9. Submitting pre-construction submittals in accordance with Specification Section 01 33 00 -Submittal Procedures.

1.2 SITE AREA

A. The limits of the project site are as indicated on the Drawings.

B. Contractor shall provide and maintain all signing, barricades, fencing, drainage facilities, and other items as required to protect public and private property from damage caused by mobilization operations.

1.3 ACCESS

A. Refer to Section 01 14 13 – Access to Site.

B. If construction access is required in addition to that shown on the Drawings, Contractor shall secure Owner's approval of all additional project entrances prior to construction. Contractor shall also obtain written approval from impacted landowner(s) if other than project owner.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 PAYMENT FOR MOBILIZATION

A. Allowable amounts for partial payment of mobilization are as follows:

1. First monthly progress estimate: Up to 60% of the Mobilization contract price in the agreed-upon Schedule of Values, or 6% of the total Contract Amount, whichever is less.

2. The balance of the Mobilization contract price in the agreed-upon Schedule of Values shall be paid after Substantial Completion.

3. The Contractor's attention is directed to the condition that 2 percent of the total Contract Price will be deducted from any money due the Contractor as progress payments until all mobilization items listed above have been completed as specified. The aforementioned amount will be retained by the Owner as the agreed estimated value of completing all of the mobilization items listed. Any such retention of money for failure to complete all such mobilization items as a lump-sum item shall be in addition to the retention of any payments due to the Contractor as specified in Article 6 Section 520 – Agreement Between Owner and Contractor for Construction Contract or Article 15 of Section C-700 – General Conditions of the Contract.

END OF SECTION 01 71 13

SECTION 01 71 23.16 - CONSTRUCTION SURVEYING

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide construction surveying for the project.

B. The Contractor shall hire a professional land surveyor to reset any disturbed survey monuments in accordance with Idaho Code.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. The electronic AutoCAD base maps used to create the drawings are available to the Contractor. In the event of a discrepancy between the stamped paper drawings and the electronic files, the stamped paper drawings shall govern. The Contractor shall immediately notify the Engineer of any discrepancies prior to proceeding. The Contractor shall indemnify and hold harmless the Owner and Engineer from all liability, claims, damages, losses and expenses, including attorneys' fees arising out of or resulting from the Contractor's use or interpretation of electronic files.

3.2 CONSTRUCTION STAKING

A. The Contractor shall provide location and grade construction surveying as required to locate the Work.

3.3 MONUMENTATION

A. The Contractor shall employ a professional land surveyor, duly and properly registered in the State of Idaho, to reference all public and private land survey monuments that will be disturbed by construction activities prior to construction. Reestablish such monuments as part of the survey work for this project before project completion in accordance with Idaho Code. Section corner and quarter corner monuments reset after construction shall include corner perpetuations and filing with the county. Sixteenth corner monuments reset and having existing corner perpetuation filed with the county shall have new perpetuation records filed after the corner has been reset. Perform all monument work in accordance with Title 55, Chapter 16 of the Idaho State Code. Perform all corner, property, and roadway centerline reestablishment in accordance with standard surveying practices under the responsible charge of a professional land surveyor.

END OF SECTION 01 71 23.16

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SECTION 01 71 33 - PROTECTION OF ADJACENT CONSTRUCTION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. It shall be the Contractor's responsibility to ascertain the actual location of all existing utilities and other improvements indicated on the drawings and to see that such utilities or other improvements are adequately protected from damage due to all construction operations. The Contractor shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be directed by the Owner.

1.2 RIGHTS-OF-WAY

A. The Contractor shall not do any work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure; nor shall the Contractor enter upon the rights-of-way involved until notified that the Owner has secured authority from the property owner.

1.3 EXISTING UTILITIES AND IMPROVEMENTS

A. The Contractor shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities, including underground utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements specified herein, and in accordance with the requirements of the Contract Documents.

B. The Contractor shall determine the exact locations and depths of all underground utilities indicated on the drawings.

C. The right is reserved to the Owner and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work of this contract.

D. Existing utility lines that are shown on the drawings or the locations of which are made known to the Contractor prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations, shall be protected from damage during excavation and back-filling and, if damaged, shall be immediately repaired by the Contractor at his expense.

E. In the event that the Contractor damages any existing utility lines that are not shown on the drawings or the locations of which are not made known to the Contractor prior to excavation, the Contractor shall refer to procedures of paragraph 4.04 of General Conditions.

F. When utility lines that are to be removed are encountered within the area of operations, the Contractor shall notify the Owner a sufficient time in advance for the necessary measures to be taken to prevent interruption of the service.

G. All repairs to a damaged improvement shall be inspected and approved by an authorized representative of the improvement owner before being concealed by backfill or other work.

H. Where the proper completion of the Work requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is shown on the drawings, the Contractor shall, at his own expense, remove and without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to the Engineer and the Owner of the facility. In all cases of such temporary removal or relocations, restoration to former location shall be accomplished by the Contractor in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 NOTIFICATION BY THE CONTRACTOR

A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, the Contractor shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than 3 days nor more that 7 days prior to excavation so that a representative of said owners or agencies can be present during such work if they so desire.

END OF SECTION 01 71 33

SECTION 01 74 30 - SITE PRESSURE PIPE TESTING AND DISINFECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall test all potable water pipelines, utility water, pressure sewer pipe and appurtenant piping, fittings, valves, and meters.

B. All waterline testing and disinfection shall be in accordance with City of Pocatello Standards.

1. pocatello.gov/DocumentCenter/View/212/City-of-Pocatello-Public-Works-Design-Principles-and-Standards-PDF?bidId=

C. The Contractor shall be responsible for obtaining permits for discharging excess testing and disinfection water and dechlorination of such water if required to satisfy permit limits.

1.2 SUBMITTALS

A. The Contractor shall furnish the following information:

1. A testing plan and schedule, including method for conveyance, control, disposal, de-chlorination, and disinfection shall be submitted in writing for approval.

2. Name of certified bacteriological testing laboratory for potable water testing.

3. Provide to the Project Engineer a record of test duration calculations for each segment tested.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All test equipment, chemicals for chlorination, temporary valves, bulkheads, and other water control equipment, and choice of disinfectant shall be as determined by the Contractor.

B. Chlorine for disinfection may be in one of the following forms:

1. Sodium hypochlorite liquid containing approximately 5 to 15% available chlorine, per ANSI/AWWA B 300.

2. Calcium hypochlorite, granular or in 5g tablets containing approximately 65% available chlorine by weight, per ANSI/AWWA B 301.

3. Liquid chlorine: Only with written authorization of Engineer, in accordance with the requirements of ANSI/AWWA B301 - Liquid Chlorine and only by trained personnel using appropriate safety practices.

C. Dechlorinate water prior to discharge. Dechlorination agents may be sodium bisulfite, calcium bisulfite, sodium sulfite, or sodium thiosulfate.

PART 3 - EXECUTION

3.1 GENERAL

A. Water for testing pipelines will be furnished by the Owner; however, the Contractor shall convey the water from the Owner-designated source to the points of use.

B. All pressure pipelines shall be pressure tested; those for potable water shall be disinfected. All chlorinating and testing operations shall be performed in the presence of the Engineer.

C. Disposal of flushing water and water containing chlorine shall be by methods acceptable to the Idaho Department of Environmental Quality.

D. Disinfection operations shall be scheduled as late as possible during the Contract Time to maximize the degree of sterility of the facilities at the time the Work is accepted by the Owner. Bacteriological testing shall be performed by a certified testing laboratory and paid by the Contractor.

3.2 HYDROSTATIC TESTING OF PIPELINES

A. Prior to hydrostatic testing, pipelines shall be flushed or blown out as appropriate. Flushing pipe velocity shall be 3.0 ft/second minimum.

B. The Contractor shall test pipelines either in sections or as a unit. No section of the pipeline shall be tested until the trench has been properly backfilled and all field-placed concrete or mortar has attained an age of 7 days, or until adequately cured. The test shall be made by closing valves when available or by placing temporary bulkheads in the pipe and filling the line slowly with water. The Contractor shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test to avoid movement and damage to piping and equipment. Remove or protect any pipeline-mounted devices that may be damaged by the test pressure. The Contractor shall provide sufficient temporary tapping's in the pipelines to allow for all entrapped air to exit. After completion of the tests, such taps shall be permanently plugged. Open all air relief valves during filling.

C. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the release valves at a reasonable velocity. All the air within the pipeline shall be allowed to escape. The differential pressure across the orifices in the air release valves shall not be allowed to exceed 5 psi at any time during filling.

D. Verify that, in a minimum two-hour test, the pipe does not leak in excess of the allowable leakage as defined by the following formula in which L is the allowable leakage in gallons per hour. **Leakage is only allowed for buried piping.**

$$Q = \frac{LD(P)^{1/2}}{148{,}000}$$

Where Q = Allowable Leakage (gallons/hour)

L = Length of pipe section being tested (feet)

D = Nominal Pipe Diameter (inches)

P = Tested Pressure (psi, gauge)

E. See plans for planned testing pressures of various pipelines. Pressure test pipe per ASTM F 2164-02 Field Leaking Testing of Polyethylene (PE) Pressure Piping Systems using Hydrostatic Pressure.

3.3 DISINFECTING PIPELINES – CONTINUOUS FEED METHOD

A. Solution Strength: Dose at 25 mg/L for 4 hours

B. Residual: 10 mg/L at 24 hours.

C. Dosing Methods:

1. Liquid Chlorine: Solution feed vacuum-operated chlorinator in combination with a booster pump. Direct feed is not allowed.

2. Hypochlorite Solution: Chemical feed pump designed for feeding chlorine solutions.

3. Calcium Hypochlorite Granules: Refer to previous section.

D. Filling Procedure: Use approved source to flow clean water at a constant, measured rate into the newly laid water main. Fill at a point not more than 10 feet downstream from the beginning of the new main. Measure concentration at regular intervals to ensure a 25 mg/L dose. Position valves so that the chlorine solution in the main being treated does not flow into water mains in active service. Do not stop chlorine application until the entire main is filled with chlorinated water. Retain the chlorinated water in the main for at least 4 hours, operating all valves and hydrants in the section treated. At the end of the 24-hour period, verify the treated water in all portions of the main has a residual of 10 mg/L free chlorine.

3.4 DISINFECTING PIPELINES – FINAL FLUSHING

A. After the retention period, flush the chlorinated water from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that in the system, or is acceptable for domestic use.

B. Dispose of flushing water to a location approved by the Engineer.

3.5 DISINFECTING PIPELINES – BACTERIOLOGICAL TESTS

A. After final flushing and before the water main is placed in service, test samples collected from the main(s) for coliform bacteria. Take 2 samples from each location at least 24 hours apart.

B. If the initial disinfection fails to produce approved bacteriological samples, reflush and resample the main. If check samples show bacterial contamination, re-chlorinate the main until approved results are obtained.

3.6 DISINFECTING PIPELINES – SWABBING

A. If connections are not disinfected along with the newly installed main, swab or spray the interior of all pipe and fittings used in making the connections with a 1% hypochlorite solution before installation.

END OF SECTION 01 74 30

SECTION 01 75 00 - EQUIPMENT TESTING AND STARTUP (WATER SYSTEM)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Equipment testing and startup are requisite to satisfactory completion of the contract and, therefore, shall be completed within the contract time.

B. The Contractor shall coordinate with the Owner all work necessary for the successful operation of all equipment.

C. During all equipment testing facility startup period and acceptance test periods, the Owner shall ensure that experienced, trained, and qualified personnel are onsite at all times to oversee and safeguard such testing and operations.

1.2 SUBMITTALS

A. Schedule: The schedule for testing and startup shall be submitted in accordance with Section 01 33 00 – Submittal Procedures.

B. Testing and Startup Plan: Not less than 60 days prior to startup, the Contractor shall submit for review a detailed Testing and Startup Plan. The Plan shall include schedules for equipment certifications, submittal of final Owner's Manuals, training of the Owner's personnel, electrical and SCADA testing, and a detailed schedule of operations to achieve successful equipment testing, startup, performance and acceptance testing and activities to implement equipment testing and process startup. The Plan shall include test checklists and data forms for each item of equipment and shall address coordination with the Owner's staff. The Contractor shall revise the Plan as necessary based on review comments by the Owner/Engineer.

C. System Outage Requests: Request for shutdown of on-line systems as necessary to test or start up the plant and equipment. Shutdown requests must be submitted at least two weeks prior to shutdown.

D. Records and Documentation: Submit documentation that the equipment has been properly installed, is in accurate alignment, is free from undue stresses from connecting piping and anchoring, and has operated satisfactorily under full load conditions.

E. The Contractor shall maintain the following records for each piece of equipment and by equipment number and name during installation, testing and station startup and submit these said records to Owner prior to acceptance:

1. Lubrication and service records for each item of mechanical/electrical equipment.

2. Hours of daily operation for each item of mechanical/electrical equipment.

3. Logs of electrical test and measurements.

4. Instrumentation calibration and testing and check lists.

5. Manufacturer’s certification of proper equipment installation.

6. Testing and validation of all PLC inputs, outputs, logic functions, status indication, and alarms.

7. Factory and field equipment settings.

8. Other records, logs, and check lists as required by the Contract Documents.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to scheduling any operations testing, the Contractor shall have previously furnished the Owner's Manuals required under Section 01 78 23 – Operations and Maintenance Data.

B. The Contractor shall coordinate the scheduling of all operations testing. The Contractor is advised that the Engineer and the Owner's operating personnel will witness operations testing and that the equipment supplier's representative shall be required to instruct the Owner's operating personnel in correct operation and maintenance procedures.

C. The Contractor shall notify the Engineer at least 5 days in advance for testing installed equipment.

3.2 FACTORY ACCEPTANCE TESTING

A. The Contractor shall be responsible for conducting a factory acceptance test and achieving Engineer approval as to the outcome of the test prior to the field installation of the equipment, if required by the specifications for the equipment.

B. The Contractor is advised that the Engineer and the Owner’s operating personnel may witness factory testing.

C. The Contractor shall be responsible for scheduling all factory acceptance testing. The Contractor shall coordinate the factory acceptance testing schedule with the Engineer at least 1 week in advance.

D. Factory acceptance testing shall be conducted per the requirements in the equipment specifications.

E. Factory acceptance testing shall involve the bench setup of RTU/PLC panels with interconnecting network connections when needed. This will be followed by a demonstration of OIT navigation menus, process data displays, alarm/status indication, and PLC implementation of control strategies described in Division 40. In addition, the Contractor shall demonstrate operation of RTU/PLCs for a minimum of eight continuous hours. Factory acceptance testing for SCADA computers requires that all software for the system be installed, configured, and operating with no errors or faults for 24 hours. The system will remain active throughout this test period. In addition, automatic windows updates must be disabled.

3.3 EQUIPMENT INSTALLATION AND TESTING

A. The Contractor shall coordinate directly with the Equipment Vendor to provide the services of an experienced and authorized representative of the manufacturer, who shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation.

B. The Contractor shall arrange to have the manufacturer's representative revisit the job site as often as necessary until any and all trouble is corrected, and the equipment installation and operation are satisfactory to the Vendor and Engineer.

C. The Contractor shall require that each manufacturer's representative furnish to the Engineer a written certification addressed to the Owner certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, and has been operated satisfactorily and tested under full-load conditions.

3.4 PROCESS SYSTEM TESTING

A. In addition to individual equipment and subsystem testing, the Contractor shall perform testing of all process control, electrical and other systems, as listed below and/or in the Contract Documents, to demonstrate proper operation with equipment operating over full operating ranges and under actual operating conditions, in all of the automatic and manual modes as specified in the control strategies and descriptions in the equipment specifications and Division 40.

B. The Contractor shall repeat the system tests as necessary to demonstrate proper operation to the satisfaction of the Engineer. The Contractor shall be back charged the cost of Owner's personnel and Engineer's personnel for all tests beyond the second test.

C. Prior to initiating the system testing, the Contractor shall submit the testing procedures to the Engineer for approval. System that are included in tests include the following and other systems not mentioned but as indicated in the Contract Documents:

1. New ground water Well #2R and Well #22R pumps and all auxiliary components.

2. Gas chlorination disinfection system and all auxiliary components.

3. Booster pumps

4. Power distribution, generator startup, lighting, and other miscellaneous electrical equipment in both buildings.

5. All HVAC equipment including: HVAC control panels, heaters, ventilation fans, and louvers.

6. Other systems as specified in the Contract Documents.

7. Contractor shall assist System Integrator with any potential instrumentation issues that connect to the SCADA panels: SCADA/controls system, all SCADA inputs, flow and pressure monitoring equipment at both well houses.

D. System testing in general shall involve demonstration that all controls, instrumentation loops, alarm/status indication, and all controls described in Division 40 function properly. In addition, the Contractor shall demonstrate sustained equipment operation for a minimum of 2 days when operated in conjunction with other system components. The Contractor shall schedule, provide, and coordinate the services of all manufacturers, suppliers, subcontractors, the Engineer, and the Owner for successful system testing.

E. All system testing activities shall follow detailed test procedures, check lists, etc., previously developed and submitted by the Contractor which have been reviewed by the Engineer. Completion of all system testing activities shall be documented by a certified report. Successful completion of the system testing is required prior to commencement of the startup specified below.

F. The Contractor shall test and fully demonstrate proper operation of the utility, safety equipment, and other support systems before commencing the process system testing.

G. The Contractor shall give the Engineer written notice confirming the date of any system test at least (3) working days before the time the system is scheduled to be tested. The Owner’s staff will observe system's testing.

H. Operational instruction for the controls and instrumentation shall occur before the startup.

3.5 TEST AND PROCESS STARTUP

A. The startup of a well is a complex operation requiring the combined technical expertise of the Contractor, Owner, and the Engineer. The Contractor and Engineer shall provide the effective coordination of all parties’ necessary for successful startup.

B. The Owner and Contractor shall provide operating personnel for the duration of the startup.

C. The startup shall not be commenced until all required individual equipment tests have been completed to the satisfaction of the Engineer.

D. All defects in materials or workmanship which appear during this test period shall be immediately corrected by the Contractor.

E. During the startup, the Owner and Contractor shall provide the services of authorized representative, in addition to those services required under operations testing, as necessary, to correct faulty equipment operation.

F. The Contractor shall be required to conduct the startup of the well, tank, and pump station, operate all system components for a period of time sufficient to detect any failures, and pass the startup test. All equipment must properly run in normal operation for 2 full days. If any item malfunctions during the test, the item shall be repaired and the test restarted at day zero with no credit given for the operating time before the aforementioned malfunction.

1. The Contractor shall lubricate and maintain the equipment in accordance with the manufacturer's recommendations prior to startup.

2. Prerequisites: The following shall be completed before testing and startup begins.

a. All Owner's manuals information required by the Contract Documents has been furnished.

b. Provide all safety equipment, fire extinguishers, protective guards and shields, handrails, grating, safety signs, and valve and piping identification required by the Contract Documents. Devices and equipment shall be fully functional, adjusted and tested.

c. Manufacturer's certification of proper installation has been accepted.

d. Leakage tests, electrical tests, and adjustments have been completed.

e. Disinfection and bacteriological testing has been performed and approved by DEQ for the new water system components.

f. The Engineer has approved the testing and startup Plan. The Plan shall include a check list documenting that all the prerequisites have been provided and/or completed.

g. Functional verification of the individual instrumentation loops (analog, status, alarm, and control).

h. Adjustment of the pressure switches, timing relays, level switches, temperature switches, flow meters, HMI monitors, and all other control devices to the settings determined by the Engineer or the equipment manufacturer.

i. Functional verification of the individual interlocks between the field-mounted control devices and the motor control circuits, control circuits of variable-speed controllers, and packaged system controls.

3.6 SUPPLIES

A. The Owner shall furnish all potable water for testing, monitoring, and operator services required for conducting the tests.

3.7 TRAINING

A. The Contractor shall coordinate the training periods with the Owner and manufacturer's representatives and shall submit a training schedule and detailed agenda for each piece of equipment or system for which training is to be provided. Said training schedule and agenda shall be submitted not less than 14 calendar days prior to the time that the associated training is to be provided. The Contractor shall confirm each training period a minimum of three days prior to scheduled time.

B. The Owner has the option to video every training session.

END OF SECTION 01 75 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Comply with requirements stated in conditions of the contract and in Specifications for administrative procedures in closing out the Work.

B. Furnish lien waivers, bond extensions, and other required data.

C. Satisfy conditions of the contract, fiscal provisions, legal submittals and additional administrative requirements.

1.2 SUBSTANTIAL COMPLETION

A. When substantially complete, the Contractor shall submit to the Owner:

1. A written notice that the Work, or designated portion thereof, is substantially complete.

2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, Engineer will perform an inspection to determine the status of completion. If the Work is not deemed substantially complete, the following will occur:

1. Owner will promptly notify the Contractor in writing, giving the reasons therefore.

2. The Contractor shall remedy the deficiencies in the Work, and send a second written notice of Substantial Completion to the Owner.

3. Owner will request the Engineer to re-inspect the Work.

4. Once the Work is deemed substantially complete and after review and approval, the Engineer will execute and deliver to the Owner and the Contractor, the Certificate of Substantial Completion with a final list of items to be completed or corrected prior to release of final payment.

1.3 PROJECT RECORD DOCUMENTS

A. Maintain at Project site, available to Owner and Engineer, one copy of the Contract Documents, shop drawings and other submittals, in good order.

1. Mark and record field changes and detailed information contained in submittals and change orders.

2. Record actual depths, horizontal and vertical location of underground pipes, duct banks and other buried utilities. Reference dimensions to permanent surface features.

3. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.

4. Identify location of spare conduits including beginning, ending, and routing through pull boxes and manholes. Record spare conductors, including number and size, within spare conduits, and filled conduits.

5. Provide schedules, lists, layout drawings, and wiring diagrams.

6. Make annotations with erasable colored pencil conforming to the following color code:

   a. Additions - Red

   b. Deletions - Green

   c. Comments - Blue

   d. Dimensions - Graphite

7. Make all annotations on one set of drawings.

B. Maintain documents separate from those used for construction.

1. Label documents “RECORD DRAWINGS.”

C. Keep documents current.

1. Record required information at the time the material and equipment is installed and before permanently concealing.

2. During progress meetings, record documents will be reviewed to ascertain that changes have been recorded.

D. Submit record documents for review. Submittal shall be in accordance with Section 01 33 00 – Submittal Procedures.

1.4 FINAL SUBMITTALS

A. The Contractor, prior to requesting final payment, shall obtain and submit the following items to the Engineer for transmittal to the Owner:

1. Written guarantees, where required.

2. Technical Manuals and instructions.

3. New permanent cylinders and key blanks for all locks.

4. Maintenance stock items; spare parts; special tools.

5. Completed record drawings.

6. Bonds for roofing, maintenance, etc., as required.

7. Certificates of inspection and acceptance by local governing agencies having jurisdiction.

8. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

9. Letter from bonding company stating that bonds will be extended for one year after substantial completion.

B. Owner will prepare a final Change Order, reflecting approved adjustments to the contract sum which were not previously made by Change Orders.

1.5 FINAL CLEANUP

A. The Contractor shall promptly remove from the vicinity of the completed Work, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the Work by the Owner will be withheld until the Contractor has satisfactorily performed the final cleanup of the Site.

1.6 MAINTENANCE AND GUARANTEE

A. The Contractor shall comply with the maintenance and guarantee requirements contained in the General Conditions.

B. The Contractor shall make all repairs and replacements promptly upon receipt of written order from the Owner. If the Contractor fails to make such repairs or replacements promptly, the Owner reserves the right to do the Work and the Contractor and its surety shall be liable to the Owner for the cost thereof.

1.7 FINAL PAY ESTIMATE

A. Submit final pay estimate and supporting data to Owner.

B. Final estimates shall reflect all adjustments to the contract sum:

1. The original contract sum

2. Additions and deductions resulting from:

a. Previous Change Orders

b. Allowances

c. Unit prices

d. Deductions for uncorrected work

e. Penalties and bonuses

f. Deductions for liquidated damages

3. Total contract sum, as adjusted

4. Previous payments

5. Sum remaining due

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall submit technical operation and maintenance information for each item of mechanical and electrical equipment in an organized manner in the Owner's Manual. It shall be written so that it can be used and understood by the Owner's operation and maintenance staff. The Owner's Manual information shall also be submitted in electronic format using a USB flash drive.

B. All manuals supplied to the Owner by suppliers of Owner-furnished equipment, shall be inserted into the Owner's Manual by the Contractor. The Contractor shall be responsible for providing all other information.

1.2 OWNER'S MANUAL

A. The Owner's Manual shall include the following for each item of mechanical and electrical equipment (as applicable):

1. Equipment Summary: A summary table shall include the equipment name and equipment number, the manufacturer's model number, serial number, and other nameplate information specific to the equipment provided.

2. Operational Procedures: Manufacturer-recommended procedures on the following shall be included:

   a. Installation

   b. Adjustment

   c. Startup

   d. Location of controls, special tools, equipment required, or related instrumentation needed for operation

   e. Operation procedures

   f. Load changes, Calibration, Shutdown

3. Troubleshooting, Disassembly, Reassembly

   a. Realignment

   b. Testing to determine performance efficiency

   c. Tabulation of proper settings for all pressure relief valves, low and high pressure switches, and other protection devices

   d. List of all electrical relay settings including alarm and contact settings

4. Preventive Maintenance Procedures:

   a. Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by leaving the equipment in place.

   b. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade, type, and temperature ranges, shall be covered.

5. Parts List and Drawings:

   a. Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.

   b. Drawings: Cross-sectional or exploded view drawings shall accompany the part list.

6. Wiring Diagrams: Include complete internal and connection wiring diagrams for electrical equipment items.

7. Shop Drawings: Include approved shop or fabrication drawings, complete with dimensions. Include performance curves for pumps furnished.

8. Safety: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

9. Documentation: All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

10. Spare Parts: This part shall contain spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall be limited to those spare parts which each manufacturer recommends be maintained by the Owner in inventory at the plant site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the Owner in ordering. The Contractor shall cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents.

B. If manufacturer’s standard brochures and manuals are used to describe operating and maintenance procedures, modify such brochures and manuals **to reflect only the model or series of equipment used on this project and features provided**. Cross out neatly or remove extraneous material, or otherwise annotate or eliminate.

1.3 TRANSMITTAL PROCEDURE

A. Provide three (3) original paper copies and one (1) electronic copy in PDF format of all operating and maintenance information. For ease of identification, label each

manufacturer's brochure and manual with the equipment name. Organize the information in 3-ring binders and use an indexing feature within the PDF submission, in numerical order, per specification section number. Include in the manuals a table of contents and tab sheets to permit easy location of desired information. Each binder shall include a cover sheet and spine label giving the project name, Engineer's project number, Contractor name and contact information, applicable subcontractor name and contact information, and supplier name and contact information.

B. The Contractor shall submit to the Engineer three identical Owner's Manuals a minimum of 90 calendar days prior to the scheduled startup of the equipment.

C. The Engineer will review the Owner's Manuals within 30 days following their receipt by the Engineer. The Contractor shall then make any corrections and changes noted and compile all the corrected Owner's Manuals for final submittal to the Engineer.

1.4 PAYMENT

A. Acceptable operating and maintenance information for the project must be delivered to the Engineer prior to the project being 75 percent complete or at least two weeks prior to startup of any equipment. Progress payments for work in excess of 80 percent completion or 2 weeks prior to startup will not be made until the specified acceptable operating and maintenance information has been delivered to the Engineer.

1.5 FIELD CHANGES

A. Following the acceptable installation and operation of an equipment item, the item's instructions and procedures are to be modified and supplemented to reflect any field changes or information requiring field data.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION 01 78 23

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SECTION 02 41 00 – DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTIONS

A. Work under this Section includes providing selective demolition of part of the existing facilities shown on the drawing and as specified herein.

B. Work under this Section also includes EPA reporting, testing (unless previously provided to the Contractor), and disposal of structures containing asbestos. The EPA required reporting is required regardless if asbestos is encountered or not.

C. Prior to performing any demolition work, the area to be demolished shall be measured and agreed upon by the Engineer and Contractor. If demolition occurs prior to this measurement and agreement with the Engineer, the Engineer will measure only the area that, in the opinion of the Engineer, should have been the limits of demolition. Repairs to areas outside of these demolition limits, as determined by the Engineer, shall be replaced or reconstructed at no cost to the Owner.

1.2 CONDITION OF STRUCTURES

A. Owner assumes no responsibility for actual conditions of items or structures to be demolished. Conditions existing at time of commencement of contract will be the responsibility of the Contractor.

1.3 PROTECTION OF FACILITIES

A. Protect from damage existing finish work that is to remain in place that becomes exposed during demolition operations.

B. Protect adjacent areas with suitable coverings when necessary to prevent surface damage, including protecting existing concrete and asphalt surfaces from concrete staining.

C. Remove protections at completion of work.

1.4 ENVIRONMENTAL CONTROLS

A. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

1.5 ASBESTOS REQUIREMENTS

A. Completing the National Emission Standards for Hazardous Air Pollutants (NESHAP) sampling, testing, submitting the EPA notification and any other required submittals as incidental to the Work.

B. The project includes structures with a potential for asbestos containing material (materials other than metal, glass, or PVC plastic). Comply with the following regulations:

1. (NESHAP Regulations 40 CFR 61

2. Toxic Substances Control Act – Asbestos 40 CFR 763

3. Asbestos Hazard Emergency Response Act (AHERA)

4. Relevant OSHA Standards

C. If asbestos is discovered in the course of the demolition Work that exceeds the threshold amounts as defined in NESHAP 40 CFR 61.145, comply with the requirements for asbestos containing materials in all of the above listed regulations and standards.

1.6 PERMITS

A. Obtain any permits for building, electrical, or plumbing demolition that may be required for the Work at no additional costs.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions of surrounding area that could be misconstrued as damage resulting from selective demolition work.

3.2 ASBESTOS SAMPLING, TESTING, HANDLING, SHIPPING, AND DISPOSAL

A. Prior to any demolition or renovation, have a National Emissions Standards for Hazardous Air Pollution (NESHAP), Asbestos Hazard Emergency Response Act (AHERA) or Environmental Protection Agency (EPA) certified inspector inspect and collect appropriate samples to determine the presence of Asbestos Containing Material (ACM) in the structure.

B. Have the collected samples analyzed at a certified asbestos analytical laboratory.

C. Generate and submit a copy of the inspection report to the Engineer.

D. If ACM is found and is below the threshold quantities as defined in NESHAP 40 CFR 61.145 Standard for Demolition and Renovation, or if ACM is not present on structures being renovated, complete the EPA Notification requirements below.

E. If ACM is found and was not previously identified in the Contract and is above the threshold quantity as defined in NESHAP 40 CFR 61.145 Standard for Demolition and Renovation, stop Work on the affected structure and notify the Owner and Engineer. Do not proceed with Work on the affected structure until a Change has been issued by the Owner.

3.3 EPA NOTIFICATION REQUIREMENTS

A. Regardless if ACM is found or not, complete a Notification of Demolition/Renovation in writing and submit to the EPA at least 10 days prior to the start of demolition/renovation operations, as outlined in NESHAP 40 CFR 61.145. Use of the following form is recommended.

1. http://www.epa.gov/region10/pdf/asbestos/demolition-renovation-notification-form_fillable.pdf

B. Submit a copy of the notification to the Engineer for concurrence prior to the EPA submittal. Allow 10 working days for Engineer concurrence. Upon concurrence, submit notification to the EPA Region 10 office. At the following address:

Asbestos NESHAP Coordinator
U.S. Environmental Protection Agency
Region 10 Office of Compliance and Enforcement (OCE-101)
1200 Sixth Avenue, Suite 900
Seattle, WA 98101

3.4 PREPARATION

A. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of adjacent facilities to remain.

B. Cease operations immediately if safety of structure or existing facility appears to be endangered. Take precautions to support structure/facilities until determination is made for continuing operations.

3.5 DEMOLITION

A. Demolish concrete flatwork only in areas shown on the drawings to be removed. However, the exact location may be adjusted in the field if required to avoid existing obstacles.

1. The line to be cut shall be marked on the surface along a string-line or straight edge with a marker that will not wash away from the action of the saw's cooling water. All cutting lines shall be marked along straight line prior to cutting.

2. Furnish and operate a power drive, self-propelled wheel mounted pavement sawing machine. The saw blade shall be either a wet cutting or dry cutting type. The depth of the saw shall be controlled by graduated positions set on the machine.

3. Concrete and asphalt slabs shall be cut by saw cutting the slab to full slab depth with one pass of the saw following exactly along the marked cutting line.

B. Where large power driven saws cannot be operated close enough to the end of the slab to completely cut it (i.e. at an abutting wall or foundation) use power driven impact tools and grinders to remove the slab and form a smooth neat joint.

C. Where slab thicknesses exceed the maximum depth of the cutting machine, cut a line as deep as possible with the machine and use power driven impact tolls and grinders to remove the slab and form a smooth neat joint.

D. Remove all foundations shown to be removed. Do not bury unless authorized by the Engineer at the time of demolition.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubble and other materials resulting from demolition work. Haul all materials from demolition to a disposal site obtained by the Contractor.

3.7 CLEANUP AND REPAIR

A. Upon completion of demolition work, remove tools, equipment, and demolished materials from site.

3.8 REPAIR

A. Repair demolition performed in excess of that required. Return structures and surfaces to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02 41 00

SECTION 03 11 00 – CONCRETE FORMING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide complete formwork design and required calculations.

B. Furnish all labor, materials, and equipment as required for forming cast-in-place concrete, including necessary shoring, bracing, and anchorage.

C. Construct openings in formwork as required for other related work.

D. Provide and install all form accessories such as snap ties, bracing, etc.

E. Stripping of forms from finished concrete.

1.2 REFERENCE STANDARDS

A. ACI 17 – Specifications for Tolerances for Concrete Construction and Materials

B. ACI 301 – Specifications for Structural Concrete

C. ACI 318 – Building Code Requirements for Structural Concrete and Commentary

D. ACI 347R – Guide to Formwork for Concrete

E. PS 1 – Structural Plywood

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Submit concrete forming plans stamped by a professional engineer registered in the State of Idaho for review for all forming where the height of the concrete work exceeds four feet.

1. Submit shoring and reshoring designs for all concrete work where shoring or reshoring is required.

2. Design and provide forms for pressure resulting from placement of concrete and construction loads while maintaining the specified tolerances.

3. Forming shall have sufficient strength to support loads, lateral pressure, and allowable stresses outlined in ACI 347R and for design considerations including wind load, temporary construction loads, and construction equipment loads.

C. Calculations: Submit concrete form design calculations stamped by a professional engineer registered in the State of Idaho.

1.4 QUALITY ASSURANCE

A. Designer's Qualifications: Professional engineer, licensed in State where Work is to be done and having experience in concrete formwork. The Contractor is responsible for the design and adequacy of formwork and shoring.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with ACI 347R, ACI 301, and ACI 318.

2.2 MATERIALS

A. Smooth Forms: Pre-manufactured forms or job fabricated forms using plyform faced with material which will produce smooth, hard, uniform texture on concrete.

1. Arrange facing materials orderly and symmetrical, keeping number of seams to a practical minimum.

2. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surfaces.

B. Forming accessories:

1. Use fabricated wire.

2. Use form ties constructed so that ends or end fasteners can be removed without causing appreciable spalling of concrete faces.

3. After ends or end fasteners of form ties have been removed, embedded portion of ties to terminate not less than two diameters from formed faces of concrete, but in no case less than 3/4-inch.

4. When formed face of concrete is not to be permanently exposed to view, form ties may be cut off flush with formed surfaces.

5. Use ties with 3/4-inch diameter cones and a 1-1/2-inch break back on both ends for water retaining structures. Ties are to be furnished with a water seal or stop.

6. Snap ties, if used, shall not be broken until the concrete has reached the design concrete strength. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used. The use of tie wires as form ties will not be permitted. Fully threaded stub bolts may be used in lieu of smooth ties with waterstops.

7. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made for the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess. Plugs shall be A58 Sure Plug as manufactured by Dayton Superior.

8. Form ties which remain in the corewall of water-retaining structures shall have waterstops and a one-inch minimum breakback or cone depth.

C. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

D. Fillets for Chamfered Corners: Wood or plastic strips attached to the inside of forms.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify lines, levels, and measurements before proceeding with formwork. Ensure dimensions agree with the Drawings.

3.2 CONSTRUCTION

A. Make forms sufficiently tight to prevent loss of cement paste.

B. Place chamfer strips in corners of forms to produce beveled edges on permanently exposed surfaces.

1. Interior corners on such surfaces and edges of formed joints will not require beveling.

C. To maintain specified finish tolerances, chamfer formwork to compensate for anticipated deflections.

D. Provide positive means of adjustment using wedges or jacks, or shores and struts, and take up all settlement during concrete placing operation.

E. Securely brace forms against lateral deflection.

F. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

G. At construction joints, overlap forms over hardened concrete at least 6 inches. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain true surface.

H. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.

I. Anchor formwork to shores or other supporting surfaces or members so that upward or lateral movement of any part of formwork system is prevented during concrete placement.

J. The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

3.3 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for Work embedded in or passing through concrete.

B. Coordinate Work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

C. Install accessories in accordance with manufacturer's instructions, level and plumb with templates where necessary. Ensure items are not disturbed during concrete placement.

D. Position embedded items accurately and support against displacement.

E. Under no circumstances shall forming be such that the drop of concrete in the wall forms will exceed 8 feet in any one place.

3.4 FORM FINISHES

A. Use smooth forms for natural plywood, grout cleaned, smooth rubbed, scrubbed, or sand floated finishes.

1. Fabricate true-to-line in order that surfaces produced will require little dressing to arrive at true surfaces.

2. Where an as-cast finish is required, no dressing shall be permitted in the finishing operation.

B. Install form panels in orderly arrangement with joints planned in approved relation to building elements.

3.5 FORM COATING

A. Unless otherwise specified or approved, treat surfaces of forms.

B. Cover surfaces of forms with form coating to aid in removal of forms with minimal damage to concrete.

3.6 REMOVAL OF FORMS

A. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.

B. Where no re-shoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs, and other concrete members in place until concrete has attained its specified strength as determined by test cylinders.

C. Where reshoring is planned, supporting formwork may be removed when concrete has reached 70 percent of specified strength as determined by test cylinders, provided reshoring is installed immediately.

3.7 REUSE OF FORMS

A. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of surface.

B. Thoroughly clean and properly coat forms before reuse.

END OF SECTION 03 11 00

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SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and place reinforcing steel and reinforcing steel accessories in accordance with the drawings and as specified herein.

1.2 REFERENCE STANDARDS

A. ACI 318 – Building Code Requirements for Structural Concrete and Commentary

B. ACI SP-66 – ACI Detailing Manual

C. ASTM A615 – Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

D. ASTM A706 – Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement

E. ASTM A996 – Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

F. ASTM A1064 – Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

G. AWS D1.4 – Structural Welding Code – Reinforcing Steel

H. CRSI (DA4) – Manual of Standard Practice

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Indicate bar schedules, sizes, spacings, locations and quantities of reinforcing steel, shapes of bent bars, wire fabric, bending and cutting schedules, splicing locations, stirrup spacing, supporting, and spacing devices.

C. Manufacturer’s Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Welder’s Certificates: Submit certifications for welders employed on the project, verifying AWS qualification withing the previous 12 months.

E. Reports: Submit certified copies of mill test report of supplied reinforcement materials analysis indicating physical and chemical analysis

1.4 QUALITY ASSURANCE

A. Fabrication tolerances:

1.	Sheared length	± 1 inch
2.	Overall for stirrups, ties, and spirals	± 1/2 inch
3.	All other bends	± 1 inch

B. Placement tolerance:

1.	Spacing	1/4 inch
2.	Clear distance	+ 1/4 inch
3.	Lengthwise location	2 inches

C. Submit shop fabrication drawings of reinforcement prior to placing concrete.

D. Perform work of this section in accordance with ACI 315 and ACI 318.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code – Reinforcing Steel".

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish steel reinforcing bars of the type and grade as shown on the contract drawings conforming to the following steel reinforcing bars specifications. If bar type and grade are not shown on the drawings, furnish bars conforming to paragraph B below.

B. Reinforcing Steel Bars: ASTM A615, Grade 60 billet-steel deformed bars, uncoated as shown on the plans.

C. Welded Steel Wire Fabric: ASTM A1064 plain type; in flat sheets or coiled rolls uncoated finish as shown on the plans.

D. Low Alloy Reinforcing Steel Bars: ASTM A706, Grade 60 low alloy steel deformed bars, uncoated as shown on the plans.

E. Smooth dowel bars for construction joints: ASTM A29, Grade 60.

1. Where indicated, provide metal dowel cap at one end of dowel to permit longitudinal movement of dowel within concrete section.

2. Provide for movement which equals joint width plus one-half inch.

F. Corrosion Resistant Steel Bars: ASTM A1035-16b, Low Carbon Chromium Steel Reinforcing Bars.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gauge annealed type.

B. Chairs, Bolster, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.3 FABRICATION

A. Fabricate reinforcement in accordance with ACI 315 and CRSI (DA4) – Manual of Standard Practice.

B. Locate reinforcing splices only where shown on the drawings. Indicate location of splices on shop drawings.

C. Weld reinforcing bars only where shown on the drawings. Furnish ASTM A706 reinforcing steel only where welding is required. Weld reinforcing bars in accordance with AWS D1.4.

PART 3 - EXECUTION

3.1 GENERAL

A. Clean reinforcement of loose or thick rust and mill scale, dirt, paint, oil, grease, earth, ice, and other foreign materials that would reduce bond to concrete.

B. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover.

C. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.2 PLACING

A. Place all reinforcement in the exact position shown on the plans and approved shop drawings and secure in position during the placing and compacting of concrete. Wire bars together with No. 16 gauge wire with ties at all intersections except where spacing is less than 12 inches in each direction, in which case tie alternate intersections.

B. Maintain the distance from the forms and between layers of reinforcement by means of prefabricated chairs, precast mortar blocks, ties, hangers, or other approved devices. Placing and fastening of reinforcement in each section of the Work must be approved by the Engineer before any concrete is deposited in the section.

C. Do not tack weld reinforcing bars.

D. Overlap sheets of metal mesh 1 square plus 6 inches to maintain a uniform strength, and securely fasten at the ends and edges, and support to maintain clearances.

E. Support reinforcing steel for formed floor slabs on metal chairs or slab bolsters. Size chairs or bolsters to position the steel in the exact location shown on the plans. Space chairs for supporting the top steel and bolsters for supporting the bottom steel not more than 5 feet on centers in each direction. Plastic coat the portion of the metal support in contact with the forms to prevent rust. Tie down deck steel to beams or forms at regular intervals of not more than 5 feet on centers along the beams to prevent movement of the steel during placing of the concrete.

3.3 SPLICING

A. Furnish all reinforcement in the full lengths indicated on the plans unless otherwise permitted. Splicing of bars, except where shown on the plans, not permitted without written approval from the Engineer. Stagger splices as far as possible.

B. Weld reinforcing steel only if detailed on the drawings

C. Do not bend reinforcement after embedding in hardened concrete.

D. Do not extend bars continuously through any expansion joint except expansion dowels.

3.4 FIELD QUALITIY CONTROL

A. An independent testing agency, as specified in the General Structural Notes – Special Inspection Tables, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all labor, materials, and equipment required for the construction of cast-in-place concrete as shown on the drawings and as specified herein.

1.2 DEFINITIONS

A. Cold Weather: When ambient temperature is below 40 degrees Fahrenheit or is approaching 40 degrees Fahrenheit and falling.

B. Contractor's Licensed Design Engineer: Individual representing Contractor who is licensed to practice engineering as defined by statutory requirements of professional licensing laws in state or jurisdiction in which Project is to be constructed.

C. Defective Area: Surface defects that include honeycomb, rock pockets, indentations, and surface voids greater than 3/16-inch deep, surface voids greater than ¾-inch in diameter, cracks in liquid containment structures and below grade habitable spaces that are 0.005-inch wide and wider, and cracks in other structures that are 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances and include but are not limited to fins, form pop-outs, and other projections. At exposed concrete, defective areas also include texture irregularities, stains, and other color variations that cannot be removed by cleaning.

D. Exposed Concrete: Concrete surface that can be seen inside or outside of structure regardless of whether concrete is above water, dry at all times, or can be seen when structure is drained.

E. Hot Weather: As defined in ACI 305.1.

F. Hydraulic Structure: Liquid containment structure.

G. New Concrete: Less than 60 days old.

H. Slurry Mixture: Mixture of sand, 3/8-inch maximum nominal aggregate size, cement, and water for wall construction joints with waterstop.

1.3 REFERENCE SPECIFICATIONS

A. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

B. ACI 301 – Specifications for Structural Concrete

C. ACI 302.1R – Guide for Concrete Floor and Slab Construction

D. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete

E. ACI 305R – Guide to Hot Weather Concreting

F. ACI 306R – Cold Weather Concreting

G. ACI 308R – Guide to Curing Concrete

H. ACI 318 – Building Code Requirements for Structural Concrete and Commentary

I. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field

J. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

K. ASTM C94 – Specification for Ready-Mixed Concrete

L. ATM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch Cube Specimens)

M. ASTM C143 – Standard Test Method for Slump of Hydraulic Cement Concrete

N. ASTM C150 – Specification for Portland Cement

O. ASTM C157 – Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete

P. ASTM C171 – Specification for Sheet Materials for Curing Concrete

Q. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete

R. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

S. ASTM C260 – Specification for Air-Entraining Admixtures for Concrete

T. ASTM C309 – Specification for Liquid Membrane-Forming Compounds for Curing Concrete

U. ASTM C494 – Specification for Chemical Admixtures for Concrete

V. ASTM C618 – Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

W. ASTM C881 – Specification for Epoxy-Resin-Base Bonding Systems for Concrete

X. ASTM C1059 – Specification for Latex Agents for Bonding Fresh to Hardened Concrete

Y. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic Cement Concrete

Z. ASTM C1107 – Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

AA. ASTM C1240 – Specification for Silica Fume Used in Cementitious Mixtures

BB. ASTM C1315 – Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

CC. ASTM C1602 – Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

DD. ASTM D1751 – Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

EE. ASTM E1155 – Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers

FF. ASTM E1643 – Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

GG. ASTM E1745 – Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

HH. IBC – International Building Code

1.4 JOB CONDITIONS

A. In hot and cold weather, comply with the requirements of ACI 305 and 306.

B. Do not place concrete on frozen ground.

C. Unless adequate protection is provided, do not place concrete during rain, sleet, or snow.

D. Do not allow rainwater to increase mixing water or damage surface finish.

1.5 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Mix Design: Submit mix design to be used for each class of concrete.

1. Submit location of materials source, admixtures to be used, and other related data

2. Submit test reports showing suitability of aggregates used in concrete mixes.

3. Test results of successful ASR mitigation using ASTM C1567.

C. Detailed plan for curing and protection of concrete: Detailed plan for curing and protection of concrete placed and cured in cold weather. Plan shall include, but not be limited to, the following:

1. Procedures for protecting sub grade from frost and accumulation of ice or snow on reinforcement, other metallic embeds, and forms prior to placement.

2. Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.

3. Methods for temperature protection during placement.

4. Types of covering, insulation, housing, or heating to be provided.

5. Curing methods to be used during and following protection period.

6. Use of strength accelerating admixtures.

7. Methods for verification of in-place strength.

8. Procedures for measuring and recording concrete temperatures.

9. Procedures for preventing drying during dry, windy conditions.

D. Detailed plan for hot weather placements including curing and protection for concrete placed and cured in hot weather. Plan shall include, but not be limited to, the following:

1. Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.

2. Use of retarding admixture.

3. Methods for controlling temperature of reinforcement and other embedded items and concrete materials before and during placement.

4. Types of shading and wind protection to be provided.

5. Curing methods, including use of evaporation retardant.

6. Procedures for measuring and recording concrete temperatures.

7. Procedures for preventing drying during dry, windy conditions.

E. Informational Submittals:

1. Preinstallation Conference minutes.

2. Manufacturer's application instructions for bonding agent and bond breaker.

3. Manufacturer's Certificate of Compliance to specified standards:

a. Bonding agent.

b. Bond breaker.

4. Statement of Qualification:

a. Batch Plant: Certification as specified herein.

b. Mix designer.

c. Installer.

d. Testing agency.

5. Field test reports.

6. Recorded temperature data from concrete placement where specified.

7. Tightness test results.

8. Concrete Delivery Tickets:

a. For each batch of concrete before unloading at Site.

b. In accordance with ASTM C94, including requirements 14.2.1. through 14.2.10.

c. Indicate amount of mixing water withheld and maximum amount that may be permitted to be added at Site.

1.6 QUALITY ASSURANCE

A. Concrete construction shall conform to requirements of ACI 117, ACI 301, ACI 318 except as modified herein.

B. Qualifications:

1. Batch Plant: NRMCA Program for Certification of Ready-Mixed Concrete Production Facilities or approved equivalent program.

2. Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in jurisdiction of the Work. Requirement may be waived if individual is Contractor's Licensed Design Engineer.

3. Testing Agency: Unless otherwise permitted, an independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.

a. Where field testing is required of Contractor, personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-l or an equivalent certification program.

b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade 1. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Grade II.

C. Preinstallation Conference:

1. Required Meeting Attendees:

a. Contractor, including pumping, placing and finishing, and curing subcontractors.

b. Ready-mix producer.

c. Admixture representative.

d. Testing and sampling personnel.

e. Engineer who authored Statement of Special Inspection Plan or Engineer's designee.

2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.

3. Agenda shall include:

a. Admixture types, dosage, performance, and redosing at Site.

b. Mix designs, test of mixes, and Submittals.

c. Placement methods, techniques, equipment, consolidation, and form pressures.

d. Slump and placement time to maintain slump.

e. Finish, curing, and water retention.

f. Thermal control plan.

g. Protection procedures for weather conditions.

h. Other specified requirements requiring coordination.

4. Conference minutes as specified in Section 01 31 19 - Project Meetings.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: Use Portland cement conforming to the requirements of ASTM C150 Type II for low alkali cement, or ASTM C595 Type IL. .

B. General Admixtures: Admixtures, other than air-entraining agents, may be used when the type and amount to be used are approved. Calcium chloride will not be allowed as an admixture.

C. Air-Entraining Agents: Use air-entraining agents to the requirements of ASTM C260 added to the mixing water.

D. Water Reducing Agents: Water reducing or water reducing and retarding admixtures may be used to increase workability of the concrete when approved by the Engineer. Use only

admixtures produced by a company approved by the Engineer. Use water reducing admixtures conforming to ASTM C494.

E. High Range Water Reducer: Conforming to ASTM C494, Type F or G. The preferred admixture shall be free of chlorides and alkalines. A second-generation-type high-range water reducer shall be Type G and be batch-plant-added.

F. Water: Use potable water for mixing concrete.

G. Coarse Aggregate: Use coarse aggregate that consists of gravel, crushed slag, crushed stone or other approved inert materials, composed of hard, strong and durable particles, free of injurious coatings, and conforming to the requirements of ASTM C33, except as modified herein.

1. Use only aggregates that include deleterious substances not exceeding the following:

	Percent Passing (by weight)
Soft Fragments	0.20
Coal and Lignite	0.30
Clay Lumps	0.30
Other Deleterious Substances	2.00
Minus 200 Material	1.75

2. Use coarse aggregate meeting the following gradations when tested in accordance to the requirements of ASTM C136.

	Percent Passing (by weight)				
Coarse Aggregate Size	1"	3/4”	3/8"	No. 4	No. 8
3/4” to No. 4	100	90-100	20-55	1-10	0-5

H. Fine Aggregate: Use aggregate of natural sand or other approved inert materials composed of hard, strong, and durable particles conforming to the requirements of ASTM C33 except as modified herein.

1. Use only aggregates that include deleterious substances not exceeding the following:

	Percent (by weight)
Clay Lumps	0.50
Coal and Lignite	0.30
Other Deleterious Substances	2.00

	Percent (by weight)
Minus 200 Material	1.75

2. Moisture content of fine aggregate shall not exceed 8 percent.

3. Use fine aggregate that is uniformly graded from coarse to fine within the following gradation, when tested in accordance to the requirements of ASTM C136.

Sieve Size	Percent Passing (by weight)
3/8"	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

I. Curing Compounds: Use curing compounds that meet the requirements of ASTM C309.

J. Chemical Hardener:

1. Colorless, aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent.

2. Not less than 2 pounds fluosilicate per gallon.

3. Provide materials which do not react with, inhibit, or otherwise interfere with adhesives and bonding of future floor finishes.

4. Acceptable Products: L&M Chem-Hard by Laticrete; MasterKure HD 300WB by BASF, or approved alternate.

K. Waterstops and Joint Fillers:

1. Waterstop of Joints: Extruded PVC waterstop, shape and size as shown on the drawings. Thermo bond all joints in PVC waterstops.

2. Expansive Water Stop: Expansive waterstop shall be a bentonite/butyl rubber based waterstop that expands on exposure to water. It shall be applied in accordance with manufacturer’s recommendations.

3. Joint Filler: Type B: Provide closed cell polyvinyl chloride foam per ASTM D1752 requirements with resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.

L. Fly ash shall be Class F conforming to AASHTO M 295 with the additional requirement that the available alkalis in the fly ash shall not exceed 2 percent.

M. Concrete Sealer: Concrete sealer is intended to be used on concrete slabs to prevent dusting and staining. The products listed are not intended to be used as curing compounds or for sealing the slab against water leakage.

1. Manufacturers: One of the following or equal:

a. Euco Diamond Hard by Euclid Chemical

b. L&M Seal Hard by Laticrete

2.2 PROPORTIONING

A. In proportioning materials for mixing, use certified scales. Do not use volume measurement except for water and liquid admixtures.

B. Proportion the materials to produce concrete meeting the strengths and ACI 318 Exposure Classifications indicated in the plans.

C. Fly ash may be used to replace a portion of the Portland cement in the concrete mix. The fly ash used shall not exceed 25 percent of the total cement material in the mix. The cement material in the mix includes both Portland cement and fly ash.

D. The proposed aggregate for the mix shall be tested for expansion and Alkali-Silica Reaction (ASR) in accordance with AASHTO T 303. Where testing indicates aggregates are reactive, the Contractor shall use fly ash, lithium compound admixtures or both to produce a concrete mix that successfully mitigates ASR. Contractor shall provide test results of successful mitigation using ASTM C1567, with results showing a linear expansion at 14 days not exceeding 0.10 percent when tested.

2.3 READY MIX CONCRETE

A. Ready-mixed concrete shall conform to the provisions in AASHTO M157 regarding batching, mixers and agitators, mixing and delivery, inspection, consistency and air content, and certification of batches.

2.4 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:

1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.

2. Laminated, reinforced 10 mil vapor barrier. Permeance of 0.025 per ASTM F1249.

3. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

4. Manufacturers, or Approved Equal:

a. Fortifiber Building Systems Group; Moistop Ultra 10: www.fortifiber.com/#sle.

b. ISI Building Products; Viper VaporCheck II 10-mil (Class-A): www.isibp.com/#sle.

c. Stego Industries, LLC; Stego Wrap, Class A: www.stegoindustries.com/#sle.

d. W.R. Meadows, Inc; PERMINATOR Class A – 10 mils: www.wrmeadows.com/#sle.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify lines, levels, and dimensions before proceeding with Work of this section.

B. Coordinate placement of embedded items with erection of concrete formwork and placement form accessories.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent according to bonding agent manufacturer's instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

2. Use latex bonding agent only for non-load-bearing applications.

D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack with non-shrink grout.

3.2 CONVEYING

A. Handle concrete from mixer to location of final placing as rapidly as practicable by methods which prevent segregation or loss of ingredients and assure that quality is maintained.

B. Use only equipment conforming to ASTM C94.

C. Use only approved pumping equipment that is rated for the lift and the capacity required for placement.

1. Control pneumatic placement to prevent segregation.

2. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 inches.

3. Do not use aluminum or aluminum alloy pipes.

3.3 PLACING CONCRETE

A. Notify Engineer not less than 24 hours prior to commencement of placement operations.

B. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

D. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer. Where approved, record the amount of water added on site and provide with the special inspection reports.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Place concrete continuously or in layers of such thickness that no concrete is deposited on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section.

1. If a section cannot be placed continuously, locate construction joints as indicated, or as approved by the Engineer.

2. If not indicated, locate construction joints not over 20 feet on center.

3. Place at such a rate that concrete which is being integrated with fresh concrete is still plastic.

4. Limit size of each placement to allow for strength gain and volume change as a result of shrinkage.

5. Make lifts not over 24 inches.

6. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.

7. Remove temporary spreaders in forms where concrete placing has reached an elevation rendering their service unnecessary.

8. Temporary spreaders may remain embedded in the concrete only if made of metal or concrete, and if prior approval has been obtained.

9. Do not allow concrete to fall over 6 feet, except when starting a wall pour. Do not drop concrete over 24 inches when starting a wall pour.

10. Joints in Footings and Slabs:

a. Ensure space beneath plastic waterstop is completely filled with concrete.

b. During concrete placement make visual inspection of entire waterstop area.

c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, and place remaining concrete to full height of slab.

d. Apply procedure to full length of waterstop.

F. Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing.

G. Control placement to prevent segregation.

H. Pumping of Concrete:

1. Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to ensure completion of concrete placement without cold joints in case of primary placing equipment breakdown.

2. Minimum Pump Hose (Conduit) Diameter: 4 inches.

3. Replace pumping equipment and hoses (conduits) that are not functioning properly.

I. Minimum Time between Adjacent Placements:

1. Construction or Control Joints: 7 days unless otherwise specified.

2. Construction joint between top of footing or slab, and column or wall: As soon as can safely be done without damaging previously cast concrete or interrupting curing thereof, but not less than 24 hours.

3. Expansion or Contraction Joints: 1 day.

4. For columns and walls with a height in excess of 10 feet, wait at least 2 hours before depositing concrete in beams, girders, or slabs supported thereon.

5. For columns and walls 10 feet in height or less, wait at least 1 hour prior to depositing concrete in beams, girders, brackets, column capitals, or slabs supported thereon.

J. Hot Weather:

1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 301, ACI 305.1, and as follows:

a. Maintain concrete temperature below 90 degrees Fahrenheit at time of placement, or furnish test data or other proof that admixtures and mix

ingredients· do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.

b. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.

K. Cold Weather Placement:

1. Unless otherwise permitted, shall be in accordance with requirements of ACI 306.1 and as follows:

a. Cold weather requirements shall apply when ambient temperature is below 40 degrees Fahrenheit or approaching 40 degrees Fahrenheit and falling.

b. Do not place concrete over frozen earth or against surfaces with frost or ice present. Frozen earth shall be thawed to acceptance of Engineer.

c. Unless otherwise permitted, do not place concrete in contact with surfaces less than 35 degrees Fahrenheit; requirement is applicable to all surfaces including reinforcement and other embedded items.

d. Provide supplemental external heat as needed when other means of thermal protection are unable to maintain minimum surface temperature of concrete as specified in ACI 306.1.

e. Maintain minimum surface temperature of concrete as specified in ACI 306.1 for no less than 3 days during cold weather conditions.

1) Protect concrete from freezing until end of curing period and until concrete has attained a compressive strength of 3,500 pounds per square inch or design compressive strength if less than 3,500 pounds per square inch.

2. Provide maximum and minimum temperature sensors placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of Work. Unless otherwise permitted, record surface temperature of concrete at least once every 12 hours during specified curing period.

3.4 CONSOLIDATION

A. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items, and into corners of forms to eliminate air or stone pockets.

B. Use internal vibrators with minimum frequency of 8,000 vibrations per minute. Do not use “jitterbugs” or similar devices.

C. Do not use vibrators to transport concrete.

D. Insert vibrators approximately 18 inches apart. Leave in long enough to consolidate concrete without segregation; generally, from 5 to 15 seconds maximum. Insert vibrator through new lift into previous lift to ensure good bond between lifts.

E. Keep spare vibrator available during concrete operations.

F. Vibrate concrete in vicinity of joints to obtain impervious concrete.

G. Where concrete is to have an as-cast or smooth-rubbed finish, bring a full surface of mortar against form by vibration process, supplemented if necessary, by spading, to work coarse aggregate back from formed surface.

3.5 CONSTRUCTION JOINTS

A. Locate construction joints, if not indicated, so as to least impair strength of structure, subject to Engineer approval.

1. In general, locate near middle of the spans of slabs, beams, and girders unless a beam intersects a girder at this point. In this case, offset joint in girder a distance equal to twice the width of the beam.

2. Locate joints in walls and columns at underside of floors, slabs, beams or girders, and at tops of footings or floor slabs.

3. Place beams, girders, brackets, column capitals, haunches, drop panels, and slabs concurrently.

4. Make joints perpendicular to main reinforcement.

B. Continue reinforcement across joints.

1. Provide keys and inclined dowels as directed by Engineer.

2. Provide longitudinal keys at least 1-1/2 inches deep in all joints in walls and between walls and slabs or footings.

C. Clean concrete surface at joints.

D. Remove all laitance prior to placing adjoining concrete.

E. When required, obtain bond by one of the following:

1. Use of an approved adhesive.

2. Use of an approved chemical retarder which delays setting of surface mortar. Remove retarded mortar within 24 hours after placing to produce a clean, exposed aggregate bonding surface.

3. Roughen surface of concrete in an approved manner which will expose aggregate uniformly.

F. Dampen, but do not saturate, hardened concrete at construction joints, joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in unexposed walls and all others not mentioned below immediately prior to placing fresh concrete.

G. Dampen, but do not saturate hardened concrete at joints in exposed Work; joints in middle of beams, girders, hoists, and slabs; and joints in Work designed to contain liquids.

1. Thoroughly cover with a coat of cement grout of similar proportions to mortar in concrete.

2. Use grout as thick as possible on vertical surfaces and at least 1/2 inch thick on horizontal surfaces.

3. Place fresh concrete before grout has attained its initial set.

H. Prepare joints receiving an adhesive and apply adhesive in accordance with manufacturer's recommendations prior to placing of fresh concrete.

I. Prior to placing of fresh concrete, prepare surfaces of joints which have been treated with a chemical retarder in accordance with manufacturer's recommendations.

3.6 BLOCKOUTS FOR PIPE AND CONDUIT

A. Where pipe or conduit passes into or through concrete walls, floors, the Contractor may, to facilitate proper alignment, leave holes through the concrete and pour the concrete opening after the pipe or conduit is in place. The size of such openings shall be 2 inches larger than the outside diameter of the bell, flange, or coupling, and shall conform to the special details for pipe openings shown on the plans. When the piping or conduit is entirely placed and securely anchored, the concrete openings through the walls will be poured in accordance with the requirements for bonding new concrete to old as set forth herein. Concrete used to pour these openings shall consist of 1 part cement, 1 part fine aggregate, 1 part non-shrinking aggregate, and 1-1/2 parts coarse aggregate of maximum size of 1/2 inch when the concrete is part of a basin which must hold liquids. Otherwise, the non-shrinking aggregate in these proportions shall be replaced by fine aggregate. Concrete poured in these openings shall be thoroughly vibrated or rodded to insure a watertight joint between the new and old concrete and the new concrete and the pipe or conduit. The form for the closure shall be constructed with a pouring funnel. A plug of concrete shall be left in the pouring funnel. After the concrete has taken its initial set, the plug shall be removed and the exposed, broken face ground smooth. Pouring of blockout holes shall be done from the pressure side whenever possible. Such joints shall be thoroughly cured by keeping them constantly wet for not less than 7 days.

B. Where approved by the Engineer, blockout holes may be dry packed using non-shrink grout for basins which must hold liquid, and normal grout in other places. Only sufficient water shall be added to make a dry, crumbling mass. When the mixture is pressed tightly together into a ball with the hands, there should not be sufficient water in the mixture to stain the hands, and when such a ball is broken, it should crumble. This mixture shall be tamped or rodded solidly into the space, preferably from the pressure side. A backing board or stop shall be provided at the back side of this space against which the mixture can be tamped. Curing shall be specified as above.

3.7 GROUTING MACHINERY FOUNDATIONS

A. Where machinery is to be secured by anchor bolts set in concrete and supported on foundations which are to be grouted in place, the original concrete pour shall be blocked out or finished off a sufficient distance below the bottom of the machinery foundation to provide for the thickness of grout specified on the plans. After the machinery has been set in position and wedged to the proper elevation by steel wedges, the space between the bottom of the machinery foundation and the original pour of concrete shall be caulked with a dry-tamped in mixture of non-shrink grout. When the mixture is pressed tightly together into a ball with the hands, there should not be sufficient water in the mixture to stain the hands; and when such ball is broken, it should crumble. This dry mixture shall be tamped or rodded solidly into the space between the machinery foundations and the original concrete. A backing board or stop shall be provided at the back side of this space against which the dry mixture can be tamped.

3.8 PLACING SLABS

A. Preparation of sub-grade for Slabs on Grade:

1. At a minimum, place 4 inches of 3/4” well graded, crushed sand and gravel base course per the geotechnical report compacted per the requirements of the geotechnical report and as shown in the drawings.. Reference the geotechnical report for all recommendations.

2. The slab subgrade shall be prepared per the recommendations of the geotechnical report. Keep subgrade free of frost.

3. If temperature where concrete is to be placed is below freezing, enclose, heat, and maintain temperature above 50 degrees Fahrenheit, long enough to remove all frost from subgrade.

4. Keep subgrade moist at time of concreting. If necessary, dampen with water in advance of concreting. Allow no free-standing water or muddy or soft spots when concrete is placed.

B. Locate Joints in Slabs as Indicated:

1. If saw-cut joints in slabs on grade are required or permitted, time cutting to eliminate raveling during sawing and before shrinkage cracks develop.

2. Cut as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw.

3. Compact before shrinkage stresses become sufficient to produce cracking.

C. Thoroughly Consolidate Concrete in Slabs:

1. Obtain consolidation of slabs with vibrating screeds, roller pipe screeds, internal vibrators, or other approved means.

3.9 PATCHING

A. Repair surface defects immediately after form removal. Coat all repaired areas with grey Sikagard 62.

B. Fill and finish tie holds with non-shrink grout and coat with grey Sikagard 62.

C. Repair defective areas.

1. Use of plaster coat embeco or calcium chloride is prohibited.

2. Remove honeycomb and defective concrete down to sound concrete.

3. Make edges perpendicular to surface or slightly undercut.

4. Featheredges are not permitted.

5. Dampen area to be patched and at least 6 inches surrounding it to prevent absorption of patching mortar water.

6. Prepare bonding grout of approximately 1 part cement to 1 part fine sand passing a No. 30 sieve.

D. Make patching mixture of same materials and of approximately same proportions as used for concrete, except omit coarse aggregate.

1. Mortar: 1 part cement to 2 parts sand by damp loose volume.

2. Mix white and gray Portland cement as required to match surrounding concrete.

3. Keep mixing water to a minimum.

4. Mix patching mortar in advance and allow to stand with frequent manipulation, without addition of water, until it has reached stiffest placeable consistency.

E. After surface water has evaporated from patch area, brush bond coat into surface.

1. When bond coat begins to lose water sheen, apply patching mortar.

2. Thoroughly consolidate mortar into place and strike-off so as to leave patch slightly higher than surrounding surface.

3. Leave undisturbed for at least 1 hour before final finish.

4. Keep patched area damp for 7 days.

5. Do not use metal tools in finishing an exposed patch.

F. Repair of concrete shall provide structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable by Engineer.

G. Tie Holes: After being cleaned and thoroughly dampened, fill tie holes solid with non-shrink grout and coat with Sikagard 62. Round tie holes less than 1/4 inch diameter by 1-1/2 inch deep in rough form finished surfaces need not be filled.

H. Remove metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, by chipping back concrete to a depth of 1 inch and then cutting or removing metal object. Repair chipped out concrete as specified for defective areas.

3.10 SLAB FINISHES

A. Float Finish: After concrete has been placed, consolidated, struck-off, and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared, and surface has stiffness sufficient to permit operation. Re-float slab immediately to a uniform sandy texture.

B. Troweled Finish: Float finish surface first. Power or hand trowel to produce smooth surface relatively free of defects, but which may still show some trowel marks. Final trowel when a ringing sound is produced as trowel is moved over surface. Leave finished surface essentially free of trowel marks, uniform in texture and appearance.

C. Broom Finish: Immediately after concrete has been floated, apply coarse transverse scored texture by drawing broom or burlap belt across surface.

D. "Dry Shake" Finish: Give surface a float finish. Apply mineral aggregate with Portland cement in proportions recommended by manufacturer of aggregate. Begin floating immediately after application of “dry shake."

E. Nonslip Finish: Give surface a "dry shake" application, as specified above, using crushed ceramically bonded aluminum oxide particles. Apply at 25 pounds per 100 square feet.

F. Exposed Aggregate Finish: Immediately after the surface of the concrete has been leveled to tolerance and surface water has disappeared, spread aggregate of the color and size selected by the Engineer uniformly over surface to provide complete coverage to the depth of a single stone. Float surface until embedded aggregate is fully coated with mortar and surface has been brought to tolerance. Flow water, without force, over surface of concrete while matrix encasing aggregate is removed by brushing with a fine bristle brush.

G. Slab Finish Schedule: The slab finishes are shown on the drawings. Where finishes of slabs are not shown, provide broom finish on exterior slabs and trowel finish on interior slabs.

H. Finish Slab Elevation: Slope slabs to floor drains. Slabs shall adequately drain regardless of tolerances.

3.11 FORMED CONCRETE FINISH

A. Rough Finish: Patch defects, chip or rub off fins exceeding 1/4-inch in height.

B. Smooth Finish: Patch tie holes and defects and remove fins completely. When surface texture is impaired and form joints misaligned by more than 1/8-inch, grind or

bushhammer. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.

C. Rubbed Finish: Remove forms and perform necessary patching as soon after placement as possible. Finish newly hardened concrete no later than day following form removal. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced. No cement grout to be used other than cement paste drawn from concrete by rubbing process.

D. Sacked Finish: Mix one-part Portland cement and 1-1/2 parts fine sand with sufficient water to produce grout having consistency of thick paint or use commercial premixed sacking grout. Wet surface of concrete sufficiently to prevent absorption of water from grout. Apply grout uniformly. Immediately after grouting, scrub surface vigorously with cork float or stone to coat surface and fill voids. While grout is still plastic, remove excess grout by working surface with rubber float or sack. After surface whitens from drying, rub vigorously with clean burlap. Keep damp for at least 36 hours after final rubbing.

E. Formed Concrete Finish Schedule. The finish required for formed concrete is shown on the drawings. Where finishes of formed concrete are not shown, provide rough finish for concrete not exposed to view and sacked finish for concrete exposed to view.

3.12 CURING AND PROTECTION

A. To preserve moisture in unformed concrete surfaces, apply one of the following immediately after placement and finishing.

1. Continuous mist spray.

2. Waterproof sheet materials, ASTM C171.

3. Curing compound, ASTM C309. Apply in accordance with recommendations of manufacturer immediately after water sheen has disappeared. Do not use on any surface against which additional concrete or other material is to be bonded or adhesively applied, unless it is proven that curing compound will not prevent bond, or unless positive measures are taken to remove it completely from areas to receive bonded applications. Provide curing compound compatible with hardener in areas where hardener is to be used.

B. Continue curing concrete for 7 days.

C. When mean daily outdoor temperature is less than 40 degrees Fahrenheit, maintain temperature of concrete between 50 degrees Fahrenheit and 70 degrees Fahrenheit for concrete placement.

D. Floors and slabs to receive concrete sealer as specified in the Contract Documents and Room Finish Schedule.

1. Apply concrete sealer at a coverage rate not to exceed 300 square feet per gallon.

2. Apply as soon as slab or floor will bear weight.

3. Before applying concrete sealer, sweep entire surface clean with very soft bristled brush that will not mark concrete finish and remove any standing water.

4. Apply concrete sealer with sprayer.

5. Use of paint rollers or mop is not acceptable.

6. Workmen shall wear flat soled shoes which will not mark or scar concrete surface.

7. Do not allow traffic on floors and slabs until concrete sealer has dried and hardened.

3.13 BACKFILL AGAINST STRUCTURES

A. Do not backfill against walls until concrete has obtained specified 28-day compressive strength.

B. Refer to General Structural Notes on the Drawings for additional requirements, including elevated slab and diaphragm completion prior to backfill.

C. Unless otherwise permitted, place backfill simultaneously on both sides of structure, where such fill is required, to prevent differential pressures.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by the Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland Cement to two and one half parts fine aggregate passing No 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2-inch in any dimension in solid concrete, but not less than 1-inch in depth. Make edge of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Patch a test area at an inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.1-inches wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4-inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

5. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of the same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

6. Repair random cracks and single holes 1-inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

7. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.15 FIELD QUALITY CONTROL

A. The Contractor shall obtain and pay for services of certified testing laboratory to perform sampling and testing of installed materials to assure that the requirements of this specification are met. Testing and analysis of concrete shall be performed as specified in the General Structural Notes – Special Inspection Tables.

B. Provide adequate facilities for safe storages and proper curing of concrete test specimens onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

C. Unless otherwise specified, sample concrete for testing for making test specimens, from point of delivery.

D. When concrete is pumped, sample and test air content at point of delivery and at point of placement.

E. The frequency herein specified for each field control test is approximate. A greater or lesser number of tests may be made, as required by the Engineer, to verify compliance with these specifications.

F. Submit proposed mix design of each class of concrete to Engineer for review prior to commencement of Work.

G. Each 100 tons of fine aggregate and each 200 tons of coarse aggregate shall be sampled and tested in accordance with ASTM D75 and C136.

H. Entrained air: Test every load of concrete delivered to the project. Air content shall be determined in accordance with ASTM C231.

I. Slump: Test every load of concrete delivered to the project.

J. Pumped Concrete: Take concrete samples for slump, ASTM C143 and test specimens ASTM C31.

K. Strength characteristics: 1 set of 4 concrete test cylinders shall be made for every 40 cubic yards or less of each class of concrete placed each day. 1 additional set shall be taken from each additional 40 cubic yards, or major fraction thereof, placed in any 1 day. 1 cylinder of each set shall be tested at an age of 7 days and 2 cylinders shall be tested at an age of 28 days. The fourth cylinder of the sets shall be tested only if deemed necessary by the Engineer. Test results shall be evaluated in accordance with ACI 214 and 318.

L. 3 additional test cylinders will be taken during cold weather and shall be cured on site under the same conditions as the concrete it represents. 1 cylinder shall be tested at an age of 7 days and the other cylinder at an age of 28 days.

3.16 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Engineer and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances, or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Engineer. The cost of additional testing shall be borne by the Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION 03 30 00

SECTION 03 60 00 – GROUTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish labor, materials and equipment as required for grouting as shown on the plans.

B. The following types of grout are covered in this Section:

1. Cement Grout
2. Non-Shrink Grout – Class I (cement based)
3. Non-Shrink Grout – Class II (cement based)
4. Epoxy Anchor Grout for Adhesive Anchors
5. Topping Grout and Concrete/Grout Fill

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.

1. Certification of Materials:
   a. Use bags of materials showing that the contents meet the Specifications.
   b. Submit mill test certificates covering materials shipped as furnished by material manufacturers.
2. Certification that grouts used on the project contain no chlorides or other chemicals that cause corrosion.
3. Manufacturer’s literature containing instructions and recommendations on the mixing, handling, placement, curing and appropriate uses for each type of grout used in the Work, and locations of use. ICBO/ES report shall be submitted for epoxy anchor grout for adhesive anchors.
4. Manufacturer’s certification that its non-shrink grout does not contain aluminum, zinc, or magnesium powders as a method of expansion.
5. Contractor shall submit manufacturer’s written warranty.

1.3 QUALITY ASSURANCE

A. Construction Tolerances: Construction tolerances shall be as indicated in Section 03 30 00 – Cast-in-Place Concrete unless indicated otherwise.

B. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the Engineer to ensure continued compliance with these specifications. The specimens will be made by the Engineer or its representative.

2. Compression tests and fabrication of specimens for concrete grout and cement based non-shrink grout will be performed in accordance with ASTM C1107 – Packaged Dry, Hydraulic-Cement Grout (Non-shrink), at intervals during construction selected by the Engineer. A set of 3 specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.

3. Compression tests and fabrication of specimens for topping grout, and concrete/grout fill will be performed in accordance with Section 03 30 00 – Cast-in-Place Concrete, at intervals during construction as selected by the Engineer.

4. Compression tests and fabrication of specimens for epoxy grouts will be performed in accordance with ASTM C579 – Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfaces and Polymer Concretes, Method B, at intervals during construction as selected by the Engineer. A set of 3 specimens will be made for testing at 7 days, and each earlier time period as appropriate.

5. The cost of laboratory tests on grout will be paid by the Contractor.

6. The Contractor shall assist the Engineer in obtaining specimens for testing and shall furnish materials necessary for fabricating the test specimens

PART 2 - PRODUCTS

2.1 CEMENT GROUT

A. Cement grout shall be composed of 1 part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4,000 pounds per square inch.

B. Cement-based non-shrink grout shall be a prepackaged, inorganic, fluid, non-gas-liberating, non-metallic, cement type grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used.

C. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout indicated herein shall be that recommended by the manufacturer for the particular application.

D. Grout shall not contain chlorides or additives that may contribute to corrosion and shall be formulated to be used at any consistency from fluid to plastic.

E. Cement-based non-shrink grout shall have the following minimum properties when tested at a fluid consistency at 28 days:

1. Minimum tensile splitting strength of 500 pounds per square inch per ASTM C496 - Splitting Tensile Strength of Cylindrical Concrete Specimens.

2. Minimum flexural strength of 1,000 pounds per square inch per ASTM C580 - Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

3. Minimum bond strength (concrete to grout) of 1,900 pounds per square inch per modified ASTM C882 - Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.

4. Grout shall be certified for use in freeze/thaw environments.

2.2 NON-SHRINK GROUT

A. Class I Non-Shrink Grout: Class I non-shrink grout shall have a minimum 28 day compressive strength of 5,000 pounds per square inch when mixed at a fluid consistency. Class I non-shrink grout shall meet the requirements of ASTM C1107, Grade B or C, when mixed to fluid, flowable and plastic consistencies.

1. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C827 - Early Volume Change of Cementitious Mixtures. The grout when tested shall not bleed or segregate at maximum allowed water.

2. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C1090 - Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.

3. Furnish certification that the non-shrink property of grout is not based on gas production or gypsum expansion.

4. Class I Non-Shrink Grout shall be MasterFlow 713 by BASF; Five Star Grout by Five Star Products; Sikagrout 212 by Sika Corporation; L&M Duragrout by Laticrete; High-Flow Grout by Euclid Chemical Company; or equal.

B. Class II Non-Shrink Grout: Class II non-shrink grout shall be a high precision, fluid, extended working time, grout. The minimum 28-day compressive strength shall be 7500 pounds per square inch, when mixed at a fluid consistency. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C827. Class II non-shrink grout shall meet the requirements of ASTM C1107 Grade B or C when tested using the amount of water needed to achieve fluid consistency per ASTM C939.

1. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C1090.

2. Class II non-shrink grout shall have an extended working time of 30 minutes minimum when mixed to a fluid consistency as defined in ASTM C827 at temperature extremes of 45 to 90 degrees Fahrenheit in accordance with ASTM C1107.

3. The grout when tested shall not bleed or segregate at maximum allowed water content.

4. Provide certification that its non-shrink property is not based on gas production or gypsum expansion.

5. Class II non-shrink grout shall be Masterflow 928 by BASF; Five Star Fluid Grout 100 by Five Star Products; L&M Crystex by Latitcrete; or equal.

2.3 EPOXY ANCHOR GROUT

A. Epoxy anchor grout shall conform to ASTM C881 - Epoxy-Resin-Base Bonding Systems for Concrete, Type IV, Class A, Band C, Grade 3 with the exception of gel time.

B. Heat deflection temperature per ASTM D648 - Deflection Temperature of Plastics Under Flexural Load shall be a minimum 120 degrees Fahrenheit.

C. Manufacturer shall certify that the epoxy anchor grout will maintain 90 percent of its strength up to a temperature of 125 degrees Fahrenheit.

D. Grout shall come in a 2 chambered cartridge with a metering system that provides the proper ratio of hardener and resin. The grout shall also come with a static mixer nozzle to thoroughly mix the hardener and resin together.

E. Epoxy anchor grout shall be capable of being used in submersed applications once cured.

F. Compressive strength per ASTM D695 - Compressive Properties of Rigid Plastics shall be 10,000 pounds per square inch minimum.

G. If the average working or operating temperature will be over 100 degrees Fahrenheit or in a high fire risk area, use cement based non-shrink grout and oversized holes.

H. Overhead anchors and anchors in fire-resistive construction shall be cast-in anchors.

I. Embedment of adhesive anchors/rebar shall be deep enough to develop the anchor/rebar. Embedment shall not exceed 67 percent of the member depth.

J. Epoxy anchor grout shall be SET-XP by Simpson; Pure110+ by DeWalt; RE 500 V3 by Hilti, or equal.

2.4 TOPPING GROUT AND CONCRETE/GROUT FILL

A. Where fill is thicker than 3 inches, structural concrete, as indicated in Section 03 30 00 - Cast-in-Place Concrete, may be used when accepted by the Engineer.

B. Grout for topping of slabs and concrete/grout fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and be mixed as indicated herein. Materials and procedures indicated for normal concrete in Section 03 30 00 - Cast-in-Place Concrete shall apply unless indicated otherwise.

C. Topping grout and concrete/grout fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45.

D. Coarse aggregate shall be graded as follows:

U.S. Standard Sieve Size	Percent by Weight Passing
1/2	100
3/8	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

E. Final mix design shall be as determined by trial mix design as indicated in 03 30 00 – Cast-in-Place Concrete, except that drying shrinkage tests are not required.

F. Strength: Minimum compressive strength of topping grout and concrete/grout fill at 28 days shall be 4,000 pounds per square inch.

2.5 CURING MATERIALS

A. Curing materials shall be in accordance with Section 03 30 00 – Cast-in-Place Concrete and as recommended by the manufacturer of prepackaged grouts.

2.6 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where dry pack is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application.

B. The slump for topping grout and concrete/grout fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

2.7 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurements shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY. STORAGE AND HANDLING

A. Grout shall be stored in accordance with manufacturer's recommendations.

3.2 GENERAL

A. Contractor shall arrange for the manufacturer of prepackaged grouts to provide on-Site technical assistance within 72 hours of request, as part of the Work.

B. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized otherwise by the Engineer.

C. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of the saturation period, excess water shall be removed with clean, oil free compressed air prior to grouting. Concrete substrate shall not be wet prior to placement of epoxy grouts.

D. Surface preparation, curing, and protection of cement grout shall be in accordance with Section 03 30 00 – Cast-in-Place Concrete. The finish of the grout surface shall match that of the adjacent concrete unless otherwise indicated.

E. Surfaces that will be in contact with grout shall be free of dirt, loose rust, oil, wax, grease, curing compounds, laitance, loose concrete, and other deleterious materials.

F. Contact the grout manufacturer's representative for assistance on hot and cold weather grouting techniques and precautions if applicable. Shade the Work from sunlight for at least 24 hours before and 48 hours after grouting.

3.3 APPLICATION

A. Unless indicated otherwise, grouts shall be provided as listed below:

Application	Type of Grout
Anchor bolts and reinforcing steel required to be set in grout in which the average working or operating temperature will be over 100 degrees Fahrenheit, or in high fire risk areas.	Non-Shrink – Class I
Anchor bolts and reinforcing steel required to be set in grout that is not high temperature or high fire risk areas.	Epoxy Anchor Grout
Beam and column (1 or 2 story) base plates less than 16 inches in the least dimension.	Non-Shrink Class I
Column base plates (greater than 2 story or larger than 16 inches in the least dimension).	Non-Shrink Class II
Storage tanks and other non-motorized equipment and machinery under 30 horsepower.	Non-Shrink Class I

Machinery over 30 horsepower and equipment under 30 horsepower but subject to severe shock load and high vibration.	Non-Shrink Epoxy
Filing blockout spaces for embedded items such as railing posts, gate guide frames, etc.	Non-Shrink Class I (Class II where placement time exceeds 20 min.)
Under precast concrete elements.	Non-Shrink Class II
Topping and concrete/grout fill greater than 3 inches thick.	Structural Concrete per Section 03 30 00 – Cast-in-Place Concrete
Surface repairs.	Cement Grout
Repair of holes and defects in concrete members which are not water bearing and not in contact with soil or other fill material.	Non-Shrink Class I
Repair of holes and defects in concrete members which are water bearing or in contact with soil or other fill materials.	Non-Shrink Class II
All application not listed above, where grout is called for on the drawings.	Non-Shrink Class I, unless noted otherwise.

3.4 GROUTING PROCEDURES

A. Mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

B. Structural, equipment, tank, and piping support bases shall be grouted, unless indicated otherwise.

1. The original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum one-inch thickness of grout, or a thickness as indicated.

2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout through a headbox of appropriate size. The mixture shall be of a fluid consistency and poured continuously into the space between the plate and the base concrete. Forms for grout shall be tight against retaining surfaces, and joints shall be sealed as recommended by the grout manufacturer to be liquid-tight. Forms shall be coated as recommended by the grout manufacturer for easy form release. Where this method of placement is not practical or where required by the Engineer, alternate grouting methods shall be submitted for acceptance by the Engineer.

C. Drilled anchors and Reinforcing Bars: Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill and cleaned. Drilled anchors shall not be installed until the concrete has reached the required 28 day compressive strength. Anchors shall not be loaded until the grout has reached its indicated strength in accordance with the manufacturer's instructions.

1. The Contractor shall identify position of reinforcing steel and other embedded items prior to drilling holes. Care shall be exercised in coring and drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and communications conduit, and piping.

D. Epoxy Adhesive Anchors: Grout shall be proportioned and mixed with automatic equipment. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's recommendations, but shall not be less than 8 diameters for threaded rod, or 12 diameters recommendations for reinforcing or smooth bars. Holes shall be dry.

E. Cement Based Non-Shrink Grout: In places of high temperature or fire hazard, anchor bolts shall be grouted in using cement based non-shrink grout, Class I. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO report, but shall not be less than 16 diameters for threaded rod or 24 diameters for reinforcing or smooth bars.

1. When the bolt diameter is 1 inch or less, the hole diameter should be a minimum of 2-inches. When the bolt diameter is greater than 1 inch, the hole diameter should be at least twice the bolt diameter.

2. Drilled holes shall be saturated with water for not less than 24 hours before installation of anchor/rod/rebar.

3. The non-shrink grout should be placed in the holes in a non-sag (trowelable) consistency. The grout should be placed in the holes before the anchor and then the anchor inserted and vibrated to ensure proper coverage.

F. Topping Grout and Concrete/Grout Fill: Mechanical, electrical, and finish work shall be completed prior to placement of topping or concrete/grout fill. To ensure bonding to the base slab, the base slab shall be given an exposed aggregate finish. Alternatively, where accepted by the Engineer, the base slab shall be given a roughened textured surface by a close- spaced rake while the surface is green. After curing, high pressure washing shall expose the aggregates and produce not less than a 3/16 inch amplitude roughness. Jackhammers or chipping hammers shall not be used.

1. The minimum thickness of grout topping and concrete/grout fill shall be 1 inch. Where the finished surface of concrete/grout fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2 inches wide by 1-1/2 inches deep.

2. The base slab shall be thoroughly cleaned and wetted to Saturated Surface Dry (SSD) condition per the International Concrete Repair Institute (ICRI) -- Technical Guide for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays, prior to placing topping and fill. No topping concrete shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of neat cement grout shall be broomed into the surface of the slab just before topping or fill placement. The neat cement grout shall not be allowed to dry before topping placement. If it does dry, it must be immediately removed using wet stiff brooms and reapplied. The topping and fill shall be compacted by rolling or thorough tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade. Coat surface with evaporation retardant as needed to prevent plastic shrinkage cracks.

3. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.

4. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping or fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement, or mixture of dry cement and sand shall be applied to the surface.

5. As soon as topping or fill finishing is completed, coat surface with curing compound. After the topping is set and sufficiently hard in clarifiers and where required by the Engineer, the tank shall be filled with sufficient water to cover the entire floor for 14 days.

3.5 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, to assure that the space to be grouted is completely filled.

3.6 CURING

A. Cement based grouts shall be cured per Section 03 30 00 – Cast-in-Place Concrete and per the manufacturer's recommendations.

3.7 GROUTING MACHINERY FOUNDATIONS

A. Where machinery is to be secured by anchor bolts set in concrete and supported on foundations which are to be grouted in place, the original concrete pour shall be blocked out or finished off a sufficient distance below the bottom of the machinery foundation to provide for the thickness of grout specified on the Plans. After the machinery has been set in position and wedged to the proper elevation by steel wedges, the space between the bottom of the machinery foundation and the original pour of concrete shall be caulked with a dry, tamped-in mixture of non-shrink grout. When the mixture is pressed tightly together into a ball with the hands, there should not be sufficient water in the mixture to stain the hands; and when such ball is broken, it should crumble. This dry mixture shall be tamped or rodded solidly into the space between the machinery foundations and the original concrete. A backing board or stop shall be provided at the back side of this space against which the dry mixture can be tamped.

END OF SECTION 03 60 00

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install concrete masonry unit as shown on the Drawings and as specified herein.

1.2 REFERENCE STANDARDS

A. ASTM A153 – Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

B. ASTM A307 – Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength

C. ASTM A563 – Specification for Carbon and Alloy Steel Nuts

D. ASTM A615 – Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

E. ASTM A615 – Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

F. ASTM A666 – Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar

G. ASTM A1064 – Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

H. ASTM C5 – Specification for Quicklime for Structural Purposes

I. ASTM C90 – Specification for Loadbearing Concrete Masonry Units

J. ASTM C91 – Specification for Masonry Cement

K. ASTM C129 – Specification for Nonloadbearing Concrete Masonry Units

L. ASTM C140 – Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units

M. ASTM C144 – Specification for Aggregate for Masonry Mortar

N. ASTM C150 – Specification for Portland Cement

O. ASTM C207 – Specification for Hydrated Lime for Masonry Purposes

P. ASTM C216 – Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)

Q. ASTM C270 – Specification for Mortar for Unit Masonry

R. ASTM C331 – Specification for Lightweight Aggregates for Concrete Masonry Units

S. ASTM C404 – Specification for Aggregates for Masonry Grout

T. ASTM C426 – Test Method for Linear Drying Shrinkage of Concrete Masonry Units

U. ASTM C476 – Specification for Grout for Masonry

V. ASTM C780 – Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

W. ASTM C1019 – Standard Test Method for Sampling and Testing Grout for Masonry

X. ASTM C1072 – Standard Test Method for Measurement of Masonry Flexural Bond Strength

Y. ASTM C1314 – Standard Test Method for Compressive Strength of Masonry Prisms

Z. ASTM D1970 – Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

AA. ASTM E2178 – Standard Test Method for Air Permeance of Building Materials

BB. ASTM E514 – Standard Test Method for Water Penetration and Leakage Through Masonry

CC. BIA Technical Notes No. 7 – Water Penetration Resistance – Design and Detailing

DD. TMS 402/602 – Building Code Requirements and Specification for Masonry Structures

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Product Data: Provide data for each different masonry unit, fabricated wire reinforcement, mortar, accessories, and other manufactured product specified.

C. Shop Drawings: Provide shop drawings for reinforcing steel showing bar sizes, bends, and dimensions.

D. Information illustrating horizontal joint reinforcement.

E. Grout proportions.

F. Mortar proportions.

G. Material certificates for the following, signed by Manufacturer and Contractor, certifying that each material complies with requirements.

1. Each different cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.

2. Each material and grade indicated for reinforcing bars.

H. Samples:

1. One of each type of masonry to be used on Project

2. Mortar colors for color selection.

I. Informational Submittals:

1. Method of placing grout.

2. Certified field test results within 5 days of performing specified tests.

3. Certified test reports showing compliance with specified performance tests.

4. Statement of acknowledgement of Quality Assurance Plan in accordance with IBC Section 1705.4

5. Method and materials for removal of efflorescence.

J. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, NCMA, and BIA, except where exceeded by the requirements of the contract documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum 5 years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

D. Mockups:

1. Layup sample panel for each type of masonry at Site.

2. Dimensions: Minimum 4 feet high by 4 feet long.

3. May be part of permanent construction.

4. Approved panels shall serve as basis of color, texture, bond, quality of finished joints, and for acceptance of permanent construction.

5. Demonstrate ability to keep insulation and grout isolated and in certain cells during any sequence of placement, and to demonstrate materials will be restricted to cells and bond beams intended to receive each material.

6. Construction shall show areas required to receive mortar, including webs on each side of each cell to prevent insulation from entering cells to receive grout or to prevent grout from entering cells to receive insulation.

7. Where bond beams are to be used, demonstrate proper placement of both insulation and grout to bond beam level, and proper placement of bond beam prior to placement of insulation and grout above bond beam level.

8. Demonstrate proper use of running bond or stacked bond.

E. Comply with the requirements and criteria of the NCMA, BIA, ASTM C90, ASTM C216, and ACI 530.1 for masonry finish and appearance, dimension tolerances, tolerances of construction, joint tolerances, and plumb tolerances.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Storage and Protection: Keep lime and other ingredients dry.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Temperature: Do not lay masonry when ambient temperature is below 40 degrees Fahrenheit on a rising temperature, or below 45 degrees Fahrenheit on a falling temperature, or when there is a probability of such conditions occurring within 48 hours, unless written approval of procedures for protection from freezing is obtained from Engineer.

B. Moisture Protection: Protect masonry construction from loss of moisture during curing period of 7 days when ambient air temperature is 90 degrees Fahrenheit or greater and when relative humidity is less than 50 percent.

PART 2 - MATERIALS

2.1 COMPRESSIVE STRENGTH OF MASONRY

A. Minimum 28 Day Compressive Field Strength (f'm) of completed assemblage: 2,000 psi.

2.2 MATERIALS

A. Concrete Block: ASTM C90 load bearing, kiln-dried, mediumweight block. Block face shall be split-faced, smooth face and fluted block as shown on the Drawings. Blocks shall be steam-cured, manufactured with lightweight aggregate conforming to ASTM C331. Scoria and tuff are not permitted for aggregate in the CMU block. Units to be tested per ASTM C426 with linear shrinkage of 0.065 percent or less. Protect from moisture at site. Moisture content of block when laid in final position shall not exceed 30 percent of total moisture absorption. Block sizes and widths as noted on Drawings. Color shall be as shown on the Drawings. Use gray smooth face block where color and block face are not shown on the Drawings.

B. Compressive Strength: 2,000 psi minimum, in accordance with ASTM C90, Table 2

C. Portland Cement: ASTM C150, Type I.

D. Masonry Cement: ASTM C91, Type II.

E. Mason's Sand: ASTM C144, except that not less than 4 percent or more than 10 percent shall pass the No. 100 sieve.

F. Pea Gravel: ASTM C404 graded with not more than 5 percent passing the 3/8-inch sieve.

G. Hydrated Lime: ASTM C207, Type S.

H. Lime Putty: ASTM C5

I. Water: Clean and potable, from domestic supply.

J. Grout Admixture: Grace Concrete Products, "Zyla 630", "Daravair AT60", "Daracem 55", and "Recover", or equals.

K. Steel Reinforcing: Deformed steel bars shall conform to ASTM A615, Grade 60.

L. Horizontal joint masonry reinforcement shall be extra heavy, Hohmann & Barnard, 120 Truss-Mesh masonry wall reinforcing manufactured from wire conforming to ASTM A1064.

M. Anchor Bolts: Steel bent bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153, Class C.

N. Expansion Anchors: One piece, three section wedge assembly of indicated sizes of stainless steel.

O. Preformed Control Joints: Rubber material designed to fit sash block and to maintain lateral stability in masonry wall. Provide size and configuration as applicable to masonry width and conditions, fused joints.

2.3 CONCRETE BLOCK MORTAR AND GROUT PROPORTIONS

A. Mortar: Type S, conforming to ASTM C270, consisting of one-part Portland Cement, 1/2-part lime putty, and 4 parts of Mason's sand by volume. Add only enough water to give mortar good working consistency. Mortar shall be used within 1/2 hour after mixing. Type S mortar shall have 1,800 psi minimum strength by compression test at 28 days. All mortar shall conform to ASTM C270.

B. Grout: Grout, conforming to ASTM C270, shall be one-part Portland cement and three parts Mason's sand. Grout shall have 2,000 psi minimum strength by compression test at 28 days. Grout cores greater than 2-inch square may have two parts of 3/8 inch pea gravel added to the above. All grout shall conform to ASTM C476.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that built-in items are in proper location, and ready for roughing into masonry work.

C. Direct and coordinate placement of metal anchors supplied for installation under other sections.

D. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

E. Select and arrange units for exposed masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

3.2 MIXING MORTAR AND GROUT

A. General: Determine all parts of mortar and grout by reasonably accurate volume measurement and mix in a mechanical mortar mixer in batches containing not less than one full sack of cement, unless otherwise approved. When partial batches are mixed, use extreme care in measuring all parts.

B. Order of Mixing: In mixing each batch of mortar or grout, mix the water, sand, and cement for not less than two minutes and until a smooth, plastic mass without lumps is obtained. Grout shall contain sufficient water to cause it to flow freely without segregation. Maintain mortar plastic and grout fluid continuously until used. Do not retemper or use mortar which has become harsh and non-plastic.

3.3 SETTING EMBEDDED ITEMS

A. All anchor bolts and miscellaneous metal work embedded in masonry shall be set in accordance with setting plans or instructions furnished by trades supplying the metal work. Exercise care to ensure that all anchors are completely surrounded by grout.

3.4 INSTALLATION OF BLOCK

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and where possible, at other locations.

B. The installation of concrete block shall be done using only mechanics skilled in the laying of masonry blocks. All necessary cutting of block on the job site shall be done with power tools in such manner to provide straight and true edges. No chipped or broken blocks shall be used. Lines shall be straight and true. Lay up concrete blocks in running bond in a full bed of mortar. Use channel blocks for lintels. Maintain alignment of cells containing reinforcement, remove projecting mortar and debris prior to grouting. Provide 3/8-inch joints, strike flush, and tool to smooth, concave, hard surface.

C. Provide cleanout openings at bottoms of all cells to be filled at each lift or pour of grout where such lift is in excess of 4 feet in height. Any overhanging mortar or other obstruction or debris shall be removed from insides of such cell walls. The cleanouts shall be sealed before grouting, after inspection.

D. All units shall be laid with full face shell mortar beds. All head and end joints shall be filled solidly with mortar for a distance in from the face of the unit equal to the full thickness of the face shall of the unit. Walls shall be erected plumb and in line.

E. Except as shown on the Drawings, all joints shall be made approximately 3/8-inch-wide, cut flush, compressed, and firmly tooled to a tight, concave joint. Joints shall have full mortar coverage on vertical and horizontal faces as noted above. Vertical joints shall be shoved tight. Seal around all pipes or ducts and make airtight. Unless otherwise indicated, build in horizontal reinforcing every third course at all walls.

F. Where required by the Drawings, and unless otherwise shown, all block walls shall have reinforcing bar steel set in vertical cell units and bonded with dowel steel which is to be set in the concrete foundation. Steel bars shall be centered and grouted solid into the cells of these units and lintels or bond beams.

G. All reinforced hollow masonry unit shall be built to preserve the unobstructed vertical continuity of the cells to be filled. Walls and cross webs forming such cells to be filled shall be full bedded in mortar to prevent leakage of grout. All head (or end) joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.

H. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed, continuous vertical cell measuring not less than 2 inches by 3 inches.

I. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 192 diameters of the reinforcement.

J. Unless indicated otherwise on the plans, all cells containing reinforcement shall be filled solidly with grout. Vertical cells containing reinforcement shall be filled solidly with grout in lifts not exceeding eight feet in height. Where fully grouted walls are indicated on the plans, all reinforced cells and unreinforced cells shall be filled solidly with grout.

K. When the grouting is stopped for one hour or longer, horizontal construction joints shall be formed by stopping the pour of grout 1-1/2 inches below the top of the uppermost unit.

L. Protect finished Work from mortar stains. Remove excess mortar and mortar smears as work progressed. Clean immediately after completing adjacent masonry work.

M. Interlock intersections and external corners.

N. Contractor shall not erect masonry when ambient temperature has dropped below 45 degrees Fahrenheit unless it is rising, at no time when it has dropped below 40 degrees Fahrenheit, except by written permission. When masonry work is authorized during temperatures below 40 degrees Fahrenheit, make provisions for heating and drying materials; protect completed Work as per Structural Clay Products Institute, Technical Notes, Volume 1, Number 1. Do not build on frozen Work. Do not lay masonry having water film or frost on its surface. Do not lay masonry in the rain.

3.5 CONTROL JOINTS

A. Preformed Control Joints:

1. Omit mortar from vertical joints.

2. Place rubber control joint material as wall is built.

3. After wall is grouted, cured, and cleaned, install backing rod and sealant.

4. Place and tool sealant to match depth of typical joint.

3.6 SHORING AND BRACING

A. All concrete block lintel beams shall be adequately shored and braced before grouting in reinforcing. Shoring and bracing shall be left in place a minimum of 14 days after grouting beams. Do not place structural members or heavy loads on lintels without adequate shoring and bracing or until 28-day concrete strength is achieved.

3.7 PROTECTION

A. Protect corners subject to possible damage. Protect block from moisture at site. Tops of all exposed open cells of block to be covered with waterproof material to prevent being filled with moisture. Protect all masonry from cold or frost. Ensure that mortar will harden without freezing. No anti-freeze ingredient shall be used in the mortar.

B. During the progress of the project, and at the end of each day’s work, the tops of all exposed open cell block shall be fully covered with heavy unruptured sheets of polyethylene and weighted down with heavy plank or other suitable materials. Under no circumstances shall the interior cells of the block be allowed to fill with snow or moisture.

1. Extend cover a minimum of 24 inches down both sies of walls and hold cover securely in place.

2. After completion of walls, protect top of wall until permanent wall caps are installed.

C. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

D. Do not allow grout and mortar stains to dry on face of exposed masonry.

E. Protect tops of walls at all times. Cover tops of walls with waterproof paper when rain or snow is imminent and when the Work is discontinued.

F. Adequately brace walls until walls and roof are completed.

G. Provide sufficient bracing to protect walls against damage from elements, including wind and snow.

H. Protect masonry against freezing for minimum 72 hours after being laid.

I. Protect masonry from damage until final acceptance of the Work. Damaged units will not be accepted.

3.8 CLEANING

A. Clean off any mortar or grout stains on masonry work immediately. Any masonry showing stains from mortar, concrete, or grout at completion of Work shall be replaced. All imperfect jointing, chipped edges or corners, and similar defects shall be corrected or replaced.

B. Upon completion of the Work, point up masonry, fill holes and joints, remove loose mortar, cut out defective joints, and repaint where necessary. Leave surfaces free from mortar and other stains at completion of Work.

C. Replace defective mortar, match adjacent work.

D. Clean masonry with specified cleaners applied according to manufacturer’s written instructions.

3.9 WATER REPELLENT MASONRY SEALER

A. Remove efflorescence prior to applying water repellents. Dispose of waste generated.

B. Apply to weather exposed exterior concrete masonry walls.

C. Repoint loose, cracked, or disintegrating mortar at least 7 days prior to application. Ensure joint sealants and caulking are fully cured and wall surfaces are clean, dry, and free of chemical cleaners, efflorescence, dirt, oils, mortar smears, and other surface contaminants.

D. Follow manufacturer's recommendations for weather conditions during application.

E. Test a 5-foot by 5-foot wall area to assure proper coverage, desired water repellency properties, and desired surface appearance when sealer is fully dried.

F. Apply with spray, brush, or roller following manufacturer's recommendations, at a coverage rate of 50 square feet to 150 square feet per gallon, as determined by testing. Use two coat application where recommended by manufacturer.

3.10 FIELD QUALITY CONTROL

A. Special Inspection of masonry in accordance with IBC Section 1705.4. Refer to Structural Drawings for Special Inspection Tables.

B. Masonry shall be tested by an independent testing agency retained by Contractor, in accordance with ASTM C1314, Method B, as modified by TMS 402/602. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

C. Masonry test prisms shall be constructed onsite with same materials and workmanship to be used for Project.

D. Masonry test prisms shall be completed independently for each well house for each type of block used (split faced and smooth faced).

E. Provide adequate facilities for safe storage and proper curing of masonry prisms, mortar samples, and grout samples, as applicable, onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

F. Inspections:

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.

3. Place grout only after inspectors have verified proportions of site-prepared grout.

G. Masonry Testing:

1. Unit Strength Method:

a. Method and frequency for mortar, grout, and masonry unit sampling and testing in accordance with IBC 2105.2.2.1.

b. Provide masonry units for test samples required.

H. Corrective Action:

1. If compressive strength tests made prior to construction of permanent structure fail to meet Specifications, adjustments shall be made to mix designs for mortar, or grout, or both, as needed to produce specified strength. Masonry units shall also be tested to verify compliance to requirements of ASTM C90, Type 1.

2. If strength tests performed on materials representative of in-place construction fail to meet Specifications, prisms or cores shall be cut from constructed walls in sufficient locations to adequately determine strength in accordance with IBC 2105.3.

I. Performance Test: Masonry using concrete masonry units and mortar with integral water repellent additives, and water repellent masonry sealer, shall achieve a Class E rating when evaluated in accordance with ASTM E514, with the test extended to 72 hours.

3.11 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4-inch.

B. Maximum Variation from Unit to Adjacent Unit: 1/16-inch.

C. Maximum Variation from Plane of Wall: 1/4-inch in 10 feet and 1/2-inch in 20 feet or more.

D. Maximum Variation from Plumb: 1/4-inch per story non-cumulative; 1/2-inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8-inch in 3 feet and 1/4-inch in 10 feet; 1/2-inch in 30 feet.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4-inch, plus 3/8-inch.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4-inch.

END OF SECTION 04 22 00

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SECTION 05 50 00 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install miscellaneous metal items as shown on the drawings and specified herein.

B. Provide shop fabricated and manufactured steel and aluminum, including, but not limited to the following:

1. Metal Gates.

2. Ledge angles, shelf angles, channels, and plates not attached to structural framing.

3. Lintels.

1.2 STANDARDS

A. AISC “Code of Standard Practice.”

B. ANSI A14.3 – American National Standard for Ladders – Fixed – Safety Requirements

C. ASTM A36 – Specification for Carbon Structural Steel

D. ASTM A53 – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

E. ASTM A153 – Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

F. ASTM A283 – Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

G. ASTM A500 – Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

H. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

I. ASTM A786 – Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates

J. ASTM B209 – Specification for Aluminum and Aluminum-Alloy Sheet and Plate

K. ASTM B221 – Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles, and Tubes

L. ASTM B429 – Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

M. ASTM B663 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel

N. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

O. ASTM D1187 – Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal

P. ASTM F1941 – Specification for Electrodeposited Coatings on Threaded Fasteners.

Q. ASTM F3125 – Specification for High Strength Structural Bolts, Steel, and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength

R. AWS D1.1 – Structural Welding Code – Steel

S. AWS D1.2 – Structural Welding Code – Aluminum

T. SSPC-SP 11 – Power Tool Cleaning to Bare Metal

U. SSPC-SP 2 – Hand Tool Cleaning

V. SSPC-SP 6 – Commercial Blast Cleaning

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Prepare shop drawings from field measurements where possible.

2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

D. Welder's Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.4 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 degrees Fahrenheit, ambient; 180 degrees Fahrenheit, material surfaces.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Quality procedures and personnel according to the following:

1. AWS D1.1 – Structural Welding Code – Steel.

2. AWS D1.2 – Structural Welding Code – Aluminum

1.6 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in the General Structural Notes – Special Inspection Tables – or – Section 01 45 00 – Quality Requirements, will inspect installed shop fabricated and manufactured steel and aluminum items for conformance to contract documents.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store and protect products with special custom wrapping and handling procedures to protect and touch-up shop primers at every stage of shipping.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturer's written recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 MATERIALS - STEEL

A. HSS (Hollow Structural Shapes): ASTM A500 Grade B

B. Bars, plates, miscellaneous shapes: ASTM A36

C. Aluminum: Alloy 5052-H32, mill finish

D. Plates: ASTM A283

E. Checkered Plate (Diamond Plate): ASTM A786, galvanized rolled steel floor plate; diamond pattern. Provide 1/4-inch thickness unless otherwise indicated.

F. Pipe: Steel pipe shall be ASTM A120 Galvanized Steel.

1. Provide steel pipe supports for downspouts.

a. Available Products, or equal:

1) Adjustable Pipe Saddle manufactured by Anvil International

2) Fig. 315 – Adjustable Pipe Support manufactured by Tolco

G. Fasteners: Provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

H. Welding Materials: AWS D1.1; type required for materials being welded.

I. Shop and Touch-Up Primer for Galvanized Surfaces: Either Tnemec Series 27 Typoxy WB at 2 to 2.5 mils or primer specified in Section 09 90 00 – Paintings and Coatings, complying with VOC limitations of authorities having jurisdiction.

2.2 BOLTS AND ANCHORS

A. Standard Service (Non-Corrosive Application): Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be steel as indicated herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated, steel for bolt material, anchor bolts and cap screws shall be in accordance with the following:

Structural Connections	ASTM A307, Grade A or B, hot-dip galvanized
Anchor Bolts	ASTM A307, Grade A or B, or ASTM A36, hot-dip galvanized
High Strength Bolts	ASTM F3125 Grade 325
Pipe and Equipment Flange Bolts	ASTM A193, Grade B- 7

B. Stainless steel bolts and nuts for corrosive service

1. Corrosive Service: All bolts, nuts, and washers in the locations listed below shall be stainless steel as indicated below.

a. All buried locations.

b. All submerged locations.

c. All locations subject to seasonal or occasional flooding.

d. Inside hydraulic structures below the top of the structure.

e. Inside buried vaults, manholes, and structures which do not drain through a gravity sewer or to a sump with a pump.

f. All chemical handling areas.

g. Inside trenches, containment walls, and curbed areas.

h. Locations indicated by the Contract Documents or designated by the ENGINEER to be provided with stainless steel bolts.

2. Unless otherwise indicated, stainless steel bolts, anchor bolts, nuts, and washers shall be Type 316 stainless steel, Class 1, conforming to ASTM A193 for bolts and to ASTM A194 for nuts. All threads on stainless steel bolts shall be protected with an antiseize lubricant suitable for submerged stainless steel bolts, to meet government specification MIL-A-907E. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.

a. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF.

b. Antiseize lubricant shall be "PURE WHITE" by Anti-Seize Technology, Franklin Park, IL, 60131, AS-470 by Dixon Ticonderoga Company, Lakehurst, NJ, 08733, or equal.

C. Bolt Requirements: The bolt and nut material shall be free-cutting steel. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

D. Bolts and nuts shall be installed with washers fabricated of material matching the base material of bolts, except that hardened washers for high strength bolts shall conform to the requirements of the AISC Specification. Lock washers fabricated of material matching the bolts shall be installed where indicated.

E. The length of each bolt shall be such that after the joint is made up, the bolt extends through the entire nut, but in no case more than 1/2-inch beyond the nut.

F. Adhesive Anchors: Unless otherwise indicated, all drilled, concrete or masonry anchors shall be adhesive anchors. No substitutions will be considered unless accompanied with ICBO report verifying strength and material equivalency.

1. Adhesive anchors are required for drilled anchors for indoor installations, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring reinforcing bars. Threaded rod shall be stainless steel Type 316. Epoxy adhesive shall be Hilti HIT RE 500 V3.

2. Unless otherwise indicated, glass capsule, polyester resin adhesive anchors will be permitted in locations not included above and shall be Hilti HVA or Cobra Anchors. Threaded rod shall be galvanized steel.

G. Expanding-Type Anchors: Expanding-type anchors if indicated or permitted, shall be galvanized steel expansion type ITW Ramset/Redhead "Trubolt" anchors; Hilti "Kwik-Bolt;" or equal. Lead caulking anchors will not be permitted. Size shall be as indicated. Embedment depth shall be as the manufacturer recommends for the load to be supported. Expansion type anchors which are to be embedded in grout may be steel. Non-embedded buried or submerged anchors shall be stainless steel.

H. Overhead Applications: Use Hilti HDA undercut anchors.

I. Miscellaneous Bolts and Nuts: ASTM A307

J. High Strength Bolts and Nuts: ASTM F3125 Grade A325

K. Concrete Anchors: Use cast in anchor bolts where cast in anchor bolts are shown on the drawings. Provide attachment to concrete with concrete anchors where shown on the drawings conforming to the following types. Use only type of concrete anchor shown on the drawings.

1. Expansion Anchors: Expansion anchors shall be wedge type with a single piece three section wedge to anchor the stud in the hole. The stud nut and wedge shall be ANSI 304 stainless steel.

2. Adhesive Anchors: Adhesive anchors shall be an all thread rod with a nut. The all thread rod and nut shall be ANSI 304 stainless steel. The rod shall be anchored in the hole using a premeasured adhesive capsule consisting of vinyl urethane methacrylate adhesive.

3. Undercut Anchors: Undercut anchors shall be an undercut style with a brazed tungsten carbide edge on the undercutting end to perform the self-cutting undercut as the anchor is installed. The anchor shall cut and undercut bearing area of at least 2.5 times the nominal anchor bolt size. The anchor stud shall be ANSI 316 stainless steel.

2.3 POWDER-DRIVEN PINS

A. Power-driven pins to be installed in concrete or steel shall be heat-treated steel alloy. If the pins are not inherently sufficiently corrosion-resistant for the conditions to which they are to be exposed, they shall be protected in an acceptable manner. Pins shall have capped or threaded heads capable of transmitting the loads the shanks are required to support. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank. Complete information describing pin capacities, connections, and proposed use locations shall be submitted to the Engineer.

2.4 IMPACT ANCHOR

A. Impact anchors shall be an expansion type anchor in which a nail type pin is driven to produce the expansive force. The pin shall have a zinc sleeve with a mushroom style head and stainless steel nail pin. Anchors shall be Metal HIT Anchors, manufactured by Hilti, Inc., Rawl Zamac Nailin, manufactured by the Rawlplug Company; or equal.

2.5 MISCELLANEOUS MATERIALS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

B. Nonshrink, Metallic Grout: Factory packaged, ferrous-aggregate grout complying with ASTM C1107, specifically recommended by manufacturer for heavy-duty loading applications. Refer to Section 03 60 00 – Grouting for further requirements.

2.6 FABRICATION

A. Workmanship: Conform to accepted shop practices. Form work true to details, with clean, straight, sharply defined profiles.

B. Fit and shop assemble items in largest practical sections, for delivery to site. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Use materials of size and thickness indicated or, if not indicated, as required to produce strength and durability in finished product for intended use and, where applicable, to meet performance requirements.

D. Fabricate items with joints tightly fitted and secured.

E. Continuously seal joined members by continuous welds, unless otherwise indicated on Drawings.

F. Joints and Connections: Weld all joints, unless other fastening methods are shown, specified or specifically approved. Close fit exposed joints; making joints where least conspicuous. Unless otherwise shown or specified, use flat and countersunk beaded bolts or screws in exposed connections.

G. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

H. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

I. Cutting, Drilling; Perform cutting, drilling, punching required for accurate fitting and assembly work. In addition, perform similar operations as required for attachment of work of other trades, provided that directions for such work are supplied prior to shop drawing approvals.

J. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

1. Provide anchor bolts for connecting to other work.

a. Drill and tap steel as required to receive bolted connections.

b. Make bolt holts 1/16-inch large than nominal bolt diameter.

K. Provisions for Attachment to Structure: Furnish miscellaneous metal items complete with framing, supports, hangers, bracing, anchors, and other devices shown specified or necessary for reinforcement and proper, secure setting or attachment to building construction.

L. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

M. Dissimilar Materials Protection: Insulate aluminum surfaces in contact with metals other than galvanized or stainless steel, or with plaster or concrete, by means of chromate gasketing or heavy coat of alkali-resistant bituminous paint.

N. Workmanship: Fabricate all items neatly and rigidly in accordance with details in first-class finished, workmanlike manner. Form curved work neatly to radii indicated. Provide members of sizes indicated and weld, bolt or rivet securely together. Furnish bolts, nuts, washers, and other fastening devices required for anchoring and securing work.

O. Welding: Use electric shielded-arc process in accordance with Welding Specifications of American Welding Society. Use only welding operators properly trained and highly skilled in arch welding. Grind smooth surface welds exposed to view.

2.7 SHOP FINISHING

A. Steel Metal Items: Galvanize all iron or steel items. Prior to galvanizing, all items after fabrication shall be cleaned thoroughly, removing scale, flux deposits, rust, oil, dirt, and other foreign matter. Except as otherwise indicated, iron or steel items specified to be galvanized shall be hot-dip galvanized after fabrication in accordance with ASTM A123. Fabricate units complete or in largest practical sections before galvanizing.

B. Aluminum Metal Items: Aluminum guardrail and handrails shall be finished with a 0.7 mil clear anodized finished, unless noted otherwise. Other aluminum items shall be mill finish.

2.8 ACOUSTICAL AND DECORATIVE GATES

A. Acoustical Gate

1. Gate panels shall be fabricated from 16 and 22 gauge cold-formed sheet steel.

2. Panels shall have width of 12-inches and a thickness of 2 ¾-inches.

3. Panel face tray shall be 22 gauge perforated cold formed steel. The panel back tray shall be 16 gauge non-perforated cold-formed steel.

4. Steel gate frames and panels shall be fabricated in accordance with ASTM A-653.

5. The panels shall be galvanized and painted with a powder coating paint system. The color will be selected by the Owner. Gates shall arrive to site undamaged.

6. Gates shall be hinged with an opening angle over 90 degrees.

7. Gates shall include exterior handles and a plunger bar setup.

8. Gate shall be lockable from the exterior and fit the dimensions of the openings shown in the drawings.

9. Gates shall be warrantied for a minimum of 1 year.

10. Manufactures: Empire Acoustical Systems Silent Screen Acoustical Gate or equal.

11. Performance: Sound absorbing gates shall have a mineral rock wool sound absorbing batting between the perforated face and solid back panel. It shall have a density of 6 lbs. per cu. ft. and conform to Federal Specifications HH-1-558B and ASTM standard E-136. The mineral rock wool sound absorbing material shall absorb less than 1% water, be non-corrosive, melt above 2,000 Degrees Fahrenheit, have a flame spread of 15 or less and a smoke development of 0 when tested in accordance with ASTM standard E-84, be rated incombustible by ASTM standard E-136, be non-hygroscopic, and have a NRC of 1.05 and STC of 35.

2.9 ACOUSTICAL SOUND PANELS

A. Manufactures: The sound barrier panels shall be Empire Acoustical Systems Silent Screen or equal.

B. Structural Steel: Structural steel members shall be the size and type specified in the plans.

C. Panels: Panels shall be fabricated from 22 & 16 gauge sheet steel conforming to the structural quality and galvanized in accordance with ASTM A-653, Class G-90. Each panel shall have a width of 12-in. and a thickness of 2-3/4-inches. The individual panels shall be “nested” horizontally into structural members.

D. Hardware: Bolts and nuts shall be the size as shown on the plans and conforming to ASTM A-307 and galvanized per ASTM A-164.

E. Finish: The panels shall have a factory applied finish consisting of an exterior grade baked on power coat paint system. Finish colors shall be selected from the manufactures standard color samples by the Owner and Engineer.

F. Performance: Sound absorbing panels shall have a mineral rock wool sound absorbing batting between the perforated face and solid back panel. The rock wool is to be a minimum of 1/2 in. from the surface of the perforated panel and shall fill the panel cavity and be 2 in. thick. It shall have a density of 6 lbs. per cu. ft. and conform to Federal Specifications HH-1-558B and ASTM standard E-136. The mineral rock wool sound absorbing material shall absorb less than 1% water, be non-corrosive, melt above 2,000 Degrees Fahrenheit, have a flame spread of 15 or less and a smoke development of 0 when tested in accordance with ASTM standard E-84, be rated incombustible by ASTM standard E-136, be non-hygroscopic, and have a NRC of 1.05 and STC of 35.

G. Installation: The steel sound barrier wall shall be installed in accordance with engineering erection plan details and in accordance with manufacturer's installation guidelines. The top edge of the sound barrier wall shall be aligned to maintain a continuous appearance. Joints and connections shall be constructed in such a manner to achieve maximum noise reduction. All joints and connections shall have a consistent and finished appearance.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; prime paint finish.

B. Lintels: As detailed, galvanized finish.

1. Size loose lintels to provide bearing length at each side of opening equal to 1/10 of clear span but not less than 8 inches, unless otherwise indicated.

C. Door Frames for Overhead Door Openings: Channel sections, prime paint finish, unless otherwise indicated.

D. Overhead Door Supports: Fabricate supports for overhead doors from steel of sizes and shapes recommended by door manufacturer and with attached anchors as recommended by door manufacturer.

2.11 FINISHES – STEEL

A. Galvanizing and prime paint all exterior steel items.

B. Prime paint all steel items.

1. Exceptions: Galvanized items to be embedded in concrete and items to be embedded in masonry.

C. Prepare surfaces to be primed in accordance with SSPC-SP 2 where indicated to receive manufacturer's standard primer.

D. Prepare surfaces to be primed in accordance with SSPC-SP 6 where indicated to receive high-performance coating finish.

E. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

F. Prime Painting: One coat of specified primer applied in strict accordance with primer manufacturer's instructions.

1. Provide one coat of manufacturer's standard primer for the following items:

a. Interior ladders.

G. Galvanizing: Galvanize after fabrication to ASTM A123 requirements.

2.12 FABRICATION TOLERANCES

A. Squareness: 1/8-inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16-inch.

C. Maximum Misalignment of Adjacent Members: 1/16-inch.

D. Maximum Bow: 1/8-inch in 48 inches.

E. Maximum Deviation from Plane: 1/16-inch in 48 inches.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Clean and strip primed steel items to bare metal where site welding is required.

C. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

D. Embedded Items: Deliver miscellaneous metal items to be embedded or installed in concrete with setting instruction to concrete contractor for setting. Verify grade and line positioning of items as set, report errors or deviations in order that corrective adjustments may be made before placement of concrete or laying of masonry.

E. Coat all aluminum surfaces in contact with concrete with an approved bituminous coating or zinc chromate primer.

3.2 GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, thru bolts, lag screws, wood screws, and other connectors.

C. Concrete Anchors: Install concrete anchors in cast in place concrete and masonry according to the details shown on the drawings and as recommended by the anchor manufacturer. When installing concrete anchors in masonry always install anchors in masonry cells that have been grouted solid. Do not install anchors into hollow cell masonry.

D. Install items plumb and level, accurately fitted, free from distortion or defects.

E. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

F. Field weld components as indicated.

G. Perform field welding in accordance with AWS D1.1

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

H. Obtain approval prior to site cutting or making adjustments not scheduled.

I. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

J. Expansion, Contraction: Assemble and install work with adequate provisions to prevent objectionable distortion and overstressing from expansion, contraction. Where necessary, provide properly designed expansion joints, construct to be weather tight if to be exposed to the weather.

K. Field Touch-up: After installation of miscellaneous metal items, tough-up field bolts, field welds, uncoated connections and abrasions with ship protective coatings. Clean items of mud, dirt, and other objectionable foreign matter.

L. Finishing: Where indicated, metal fabrication items shall be painted after installation in accordance with Section 09 90 00 – Painting and Coating.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturer's written instructions and requirements indicated on Shop Drawings.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

1. Clean surfaces of weld seams according to SSPC-SP 11, “Power Tool Cleaning to Bare Metal”.

3.6 TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch

END OF SECTION 05 50 00

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials and equipment as required to construct all rough carpentry work, which is generally not exposed and is covered by finish work.

1.2 REFERENCES STANDARDS

A. AWC (WFCM) – Wood Frame Construction Manual for One and Two-Family Dwellings

B. APA PRP-108 – Performance Standards and Qualification Policy for Structural-Use Panels (Form E445)

C. ASTM A153 – Specification for Zinc-Coating (Hot-Dip) on Iron and Steel Hardware

D. ASTM A653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process

E. ASTM D2898 – Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing

F. AWPA U1 – Use Category System: User Specification for Treated Wood

G. IBC – International Building Code

H. NFPA – National Design Specification for Stress Grade Lumber and its Fastenings

I. PS 1 – Structural Plywood

J. PS 2 – Performance Standard for Wood-Based Structural-Use Panels

K. PS 20 – American Softwood Lumber Standard

L. WCLIB (GR) – Standard Grading Rules for West Coast Lumber No. 17

M. WWPA G-5 – Western Lumber Grading Rules

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

1. For composite-wood products, provide documentation indicating that product contains no urea formaldehyde.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 - PRODUCTS

2.1 LUMBER MATERIALS

A. Lumber Materials

1. General: Factory mark each piece of lumber with type, grade, mill and grading agency.

2. Species: See General Structural Notes in Drawings.

3. Provide dimensioned lumber as required by PS 20.

4. Use S4S lumber, unless otherwise indicated.

5. Use seasoned lumber with 19 percent maximum moisture at time of use.

6. Use No. 2 grade Douglas Fir or Larch, or any species and grade meeting the following requirements, unless otherwise noted; see General Structural Notes in Drawings:

a. Fb: 900 psi minimum

b. E: 1,600,000 psi minimum

B. Pressure-Treated Lumber: All wood nailing blocks, sills, and plates resting on or embedded in concrete or masonry within 18 inches of grade shall be pressure-treated in accordance with AWPA C1. Preservative shall conform to American Wood Preservers Assn. and American Wood Preservers Bureau Standard Specifications. Creosote shall not be used.

2.2 PLYWOOD MATERIALS

A. Plywood: Plywood shall conform to the requirements of U.S. Product Standard PS-1 as specified herein. All plywood panels shall be marked with grade mark of the American Plywood Association. The mark shall identify the plywood as to species, glue type, and grade in compliance with the applicable commercial standard. Plywood shall be Douglas Fir, Exterior, C-D, S1S.

B. Oriented Strand Board (OSB): Where shown on Plans, OSB shall conform to American Plywood Association Sturd-I-Floor and conform to the Council of American Building Officials NER 108. Use edge sealed tongue and groove OSB for flooring. Use glue nail application approved by the American Plywood Association for Sturd-I-Floor construction

2.3 ACCESSORIES

A. Nails, Spikes and Staples: Galvanized for exterior locations, high humidity locations; plain finish for other interior locations; size and type to suit application.

B. Bolts, Nuts, Washers, Lags and Screws: Medium carbon steel; size and type to suit application; galvanized for exterior locations, high humidity locations, and treated wood; plain finish for other interior locations.

C. Fasteners: Expansion shield and lag bolt type for anchorage to concrete. Bolts or power activated type for anchorage to steel.

D. Metal Framing Devices: Provide metal framing devices as shown on the Drawings. Acceptable products include “Strong-Tie” by Simpson Company, Silver Metal Products, or equivalent by approval.

E. Plyclips shall be extruded aluminum clips, manufactured from 6063-T6 aluminum alloy, and designed for intended use. Size shall be as required for plywood or shall be as shown.

PART 3 - EXECUTION

3.1 GENERAL

A. Discard units of material with defects which might impair quality of Work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Set carpentry work accurately to required levels and lines with members plumb and true and accurately cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as shown, and as required by recognized standards. Countersink nail heads and fill holes in exposed carpentry work.

D. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood and pre-drill as required.

E. Rough Hardware: All rough hardware not otherwise specified and which is necessary for the satisfactory execution of framing, including nails, spikes, dowels, fasteners, and similar incidentals shall be provided and installed by the Contractor. Rough hardware shall be coordinated, furnished, installed, and embedded as shown and as required for a complete Work.

F. Framing: Framing members and assemblies shall be closely fitted, accurately set, and rigidly secured to required lines, levels, and arrangements shown. Framing shall be accurately and neatly cut and shall be securely nailed, spiked, or otherwise fastened in place in a workmanlike manner. Timber connectors and installation thereof shall conform to applicable requirements of AITC 104 and AITC 105.

3.2 INSTALLTION – GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including shims, bracing, and blocking.

C. Where treated wood is used on interior; provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWI (WFCM) Wood Framing Construction Manual.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2-inches of bearing at each end.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise specified.

G. Provide bridging at joists in excess of 8 feet span as detailed. Fit solid blocking at ends of members.

H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs. See structural details for further information.

3.4 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. Plate and Sill Installation: Bottom plates and sill plates which are secured to concrete shall be located as shown. The anchor bolts shall be located as shown or as required by Referenced Standard if not shown. The plates and sills shall be leveled with shims. Washers shall be placed and nuts shall be tightened to level bearing, after which the spaces (1/2-inch minimum) between the sill and concrete shall be dry packed with concrete.

C. Blocking and Backing: All blocking and backing in walls and ceilings shall be nominal 2-inch-thick material of a depth as needed and shall be accurately located around light fixtures, ceiling registers, grilles, and other required mechanical and electrical items. The blocking shall fit snugly and shall be spiked into the supporting framing members. Wood blocking (backing) to receive sheathing, siding, metal lath, and gypsum board shall be provided wherever necessary for securing the facing materials.

D. Plywood Sheathing: Plywood sheathing shall be installed with face grain across supports and end joints shall be over joists and shall be staggered. Blocking shall be provided at all unsupported edges.

E. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

F. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

G. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

H. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.5 FRAMING DEVICES

A. Metal Framing Devices: Metal framing devices shall be furnished and installed where shown. Nails for the framing devices shall be as furnished or recommended by the manufacturer of the anchor device. All nails shall be driven to their full depth at all holes in anchors. Bolt and lag fasteners shall be drawn tight.

3.6 INSTALLATION OF PANELS

A. Roof Nailers and Fascia Backing: Secure panels with long dimension perpendicular to framing members with ends staggered and over firm bearing.

B. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.

1. Provide a 1/8-inch space between panel edge and end joints to allow for expansion.

2. Follow sheathing schedule in the Drawings for nailing patterns, staples are not permitted.

C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered.

1. Protect sheathing from moisture. Do not cover wet sheathing materials. Remove and replace wet materials.

2. Provide a 1/8-inch space between panel edge and end joints to allow for expansion.

3.7 TOLERANCES

A. Framing Members: 1/4-inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4-inch in 10 feet maximum, and 1/4-inch in 30 feet maximum.

END OF SECTION 06 10 00

SECTION 06 17 53 – SHOP - FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Finish and install wood roof trusses as indicated on the Drawings and as specified herein.

1.2 SUBMITTALS

A. Shop Drawings: Contractor shall submit shop drawings for approval showing complete details of wood trusses. Show the following information:

1. Design and fabrication data.

2. Thickness, nominal sizes and location of metal connectors at all joints.

3. Pitch span and spacing of trusses.

4. Species and stress grades of lumber to be used as members.

5. Design loading of trusses and allowable stress increase.

6. Force analysis in each member.

7. Any bracing required to prevent compression buckling of truss members.

8. Camber and deflection.

9. Final truss calculations shall be stamped by a registered Professional Engineer licensed in the State where the Work is to be done along with a truss layout with all trusses labeled corresponding to the piece marks indicated in the stamped calculations.

1.3 QUALITY ASSURANCE

A. Standards: The design and fabrication of wood trusses shall comply with the following standards latest edition:

1. "National Design Specifications for Stress-Grade Lumber and Its Fastenings" by NFPA.

2. "Timber Construction Standards" by AITC.

3. "Design Specifications for Light Metal Plate Connected Wood Trusses" by Truss Plate Institute.

1.4 DESIGN STANDARDS

A. The truss manufacturer is responsible for the design and fabrication of the truss system, all truss hangers and truss bracing requirements.

B. Design trusses to support the loads shown on the drawings.

(See General Structural Notes - Basis of Design, on Construction Drawings for Additional Loading Requirements, I.E. Wind, Seismic and Importance Factors)

C. Truss design shall conform to the requirements of the current edition of IBC Section 1608 and ASCE 7 Section 7. These requirements shall include, but are not limited to, the following:

1. Partial loading.

2. Unbalanced snow loads.

3. Drifts on lower roofs and roof projections.

4. Sliding snow.

5. Ice dams and Icicles along eaves (double eave loads).

6. Wind Loading

7. Deflection

D. The truss manufacturer shall consider the effects of eccentric loading in the design of heel joints.

E. No stress increase for plate connectors will be allowed.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Fabricated trusses shall be handled with care so that they are not subject to damage. If trusses are stockpiled prior to erection, they shall be set in vertical position, resting on temporary supports, and braced to prevent unusual bending or tipping over.

PART 2 - PRODUCTS

2.1 MATERIALS OF CONSTRUCTION

A. All lumber used for the truss members shall be Douglas Fir Dense No. 1 Grade. All lumber used for truss members shall conform to the published stress ratings for the species and grades as set out in the official grading rules of the Lumber Association.

1. Moisture content of lumber shall not exceed 19 percent nor be less than 7 percent at the time of fabrication.

2. Lumber shall be uniformly sized S4S and conform to the nominal sizes shown on the shop drawings.

3. All members shall be cut from lumber which bears the proper grademarks stamp of a recognized grading association.

2.2 CONNECTORS

A. All truss connector plates shall be fabricated from galvanized sheet steel which has minimum uncoated thickness of 0.0359 inches 20 gauge and a minimum yield strength of 33,000 psi. Corrosion-resistant coating shall be 1.25 oz. per square foot commercial class hot-dipped galvanized.

2.3 FABRICATION

A. Trusses shall be fabricated in a properly equipped manufacturing facility. They shall be manufactured by experienced workmen using proper truss fabricating equipment.

B. Truss members shall be accurately cut to length, angle and be true to line to assure tight joints in finished trusses.

C. Truss members and connector plates shall be properly placed in special jigs and the members tightly clamped in place until the connector plates have been pressed into the lumber simultaneously on both sides of the joints.

PART 3 - EXECUTION

3.1 ERECTION

A. During erection, care shall be taken to keep horizontal bending of the trusses to a minimum.

B. Proper erection bracing shall be installed to hold the trusses true and plumb until the permanent truss bracing system is solidly nailed in place.

C. Erection of permanent bracing shall be installed before application of any leads.

END OF SECTION 06 17 53

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SECTION 07 11 13 – BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and apply cold-applied asphalt emulsion damp-proofing as shown on the drawings and as specified herein.

1.2 REFERENCE STANDARDS

A.	ASTM D449	Standard Specification for Asphalt Used in Dampproofing and Waterproofing
B.	ASTM D1187	Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
C.	ASTM D1227	Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
D.	NRCA (WM)	The NRCA Waterproofing Manual

1.3 SUBMITTALS

A. Submit manufacturer's technical product data in accordance with Section 01 33 00 – Submittal Procedures. Shop drawing information shall include installation instructions, and recommendations for each damp-proofing material required. Provide properties of primer, bitumen, and mastics.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Applier shall be a firm which has specialized for no less than three years in installation of types of damp-proofing required for this project and which is acceptable to manufacturer of primary materials.

B. Warranty: Furnish a written warranty for unconditional water-tightness for a period of two years from the date of substantial completion.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees Fahrenheit for 24 hours before and during application until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.

1. Composition – Vertical Application: ASTM D1227 Type III or ASTM D1187 Type I

2. VOC Content: Not more than permitted by Local, State and Federal Regulations

3. Applied Thickness: 1/16-inch, minimum, wet film.

B. Dampproofing Protection Course: multi-ply, semi-rigid core manufactured in accordance with ASTM D6506.

1. Thickness: 0.220-inch minimum.

2. Puncture Strength: 82 pound minimum.

3. Bituminous dampproofing and protection course to be by same manufacturer or dampproofing manufacturer’s recommendations.

2.2 MANUFACTURER

A. The approved manufacturer shall be subject to compliance with specified requirements:

1. Celotex Corporation

2. Manville Building Products Corp.

3. Tamko Asphalt Products, Inc.

4. Tremco Company

5. W.R. Meadows, Inc.

PART 3 - EXECUTION

3.1 PREPARATION

A. Proceed with damp-proofing work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer’s recommendations.

B. Provide adequate ventilation to prevent accumulation of hazardous fumes during application of solvent-based components in enclosed spaces and maintain ventilation until coatings have thoroughly cured.

C. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer. Fill voids, seal joints, and apply bond breakers (if any) as recommended by prime materials manufacturer, with particular attention at construction joints.

3.2 APPLICATION

A. Comply with manufacturer's instructions as to application rates and application methods.

B. Apply damp-proofing to all exterior below grade surfaces of exterior underground walls of building structures in contact with earthwork or other backfill, in any situation where space of any kind is enclosed on opposite side. Extend over top of footing and turn down minimum of 6 inches over outside face of footing

C. Extend vertical damp-proofing down walls from finished grade line to top of footing. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces which will be exposed to view when project is completed.

D. Install protection course as indicated by manufacturer's recommendations over completed and cured damp-proofing to protect the damp-proofing from damage during backfilling. Comply with damp-proofing materials manufacturer's instructions for support or attachment of protection materials.

END OF SECTION 07 11 13

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SECTION 07 21 00 – THERMAL INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install board insulation at perimeter foundation wall under the interior floor slab.

B. Furnish and install batt insulation and vapor retarder in ceiling and roof construction.

C. Furnish and install batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2019.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C; 2019a.

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirement of Section 01 33 00 – Submittal Procedures.

B. Product Data: Provide data on product characteristics, performance criteria, product limitations.

1.4 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 - PRODUCTS

2.1 APPLICATIONS

A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

1. Below-grade Insulation: Below-grade insulation at floor slabs, footings, and foundation walls shall be 2-inch-thick rigid expanded polystyrene "Styrofoam-

thermal insulation conforming to ASTM C 578, Type II. Insulation shall have a minimum compressive strength of 25 psi, maximum water vapor transmission rate of 1.5 perm-in, density of 1.5 pounds per cubic foot and an -R- value of 5 per inch of thickness. Acceptable manufacturers include Amoco Foam Products Co., Dow Chemical U.S.A., Minnesota Diversified Products, Inc., UC Industries, or approved equal

B. Insulation in Wood Framed Ceiling Structure: Batt insulation with separate vapor retarder.

2.2 BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.

B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.

1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.

2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.

3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.

4. Formaldehyde Content: Zero.

5. Thermal Resistance: R-value of 30, minimum at roofs.

6. Facing: Unfaced.

7. Products:

a. CertainTeed Corporation; .: www.certainteed.com/#sle.

b. Johns Manville; .: www.jm.com/#sle.

c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.

C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.

2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

3. Thermal Resistance: R-value of 30, minimum at roofs.

4. Products:

a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.

b. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.

c. ROCKWOOL (ROXUL, Inc); COMFORTBATT: www.rockwool.com/#sle.

d. Thermafiber, Inc; SAFB: www.thermafiber.com/#sle.

2.3 ACCESSORIES

A. Sheet Vapor Retarder: interior polyethylene film reinforced with glass fiber square mesh, 10 mil thick.

B. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.

1. Application: Sealing of interior circular penetrations, such as pipes or cables.

2. Width: Are required for application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Apply adhesive to back of boards:

1. Three continuous beads per board length.

B. Install boards horizontally on foundation perimeter.

1. Place boards to maximize adhesive contact.

2. Install in running bond pattern.

3. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.3 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over face of member.

F. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member

G. Tape seal tears or cuts in vapor retarder.

H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.4 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 07 21 00

SECTION 07 25 00 – WEATHER BARRIERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install water-resistive air barrier: Under exterior wall cladding, over sheathing and other substrate, not airtight or vapor retardant.

B. Furnish and install Vapor Retarders: Materials to make exterior walls, joints, between exterior walls and roof, and joints around frames of openings in exterior walls water vapor resistant and airtight.

1. Installed above interior gyp board or interior sheathing.

1.2 REFERENCE STANDARDS

A. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2018.

B. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2016.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

E. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

F. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017.

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirement of Section 01 33 00 – Submittal Procedures.

B. Product Data: Provide data on material characteristics.

PART 2 - PRODUCTS

2.1 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened:

1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.

2. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.

3. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for minimum of 5 hours, when tested in accordance with AATCC Test Method 127.

4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 180 days of weather exposure.

5. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.

6. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.

7. Manufacturers:

a. DuPont de Nemours, Inc; Tyvek Commercial Wrap with accessories: www.dupont.com/#sle.

b. Fiberweb, Inc; Typar MetroWrap: www.typar.com/#sle.

c. Fortifiber Building Systems Group; WeatherSmart: www.fortifiber.com/#sle.

d. Kingspan Insulation LLC; GreenGuard RainDrop Building Wrap: www.trustgreenguard.com/#sle.

e. VaproShield, LLC; WrapShield IT - Integrated Tape: www.vaproshield.com/#sle.

2.2 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Vapor Retarder Sheet: ASTM D4397 polyethylene film reinforced with glass fiber square mesh, clear.

1. Thickness: 10 mil, 0.010 inch.

2. Water Vapor Permeance: 0.076 perms, as required by referenced standard for thickness specified.

3. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material.

2.3 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Flexible Flashing: Sheathing fabric saturated with air barrier coating and complying with the applicable requirements of ICC-ES AC148.

C. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.

1. Width: 3-1/2 inches.

2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.

D. Vapor Retarder Tape: Coated polyester film with acrylic adhesive backing; pressure sensitive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

D. Mechanically Fastened Sheets - On Exterior:

1. Install sheets shingle-fashion to shed water, with seams generally horizontal.

2. Overlap seams as recommended by manufacturer but at least 6 inches.

3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.

4. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.

5. Install air barrier and vapor retarder underneath the jamb flashings.

6. Install head flashings under weather barrier.

7. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

E. Mechanically Fastened Sheets - Vapor Retarder On Interior:

1. When insulation is to be installed in assembly, install vapor retarder over insulation.

2. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, making air tight seal.

3. Locate laps at a framing member; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet.

4. Seal entire perimeter to structure, window and door frames, and other penetrations.

5. Where conduit, pipes, wires, ducts, outlet boxes, and other items are installed in insulation cavity, pass vapor retarder sheet behind item but over insulation and maintain air tight seal.

F. Openings and Penetrations in Exterior Weather Barriers:

1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.

2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.

3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.

4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.

5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.

6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.4 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by Manufacturer.

END OF SECTION 07 25 00

SECTION 07 30 10 - ROOFING UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies underlayment for sloped roofs.

1. Self-adhering sheet membrane

2. Asphalt saturated felt membrane

B. Related Sections: Refer to the following specification sections for coordination:

1. Section 061000 - Rough Carpentry.

2. Section 076100 - Sheet Metal Roofing.

C. Referenced Standards: Comply with the requirements of the following standards published by ASTM International to the extent referenced in this section.

1. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

2. ASTM D461 - Standard Test Methods for Felt.

3. ASTM D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

4. ASTM D1970 - Standard Specification for Self - Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

5. ASTM D3767 - Standard Practice for Rubber — Measurement of Dimensions.

6. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

7. ASTM G90 – EMMAqua test.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable codes at the location of the project.

B. Manufacturer: Minimum 10 years experience producing roofing underlayment.

C. Installer: Minimum 2 years experience with installation of similar underlayment.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened factory labeled packages. Protect from damage.

B. Cover materials and store in dry condition between temperatures of 40 and 90 degrees F (5 and 32 degrees C). Use within one year of date of manufacture. Do not store at elevated temperatures as that will reduce the shelf life of the product.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Self - Adhering Sheet Membrane Roof Underlayment: Provide Ice and Water Shield with the following characteristics:

1. Material: Cold applied, self adhering membrane composed of a high strength polyethylene film coated on one side with a layer of rubberized asphalt adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the polyethylene.

2. Membrane Thickness: 40 mil (1.02 mm) ASTM D3767 procedure A (Section 9.1).

3. Tensile Strength, Membrane: 250 psi (1720 kN/m2) ASTM D412 (Die C modified).

4. Elongation, Membrane: 250% ASTM D412 (Die C modified).

5. Low Temperature Flexibility: Unaffected @ - 20°F (-29°C) ASTM D1970.

6. Adhesion to Plywood: 3.0 lbs/in. width (525 N/m) ASTM D903.

7. Permeance (Max): 0.05 Perms (2.9 ng/m2s Pa) ASTM E96.

8. Material Weight Installed (Max): 0.3 lb/ft2 (1.3 kg/m2) ASTM D461.

9. Service Temperature: 180 degrees F (82.2 degrees C) per ASTM D1204

10. Code and Standards Compliance: Ice and Water Shield meets the following:

a. Underwriters Laboratories Inc. Class A fire classification under fiber - glass shingles and Class C under organic felt shingles (per ASTM E108/UL 790).

b. International Conference of Building Officials (ICBO-ES) Report No. 3997.

B. Asphalt Saturated Felt Membrane

1. Material: Asphalt saturated felt underlayment

2. Thickness: 30# felt membrane, 0.03” thick

3. Adhesion: Mechanically attached per manufacturer’s recommendations

4. Standards Compliance:

a. ASTM D-4869 Type II

PART 3 - EXECUTION

3.1 EXAMINATION

A. A. Prior to start of installation, inspect existing conditions to ensure surfaces are suitable for

B. installation of roofing underlayment. Verify flashing has been installed. Starting work indicates installers acceptance of existing conditions.

3.2 INSTALLATION

A. A. Installation:

1. Install roofing underlayment on sloped surfaces at locations indicated on the

2. Drawings:

a. Install asphalt saturated felt underlayment as shown on the Drawings.

b. Install self-adhered underlayment membrane as shown, but not at less than at hips, ridges, eaves, valleys, sidewalls and chimneys, and surfaces over interior space within 36 inches (914 mm) from the inside face of the exterior wall. Strictly comply with manufacturer’s installation instructions including but not limited to the following:

1) Schedule installation such that underlayment is covered by roofing within the published exposure limit of the underlayment.

2) Do not install underlayment on wet or frozen substrates.

3) Install when surface temperature of substrate is a minimum of 40 degrees F (5 degrees C) and rising.

4) Remove dust, dirt, loose materials and protrusions from deck surface.

5) Install membrane on clean, dry, continuous structural deck. Fill voids and damaged or unsupported areas prior to installation.

6) Install membrane such that all laps shed water. Work from the low point to the high point of the roof at all times. Apply the membrane in valleys before the membrane is applied to the eaves. Following placement along the eaves, continue application of the membrane up the roof. Membrane may be installed either vertically or horizontally after the first horizontal course.

7) Side laps minimum 3-1/2 inches (89 mm) and end laps minimum 6 inches (152mm) following lap lines marked on underlayment.

8) Patch penetrations and damage using manufacturer's recommended methods.

3.3 CLEANING AND PROTECTION

A. Protection: Protect from damage during construction operations and installation of roofing materials. Promptly repair any damaged or deteriorated surfaces.

B. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired in the opinion of the Engineer.

C. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protective film and reclean as necessary immediately before final acceptance.

END OF SECTION

SECTION 07 40 00 – ROOFING AND SIDING PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install architectural roof, wall and soffit preformed steel panels as shown on the drawings and as specified herein. All metal panel products shall be provided by a single manufacturer.

1.2 REFERENCE STANDARDS

A. The Design shall comply with the 2018 International Building Code (IBC).

B. AISI S100 – Specification for the Design of Cold-Formed Steel Structural Members

C. AISC Steel Construction Manual

D. ASTM A653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

E. ASTM A924 – Specification for General Requirement for Steel Sheet, Metallic-Coated by the Hot-Dip Process

F. ASTM D1790 – Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

G. ASTM E283 – Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen”

H. ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference

I. NRCA MS104 – The NRCA Roofing Manual: Steep-slope Roof Systems

J. SMACNA (ASMM) – Architectural Sheet Metal Manual

K. UL 263 – Standard for Fire Tests of Building Construction and Materials

L. Coating Performance Reference Standards

M. Manufacturer’s Standards: In addition to the standards listed above, all roof, wall, soffit panels, and their related accessories shall be in accordance with the manufacturer’s published recommendations and specifications.

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Summary of test results, indicating compliance with specified requirements.

2. Storage and handling requirements and recommendations.

3. Installation methods.

4. Specimen warranty

C. Shop Drawings: Include layouts of roof, wall, and/or soffit panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.

1. Show work to be field-fabricated or field-assembled.

2. Indicate erection procedures and accessories required.

D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of colors and patterns.

E. Verification Samples: For each panel system specified, submit samples of minimum size 12-inches square, representing actual metal thickness, profile, color, and texture.

1. Include typical panel joint in sample.

F. Maintenance Data: For metal panels to include in maintenance manuals.

G. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 10 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 10 years of documented experience.

1. The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having at least 5 years successful experience installing metal panel roofing systems similar to the specified system and having installed at least four roofing application of similar systems of equal or greater size within the last 12 months.

2. Crew Experience and Supervision: Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and experienced foreman/superintendent on the job at all times roofing work is in progress.

C. Perform Work in accordance with NRCA MS104 – NRCA Roofing Manual and manufacturer's instructions.

1.5 WARRANTY

A. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of 20 years from Date of Substantial Completion.

B. Warrant steel panel core substrate against rupture, structural failure, or perforation due to exposure to normal atmospheric corrosion within a 25 year period after Substantial Completion.

C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of 20 years from Date of Substantial Completion.

1. The warranty shall have a maximum 2 year installer's obligation for weathertightness from Substantial Completion and shall not be tied to or reset by the occurrence of leaks within that or any other period.

2. Pro-rated Systems Warranties are not acceptable.

3. The warranty shall be from the manufacturer of the metal panel, not a marketer. No rebranded products shall be accepted.

4. The warranty shall include the full assembly, including, but not limited to: metal panels, associated flashings, insulation, SAHTS, vapor barrier, fasteners, clips, etc.

5. The warranty shall contain no exclusion or limitation for improper installation.

6. Warranty coverage shall not be excluded for roof slopes down to and including 1:12.

7. Manufacturer shall ultimately provide warranty responses in the event installer/contractor fails to.

PART 2 - PRODUCTS

2.1 PANELS

A. Wall Systems:

1. Panel manufacturer shall furnish trim and accessories, such as head jamb, sill, drip edge and corner flashings. All custom trim and flashings shall be made to project requirements, and trim coil and sheet stock shall be used for field forming where required. Accessories such as fasteners, sealants, neoprene plugs and closures shall be included in the installation.

2. Multi-Purpose panels shall be fabricated with a concealed fastening system. Panel width shall be 12 inches. Panel lengths shall be cut to proper length to fit the installation requirements. The semi-standing seam panels shall be rollformed from minimum 24-gauge steel. Installation shall be by hook, pull, and fasten. The fasteners will be concealed by the rib of the consecutive panel. Atas MPN 120 series or equal.

B. Soffit Panels:

1. Soffit panels shall be coated metal panels consisting of a concealed fastener soffit system for long overhang soffits. Installation shall be with framing system, girts or a solid substructure. No fasteners shall be visible after installation. The special locks shall prevent slipping of the panel. Provide smooth solid panels and lanced panels for ventilation where soffit vents are shown on the drawings. Install the strip first, followed by the J channel and soffit panel.

2. Soffit panels shall be fabricated with a concealed fastening system. Panel width shall be 12 inches. Panel lengths shall be cut to proper length to fit the installation requirements. The soffit panels shall be rollformed from minimum 24-gauge steel. Panel depth shall be a minimum of 7/16-inches. Atas Wind-Lok Vented/Smooth or equal.

C. Roof Panels: Factory-formed panels with factory applied finish.

1. Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

2. Profile Configuration: Standing Seam Metal Roof: Vertical 1-1/2-inch-high seams minimum with 12-inch panel. Minimum 24-gauge panels with striations.

3. Length: Provide panels in the maximum length recommended by the manufacturer to minimize end laps.

4. Panel: The panel shall be a standing seam metal roofing panel. Atas Standing Seam 1-1/2” Field-Lok or equal.

D. Profile Composition:

1. Base Metal:

a. Material: Steel conforming to ASTM A792 Grade 50 (D) with a minimum yield strength of 50,000 psi. and thickness not less than 24-gauge.

b. Protective Coating: Galvanized G-90 coating in accordance with ASTM A653 and coated with a paint system specified below.

2. Coating:

a. Paint system: Signature 300™ 0.8 mil 70% resin finish coat applied over a 0.2 mil baked-on base primer to a total film thickness of 1.0 mil.

b. Color selected by Owner from manufacturer’s standard or premium color chips.

E. Concealed-Clips:

1. Material: 20-gauge galvanized steel.

   Configuration: Clips shall be designed as to fix by concealed fasteners, and fully engage the rib of every panel.

F. Fasteners:

1. Clip Fasteners: Follow manufacturer's recommendations for clip attachment to the substrate shown on the drawings.

2. Other Fasteners: Self-drilling or self-tapping screws or stainless steel pop rivets painted to match the panels where visible, per the panel manufacturer's recommendations.

G. Flashing and Trim:

1. Flashing and/or trim shall be supplied at rakes, high and low eaves, corners, bases, framed openings and as required or specified to provide weathertightness and/or a finished appearance.

2. Standard trim configurations and/or finishes for given conditions shall be determined by the specific roof and wall panel system and finish combinations.

3. Trim finish shall be paint system Signature 300™ 0.8 mil 70% resin finish coat applied over a 0.2 mil baked-on base primer to a total film thickness of 1.0 mil. Color of the exterior finish shall be selected by the Owner/Engineer from the manufacturer's standard or premium colors.

H. Mastics and Sealants:

1. Pre-formed tape mastics, and/or non-skinning tube sealants shall be used for the sidelaps and endlaps of all roof coverings.

2. Tape Mastic shall be pre-formed butyl rubber-based compound conforming to TT-C-1796-A or approved equivalent. The compound shall be non-hardening, non-corrosive to metal and have excellent adhesion properties. Tape mastic shall be white or light gray in color. Tube Sealant shall be a synthetic elastomer-based material in gray or bronze.

3. Gunnable Sealant: Use sealant to meet TT-S-00230C or approved equivalent.

I. Preformed End Closures:

1. Closures, formed to match roof panel profiles shall be used to provide weather tightness. Closures shall be of a closed cell, non-absorbent, laminated, semi-rigid material, EPDM (Ethylene-Propylene-Duene-Monomer) foam in a gray or neutral color shaped to tightly fit the panel configuration.

J. Finish:

1. FLUOROFINISH® (Polyvinylidene Fluoride) consisting of 0.25 +/- 0.05 mil primer on both sides with 0.75 +/- 0.1 mil 70 percent Signature 300 or Kynar 500 top coat.

2. The exterior color shall be selected by Owner from manufacturer's standard or premium colors.

K. Trim and Flashing Material:

1. Shall be of the same material, gauge, finish and color as the panels, unless otherwise indicated.

L. Accessories:

1. Fasteners:

a. Type 304 Stainless Steel with 5/8-inch diameter combination neoprene bonded metal washers, shall be #14 Type A for sheet to sheet and Type B for sheet to structural steel support.

b. Exposed fasteners color coated to match panels.

2. Closures:

a. Provide where called for on the drawings pre-molded flexible, cross-linked, closed-cell gray polyethylene foam to fit the contour of the panel specified.

b. Metal closures shall be manufactured from material that is the same finish and color of the adjacent metal panels and furnished where shown on drawings.

3. Tape Sealant shall be installed in all side and end laps of all metal panels and for all flashings, to assure weather tightness.

M. Approved Manufacturers

1. MBCI Metal Roof and Wall Systems

2. Atas International Inc.

3. Metal Sales Manufacturing Corporation

4. Taylor Metal Products

2.2 FABRICATION

A. Must be in compliance with dimensions, profile limitations, gauges and fabrication details of Manufacturer.

B. Components shall be fabricated to the greatest extent possible in the factory ready for field assembly.

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE

A. Materials shall be delivered to the site in a dry and undamaged condition and unloaded per the manufacturer's instructions. The installer shall inspect materials for damage and stains upon arrival to the site. Materials shall be stored out of contact with the ground in weathertight coverings to keep them dry per the manufacturer's recommendations. Storage accommodations shall provide good air circulation and protection from surface staining.

3.2 INSPECTION

A. The installer shall examine substrates, areas, and conditions for compliance with requirements for installation tolerances, panel supports, and other conditions affecting performance of the Work.

B. Field-check dimensions and check support alignment with a taut string or wire; support misalignment will cause panel "oil-canning."

C. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

D. Should any condition be found which, in the opinion of the installer, will prevent proper execution of their work, the installer shall report such condition.

E. Do not proceed until unsatisfactory conditions are corrected.

3.3 INSTALLATION

A. Protect installed panels from abuse by other trades. The Contractor shall be responsible for protecting the panels from wet cement, plaster, painting operations, etc. The installer shall provide walk boards in heavy roofing traffic areas to prevent damage to panels. The metal roof panels shall be mechanically seamed with appropriate equipment as recommended by the manufacture.

B. Install panels in accordance with approved shop drawings and panel manufacturer’s instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.

C. Accessories: Install all components required for a complete assembly, including flashings, trim, closure strips, and similar accessory items.

D. Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.

E. Flashing and Trim: Comply with performance requirements, manufacturer’s written installation instructions, and SMACNA (ASMM).

3.4 DAMAGED MATERIAL AND CLEANING

A. Replace damaged panels and other components of Work which cannot be repaired by finish touch-up or similar minor repair prior to Date of Substantial Completion.

B. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

C. To prevent rust staining, remove immediately from finished surfaces any filings caused by drilling or cutting.

END OF SECTION 07 40 00

SECTION 07 60 00 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide sheet metal and appurtenant work, complete, in accordance with the Contract Documents.

B. The principal items of sheet metal work shall include, but not be limited to the following: sheet metal flashings, collars, pitch pockets (pans), equipment platforms, and equipment (sleeper) supports at all roof penetrations which are not provided as part of the roofing system.

1.2 REFERENCE STANDARDS

A. TT -P-641 G(1) Primer Coating, Zinc Dust-Zinc Oxide (For Galvanized Surfaces)

B. UU-B-790A INT AMD 1 Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire Resistant)

C. ASTM A240 Stainless and Heat-Resisting Chromium Steel Plate. Sheet. and Strip

D. ASTM A653 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

E. ASTM A666 Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

F. ASTM B32 Solder Metal

G. ASTM B209 Aluminum and Aluminum-Alloy Sheet and Plate

H. ASTM C920 Specification for Elastomeric Joint Sealants

I. ASTM D226 Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

J. ASTM D1187 Asphalt-Base Emulsions for Use as Protective Coatings for Metal

K. SMACNA (ASMM) Architectural Sheet Metal Manual

L. AWS The Aluminum Association Specifications for Aluminum Sheet Metal Work in Building Construction, American Welding Society

M. Manufacturer's Standards: In addition to the standards listed above, the flashing products and their installation shall be in accordance with the manufacturer's published recommendations and specifications.

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirement of Section 01 33 00 – Submittal Procedures.

B. Samples: Color samples and samples shall be submitted where required for color selections and/or review by the Engineer.

C. Shop Drawings: Shop drawings showing materials, gauges, finishes, layout, jointing, profiles, fasteners, fabrication of special shapes, and method of attachment to adjacent construction shall be submitted.

D. Submit manufacturers literature indicating materials, finish, construction, and method of installation of prefabricated items and sealants.

E. Warranties: Special warranties as specified in this Section.

1.4 QUALITY ASSURANCE

A. General: sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Design, fabricate, and install flashings at roof edges in accordance with SPRI ES-1, except with basic wind speed as indicated on the Structural Drawings.

C. Water Infiltration: Provide sheet metal flashing and trim that does not allow water infiltration to building interior.

D. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.

E. Fabricator and Installer Qualifications: Company specializing in sheet metal work with ten years of documented experience.

F. Warranty:

1. Special Project Warranty: Submit Installer’s warranty, or installer’s standard or customized form, signed by Installer, covering the Work of this Section, including all components of flashing and sheet metal against defects in materials and workmanship, for two years from date of substantial completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Sheet metal shall be aluminum and/or galvanized steel unless otherwise specified or shown. Sheet metal work in connection with roofing shall be in accordance with roofing manufacturer's published specifications.

B. All sheet metal flashings necessary to make building weathertight shall be provided, whether or not specified or shown.

2.2 ALUMINUM PRODUCTS

A. Aluminum shall be 0.032-inch minimum thickness and shall conform to ASTM B209, alloy 3003-H 14, with color selected by Owner having an anodized finish AA-C12-A42 unless specified or shown otherwise. Thickness of aluminum to be welded shall be as necessary for welding method being used.

B. Reglets shall be extruded aluminum with protective coating such as manufactured by Superior Concrete Accessories; Morrison and Company "Cushion-Lock"; Fry Reglet; or equal.

2.3 FERROUS METALS

A. Unless otherwise specified, galvanized steel shall be 24-gauge minimum thickness conforming to ASTM A653.

B. Stainless steel shall be 24-gauge minimum thickness conforming to ASTM A176, Type 3.04, dull No. 20 finish.

2.4 LEAD AND SOLDERING MATERIALS

A. Lead shall be 4 to 6 percent antimony and remainder shall be lead. Lead sheet shall be soft temper I except hard temper for flanges. Weight shall be not less than 4 pounds per square feet unless otherwise shown.

B. Solder shall conform to ASTM B32, Alloy 5b, 50 percent tin, 50 percent lead.

C. Soldering flux shall be of a type not injurious to metal surface being treated.

2.5 FASTENERS

A. Fastening devices shall be of the same material as the sheet metal being used or corrosion-resistant metal compatible with sheet metal being used. Fasteners exposed to the weather shall have neoprene washers. Washers shall be 0.04-inch minimum thickness. A rubber-type washer shall be used beneath the aluminum washer or fastener head where weathertightness is required.

2.6 SEALING MATERIALS

A. Sealants shall be as specified under Section 07 92 00 – Joint Sealants or shall be of the silicone type. Colors shall be selected by the Engineer from manufacturer's standard colors.

B. Sealer tape shall be polyisobutylene sealer tape specifically formulated for setting flanges on bituminous roofing, as manufactured by Morrison and Company CL-50; plasticity 579.6; or equal.

2.7 COATING MATERIALS

A. Primer coat for galvanized steel shall conform to Federal Specification TT-P-641 G(1) Type II.

B. Asphaltic coating compound shall conform to ASTM D1187.

2.8 BUILDING PAPER OR FELT

A. Unless other specified, provide asphalt saturated roofing felt underlayment (Number 30) conforming to ASTM D226

2.9 SHOP FABRICATION REQUIREMENTS

A. General: Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA (ASMM) that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to the greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

5. Snip flashing material with shears in lieu of abrasive cutting to close off bare metal with finish during fabrication in shop and on site.

B. All aluminum shall be welded where specified or shown. Welding shall conform to Reference Standards.

C. Galvanized steel corner joints shall be soldered. Other joints shall be as specified, or as required by the Reference Standards.

D. All Work and finishes shall be protected from scratches and abrasions.

E. All flashings, reglets, counter-flashing and other associated flashings shall be fabricated by the same manufacturer and be installed as a complete flashing system. All flashings shall be creased longitudinally or otherwise formed with sufficient spring action to hold bottom edges firmly against base flashing or similar material.

F. Intersecting corners of copings shall be accurately fitted and welded. Corners may be shop-assembled, manufactured, or extruded units. Coping shall be per ASMM Plate 68 except modified as shown, with Alternate 5 seams that allow for 1/4-inch expansion per each 10 feet of length.

G. All required access doors, unless specified elsewhere, shall be provided. Size and location shall be as required by governing authorities, codes, and as shown. Key-locked access doors shall be provided where shown.

H. Flashing required through concrete or clay tile shall be flexible flashing in order to assure against undue separation between tiles on account of rigidity of the flashing material. Flashing around pipes, vents, flues, chimneys, etc., shall be of lead, copper, or other approved flexible flashing material.

2.10 FABRICATED SHEET METALWORK

A. Stamped sheet metal vents or louver-type vents (where shown) shall be designed to provide watertight flush corners and shall be of size shown. Each vent shall be equipped with 1/4-inch square galvanized or aluminum mesh hardware cloth insect screen. Stamped metal items shall be made of coated aluminum or galvanized sheet metal.

B. Metal vent screeds shall be plaster channel screeds PCS-V-300 as manufactured by Fry Reglet Corp.; H.K. Porter Co., Inc.; or equal. Screeds shall be extruded aluminum with either clear plastic coating, clear anodized coating, or clear acrylic baked-on coating. All corners shall be mitered.

C. Wall louvers shall be extruded aluminum louvers conforming to ASMM Plate 14, unless otherwise specified or shown. Louvers and screens shall have clear anodized finish. All exterior louvers shall be provided with 1/2-inch by 1/2-inch mesh bird screen and frame. Screen units shall be removable.

D. Equipment supports conforming to Reference Standards shall be provided where required or necessary and may be of galvanized steel construction unless otherwise shown.

E. The roof penetrations sheet metal work items shall be provided and shall be coordinated with the roofing system. The design and details shall conform to the Reference Standards unless otherwise shown.

F. The roof penetrations shall be provided with the following flashing:

1. Vent pipes: Lead collars vent pipe flashing with top of lead sleeve flashing bent into vent pipe. Ref. ASMM. Plate 66, F18.B and 71 Figure A.

2. Single pipes: Sheet metal or lead collars with sheet metal or lead draw band with sealant or cap top. Ref. ASMM. Plate 65 & 66, F18.C.

3. Multi-pipes: Lead collar with cap. Ref. Stoneman Engineering and Mfg. Co.

4. Multi-pipes w/curb: Sheet metal with sealant and draw bands. Ref. ASMM. Plate 65, Figure B.

5. Equipment support and/or Platform (See Note 1): Sheet metal. Ref. ASMM. Plate 68.

6. Pitch pockets for supports: Sheet metal with all joints welded or soldered. Ref. ASMM. Plate 61, figure E.

7. Ducts with curb (See Note 1): Sheet metal. Ref. ASMM Plate 148, Figure B 150, 151.

8. Prefabricated products, curbs, supports, and platforms which are part of mechanical equipment and are specified in other Sections of these Specifications, shall be provided with equipment as specified.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall coordinate the flashings necessary with the different trades to make sure all items which penetrate the roof are provided with all necessary sheet metal items and work, such as (but not limited to) the following: pipes, ducts, support racks, equipment platforms or sleepers, and supports. Sheet metal shop manufactured curbs, equipment supports, and equipment platforms shall be provided where prefabricated curbs, support or platform are not specified in other Sections of these Specifications.

B. All Work shall conform to Reference Standards. Flashing work shall be coordinated with roofing work. Sheet metal and roofing shall provide a weather-tight and watertight assembly without oil canning, buckles, tool marks, fastening stresses, distortion or defects which impair strength or mar appearance.

C. Sheet metal work shall be accurately formed to dimensions and shapes shown. Work shall be fitted snugly, with straight, true lines with exposed faces aligned in proper plane, free from waves and buckles. Arises and angles shall have true and sharp lines, and surfaces shall be free from waves and buckles. All exposed edges shall be hemmed. Holes for fasteners within sheet metal work exposed to temperature changes shall be elongated holes for material expansion and movement.

D. All sheet metal work shall be furnished complete with supports, hangers, bracing, anchors, and other devices as required for reinforcement and proper attachment to adjacent construction. Fastenings shall be concealed wherever possible. Joints, fastenings, reinforcements, and supports shall be sized and located as required to preclude distortion or displacement due to thermal expansion and contraction.

E. All surfaces upon which sheet metal is to be placed shall be dry, smooth, even, and free of any projections and hollows. Sheet metal shall be laid with all joints true and even and firmly attached with all fastener heads flush with the top surface.

F. The underlayment shall be overlapped at least 2 inches so as to shed water and shall be secured along the lapped edges. Aluminum fasteners shall be used with aluminum sheet metal.

G. Dissimilar materials shall be isolated with 2 coats of asphaltic paint, asphaltic coating compound, or sealer tape. Only stainless-steel fasteners shall be used to connect isolated dissimilar metals.

H. Joints shall be sized and spaced to permit sheet movement for thermal expansion and contraction of 1/4 inch per 10 feet length, on 140 degree Fahrenheit temperature difference. Holes for fasteners or anchors shall be elongated to provide for movement.

I. Roofing sheet metal items shall be built into the roofing in strict accordance with directions of roofing manufacturer.

3.2 INSTALLATION

A. Flashing at vertical surfaces shall be installed at intersections of roof with vertical surfaces and at projections through roof. Corner units shall be factory-fabricated and shall have mitered soldered or welded corner joints and shall be installed with 3-inch (min) lap joint over flashings on each side.

B. Copings shall have joints at 10 feet (max) spacing and at 2-1/2 feet from corners. Joints shall be butted with 3/16-inch space centered over matching 8-inch-long backing plate with sealer tape in laps. Corner units shall be welded or soldered units. All joints shall be provided with cover plates.

C. Flanges of sheet metal items shall be set on continuous sealer tape on top edge envelope ply of roofing. Flanges shall be nailed through sealer tape at 3 inches (max) spacing or securely fastened per Reference Standards.

D. Metal protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

END OF SECTION 07 60 00

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install joint sealers shown on the drawings and as specified herein.

1.2 REFERANCE STANDARDS

A. ASTM C834 – Specification for Latex Sealants

B. ASTM C920 – Specification for Elastomeric Joint Sealants

C. ASTM C1193 – Guide for Use of Joint Sealants

D. ASTM C1248 – Test Method for Staining of Porous Substrate by Join Sealants

E. ASTM C1521 – Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints

F. ASTM D2240 – Test Method for Rubber Property – Durometer Hardness

1.3 CONDITIONS

A. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer for installation.

B. Except as otherwise indicated, joint sealers are required to establish and maintain waterproof continuous seals on a permanent basis, which recognized limitations of wear and aging as indicated for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials and workmanship.

1.4 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Product Data for Sealants: Submit manufacturer’s technical data sheets for each product to be used, that includes the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.

2. List of backing materials approved for use with the specified product.

3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.

4. Substrates the product should not be used on.

5. Substrates for which use of primer is required.

6. Installation instructions, including precautions, limitations, and recommended backing material and tools.

7. Warranties: See warranties as specified in this Section

1.5 QUALITIY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least five years of documented experience.

C. Warranty:

1. Special Manufacturer's Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this section within specified warranty period.

a. Warranty Period for Silicone Sealants: 20 years from Date of Substantial Completion.

b. Warranty Period for Polyurea Sealants: 1 year for Date of Substantial Completion.

c. Warranty Period for All other Types of Sealants: 5 years from Date of Substantial Completion.

2. Include Coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Elastomeric Sealants

1. Joints in Concrete Floors and Sidewalks: One component self-leveling polyurethane sealant conforming to ASTM C920, Type M, Grade P.

2. Joints in Water Containing Structures and Intermittently Submerged Joints: Two component, non-sag, water immersion, polysulfide polymer based elastomeric sealant conforming to ASTM C920, Type M, Grade NS.

3. Exterior Joints in Building Construction: One component, non-sag, SBR polymer based elastomeric sealant conforming to ASTM C920, Type M, Grade NS. Sealant color match substrate.

a. Seal open joints, whether or not the joint is indicated on Drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.

1) Wall expansion and control joints.

2) Joints between door, window, storefront, and other frames and adjacent construction.

3) Joints between different exposed materials.

4) Openings below ledge angles in masonry.

5) Masonry control and expansion joints.

4. Interior Joints in Building Construction: One component multipurpose silicone sealant conforming to ASTM C920, Type S, Grade NS. Color of sealant to match substrate. Translucent where color match is not available.

a. Seal interior joints unless specifically indicated not to be sealed. Interior joints to be sealed include, but are not limited to, the following items.

1) Joints between door, window, storefront, and other frames and adjacent construction.

2) All joints between dissimilar materials.

3) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.

a) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.

5. Do not seal the following type of joints:

a. Intentional weepholes in masonry.

b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.

c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.

d. Joints where installation of sealant is specified in another section.

B. Fire Stopping: Where piping, conduit, wire, or other materials pass through fire rated walls, floors, ceilings or roofs, provide a 1-hour fire rated sealant in accordance with ASTM E814 and UL 1479. Fire-resistant penetration sealant shall be a medium-density, fire-resistant foam that retains form and stability at high temperature.

C. Joint Primer/Sealer: Provide type of joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed; non-staining.

D. Sealant Backer Rod: Provide compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorbent materials as recommended by sealant manufacturer for back-up of and compatibility with sealant. Oversize 30 to 50 percent larger than joint width.

PART 3 - EXECUTION

3.1 JOINT PREPARATION

A. Clean joint surfaces immediately before installation of gaskets, sealants, or caulking compounds. Remove loose materials and foreign matter that could impair adhesion of sealant. Remove dirt, insecure coatings, moisture and other substrates which could interfere with seal. Prepare all joint surfaces as recommended by sealant manufacturer.

B. Use primer on all surfaces as recommended by the product manufacturer. Use backer rod on all joints to control the depth of sealant application to manufacturer's recommended sealant depth.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

3.2 INSTALLATION

A. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

B. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. When horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove so that joint will not trap moisture and dirt.

C. Perform installation in accordance with ASTM C1193.

D. Seal all exposed joints of dissimilar materials and elsewhere as indicated.

E. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

F. Install sealant free of air pockets, foreign embedded material, ridges, sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Seal bottoms of hollow metal frames to floor at resilient flooring.

I. Seal thresholds in a full continuous bed of sealant.

J. Spillage: Do not allow sealants or compounds to overflow from confines of joints, or spill onto adjoining work, or to migrate into voids of exposed finishes. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

K. Recess exposed edges of gaskets and exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.

3.3 CURE AND PROTECTION

A. Cure sealants in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength, and surface durability. Advise Contractor of procedures required for cure and protection of joint sealers during construction period so that they will be without deterioration or damage (other than normal wear and weathering) at time of substantial completion. Cure and protect sealants in a manner which will minimize effects. Replace or restore sealants which are damaged during construction period.

3.4 POST OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that the joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION 07 92 00

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SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install non-fire-rated hollow metal doors and frames.

B. Furnish and install fire-rated hollow metal doors and frames where indicated on the Drawings.

C. Furnish and install thermally insulated hollow metal doors and frames.

1.2 REFERENCE STANDARDS

A. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

B. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

C. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

D. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.

E. ASTM C476 - Standard Specification for Grout for Masonry; 2020.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

G. ITS (DIR) - Directory of Listed Products; current edition.

H. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.

I. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

K. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.

L. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

M. UL (DIR) - Online Certifications Directory; Current Edition.

N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirement of Section 01 33 00 – Submittal Procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: www.steeldoor.org/sdicertified.php/#sle.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Ceco Door, an Assa Abloy Group company; : www.assaabloydss.com/#sle.

2. Curries, an Assa Abloy Group company; : www.assaabloydss.com/#sle.

3. Republic Doors, an Allegion brand; : www.republicdoor.com/#sle.

4. Steelcraft, an Allegion brand; : www.allegion.com/#sle.

5. Or Engineer approved equal.

2.2 PERFORMANCE REQUIREMENTS

A. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

a. Level 3 - Extra Heavy-duty.

b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.

c. Model 1 - Full Flush.

d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.

2. Door Core Material: Polyurethane, 2.0 lbs/cu ft minimum density.

a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.

b. Minimum R-value 2.5

3. Door Thickness: 1-3/4 inches, nominal.

4. Door Finish: Factory primed and field finished.

2.4 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Face welded type.

1. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

2. Frame Finish: Factory primed and field finished.

3. Weatherstripping: Separate, see Section 08 7100.

2.5 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.6 ACCESSORIES

A. Transom Window: Horizontal frame member above top of door removeable and re-installable; finish same as door components; factory-installed.

1. Window: Shall be 1/4” clear tempered removable glass and to be re-installable.

2. Fasteners: Exposed or concealed fasteners.

B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Install door hardware as specified in Section 08 71 00 – Door Hardware.

3.3 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION 08 11 13

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SECTION 08 51 13 – ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install window units complete with glazing and necessary anchors and accessories, including glazing beads.

B. The Drawings indicate sizes, profiles, dimensional requirements, and aesthetic effects of windows and are based on the specific window types and models indicated. Other window manufacturers whose products have equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect.

1.2 REFERENCE STANDARDS

A. ANSI/AAMA 108-88, AAMA 1502 & 1503

B. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars

C. ASTM C509 Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material

D. ASTM D2000 Standard Classification System for Rubber Products in Automotive Applications

E. ASTM D2287 Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

F. ASTM E283 Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

G. ASTM E331 Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

H. Aluminum Association

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 – Submittal Procedures. Submit drawings showing window type, fabrication, and installation of each type of window required including information not fully detailed in manufacturers standard Product Data.

B. Product Data: The manufacturer's specifications, literature, and published installation instructions for all components of the window units shall be submitted by the Contractor.

C. Samples for Verification: The Engineer reserves the right to require additional samples that show fabrication techniques, workmanship, and accessories.

D. Test Reports: The Contractor shall submit certified independent laboratory test reports verifying compliance with all test requirements and structural calculations prepared by registered structural engineer licensed in the State where Work is being performed, and indicating adequacy of all installed materials to meet the uniform and structural load requirements as specified

1.4 QUALITY CONTROL

A. Single-Source Responsibility: Aluminum windows, frames, and all accessories shall be obtained from one source and by a single manufacturer.

B. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

C. Special Warranty: A written warranty signed by aluminum window manufacturer agreeing to repair or replace window components that fail in materials or workmanship within the specified warranty period shall be submitted. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.

2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

D. The warranty period shall last for three 3 years after date of Substantial Completion. The warranty period for metal finishes and glass shall be for five 5 years after Substantial Completion.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Comply with minimum test requirements of AAMA for classification of specified window in following: (1) Air infiltration; (2) Water Resistance; and (3) Uniform Structural Load

B. Each window shall be designed to conform with AAMA performance class of CW and Performance Grade at least as high as specified design pressure.

C. Condensation Resistance Factor (CFR) of 48 minimum when tested in accordance with AAMA 1502 Standards.

D. Thermal Transmittance of 0.65 maximum when tested in accordance with AAMA 1503 Standards.

2.2 FIRE-RATED WINDOWS

A. Unless otherwise specified, all interior window shall be fire-rated as shown. Provide pre-glazed units with one-hour fire-rated frame.

B. Glazing Characteristics: Provide 3/16-inch thick, premium Firelite (polished surfaces), permanently labeled with listing mark of Underwriters Laboratories, Inc. and Warnock Hersey International, Inc. Glazed into appropriate fire-rated frame with Metacaulk or equivalent listed product.

1. Approved Manufacturers, or Equal

a. Technical Glass Products

2.3 FABRICATION

A. Aluminum window units shall be fabricated to comply with indicated standards. A complete system for assembly of components and anchorage of window units shall be included.

B. Units that are reglazable without dismantling sash framing shall be provided. Frame shall be 2-7/16-inches wide, with minimum 0.125-inch wall thickness.

C. Windows shall be preglazed at the factory.

D. Subframes: Provide subframes with anchors for window units of not less than 0.062-inch thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units.

E. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated.

F. Glazing Stops: Provide screw-applied or snap-on glazing stops, coordinated with glass selection and glazing system indicated. Finish to match window units.

2.4 FINISHES

A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Architectural Class II minimum anodizing.

C. Color to be selected by the Owner.

2.5 ACCESSORIES

A. Fasteners: Fasteners: Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with

aluminum window members, trim, hardware, anchors, and other components of window units.

B. Reinforcement: Where fasteners screw anchor into aluminum less than 1/8-inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.

C. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

D. Anchors and Clips: Fabricate anchors, clips, and window accessories of aluminum or nonmagnetic stainless steel. Other corrosion-resistant or insulated anchors as specifically approved in writing prior to use. Sufficient strength to withstand design pressure indicated shall be provided.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of window units, and other components of the Work shall comply with the manufacturer's specifications and recommendations.

3.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Manufactured products shall be delivered in original unbroken packages, containers, or crating, bearing the manufacturer's label with manufacturer's name, product description, and rating.

B. Storage: All products shall be carefully stored in an area that is protected from the elements, in a manner recommended by the products manufacturer. Storage shall be in a manner that will prevent damage to the product and its finish.

3.3 INSPECTION

A. Inspect openings before installation. Verify that rough or masonry opening is correct, and that sill is level. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.

3.4 INSTALLATION

A. Experienced mechanics shall install windows. Do not force windows into openings.

B. Set receptors or sub-frames plumb, level, and in alignment. Secure window proper to receptor or sub-frame with anchors and fastening devices supplied by Manufacturer.

C. Bed joints at mullions and contacts of windows with sills in specified sealant. Trim off excess sealant.

D. Avoid direct contact between aluminum and adjacent steel work by insulating with materials equal to 3M's EC 1202 tape if materials are in pressure contact, or with bituminous paint if pressure between surfaces cannot be maintained.

E. Protect window surfaces from adjacent work as necessary.

F. Sill members shall be set in sill pan (seal edges) and other members in a bed of sealant with joint fillers to provide weathertight construction. The Contractor shall coordinate installation of the window units with wall flashings and other components of the Work.

1. Sealants, joint fillers, and gaskets to be installed after installation of window units as specified in Section 07 92 00 – Joint Sealants.

3.5 CLEANING

A. Clean aluminum and glass surfaces promptly after installing windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances.

END OF SECTION 08 51 13

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SECTION 08 62 00 – UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall furnish and install all skylights, complete, in accordance with the requirements of the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Codes:

1. 2018 International Building Code (IBC)

B. Commercial Standards:

1. NRCA National Roofing Contractors Association

C. Manufacturer's Standards: In addition to the above listed standards, all skylights and their installation shall be in accordance with the manufacturer's published recommendations and specifications.

1.3 SUBMITTALS

A. All submittals shall be in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. The manufacturer's specifications, literature, and published installation instructions for each type of skylight shall be submitted to the Engineer.

C. Shop drawings shall be submitted for all skylights prior to fabrication.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Manufactured products shall be delivered in original, unbroken, packages, containers or bundles bearing the name of the manufacturer.

B. Storage: All products shall be carefully stored on wood blocking in an area that is protected from the elements. Storage shall be in a manner that will prevent damage or marring of finish.

PART 2 - PRODUCTS

2.1 SKYLIGHTS

A. Design: Skylights shall be factory-assembled of the double-dome type, designed to meet applicable state OSHA and building code requirements. Skylights shall be weathertight. The skylight unit shall be designed to accommodate a temperature change of 100 degrees F without distress in assembly, fasteners, or glazing.

B. Skylight shall be designed to be able to be removed and reinstalled.

C. Skylight structural members shall be designed for the following loads:

1. Snow Live Load: 35 pounds per square foot

2. Wind Load: 30 pounds per square foot

3. Deflection in structural members shall be limited to L/175 under fully loaded conditions.

D. Aluminum:

1. Aluminum extruded components shall be alloy 6063-T5 or 6063-T6, or sufficient thickness for this application, and as required per structural calculations.

2. Aluminum sheet products shall be alloy 5052-H32 and a minimum thickness of 0.040 inches.

E. Glazing Materials:

1. Dual seal silicone insulated glass units 1-inch overall thickness. Made up of bronze, tempered Low e glass exterior, argon filled airspace and clear laminated glass interior. Glass thickness as required by the spans and loads.

F. Glazing Accessories: All glazing types, gaskets

G. Fasteners

1. Exterior fasteners and fasteners exposed to wet areas in frame shall be 300 series stainless steel, except pop rivets used on glazing cap to be aluminum.

2. Dry area fasteners shall be cadmium-plated steel or stainless steel.

3. All welding shall be by the TIG process. All exposed welds to be finished to match frame color where practical.

H. Frames and Gaskets: Skylights shall include a 6063-T5 extruded aluminum curb frame, with an integral sloping gutter and dome elevating leg, with continuous vinyl or neoprene support gasket and retaining frame. Frame shall be a thermal-break curb and thermally sealed double dome glazing unit. The prefabricated curb for fixed skylights shall be of aluminum construction, insulated with fiber glass, and shall be 9 inches in height. Approximate sizes of skylight openings are shown on the Drawings.

I. Domes:

1. Outer dome for skylights shall be formed of one-piece white translucent cast I acrylic to withstand a minimum live load of 40 pounds per square foot.

2. Inner dome shall be formed of one-piece white translucent cast acrylic.

J. Manufacturers, or Equal:

1. VELUX Commercial, Sparks, NV

2. Fiore Skylights, Somerdale, NJ

3. Kingspan 4848-ALT-CT-2-CCA/WTM-B/B-MF-A or Equal

PART 3 - EXECUTION

3.1 GENERAL

A. The installation shall conform to applicable codes and the manufacturer's published recommendations, specifications, and installation instructions for the type of work being performed. The construction shall be coordinated with the work of other trades.

B. The Contractor shall investigate the substrate and the conditions under which roofing work is to be performed, and shall notify the Engineer in writing of unsatisfactory conditions. The work shall not proceed until such unsatisfactory conditions have been corrected.

C. The Contractor shall verify the opening sizes required for the skylights prior to structural framing; shall notify the Engineer of conflicts and for directions; and shall make modifications to the structural framing or skylight details as necessary to accommodate the approved skylights submitted by the Contractor.

3.2 INSTALLATION AND CONSTRUCTION REQUIREMENTS

A. Cant and Edge Strips: Cant strips and tapered edge strips shall be provided at all intersections of roof surfaces with curbs and accessories which do not have built-in cants, and shall be miter cut at corners. Cant strips and tapered edge strips shall be firmly attached in place prior to roof application.

B. Pitch Pockets: Pitch pockets shall have all surfaces of sheet metal cleaned and primed with asphalt primer before installation of roofing oakum or styrofoam, plastic cement, low- melt asphalt and flashing compound. Pitch pockets shall be filled with one inch of plastic cement and with low-melt asphalt to within 1/2-inch of top of pocket. Flashing compound shall be provided over cooled low-melt asphalt and shall be sloped from embedded object to the outside of the pan so water will drain off pitch pocket.

C. Embedded Sheet Metal: All sheet metal surfaces to be embedded into roofing shall be cleaned and prime-coated with asphalt primer prior to embedding into roofing system.

D. Dissimilar Metals: Dissimilar metals shall be properly isolated with protective coating or isolation material.

E. Thermal Movement: Thermal movement, up to 100 degrees F change, shall be accommodated without distress in assembly of fasteners.

3.3 INSTALLATION OF SKYLIGHTS AND HATCHES

A. Dissimilar metals shall be properly isolated.

B. Thermal movement under temperature changes of up to 100 degrees F, shall be accommodated without distress in assembly of fasteners.

END OF SECTION 08 62 00

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install all hardware for wood and hollow metal doors, fire-rated doors, thresholds, weatherstripping and gasketing.

1.2 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. BHMA A156.1 - American National Standard for Butts and Hinges; 2016.

C. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2017.

D. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

E. BHMA A156.6 - American National Standard for Architectural Door Trim; 2015.

F. BHMA A156.16 - American National Standard for Auxiliary Hardware; 2018.

G. BHMA A156.18 - American National Standard for Materials and Finishes; 2016.

H. BHMA A156.21 - American National Standard for Thresholds; 2014.

I. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems Sponsor; 2017.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

K. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

L. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.

M. UL (DIR) - Online Certifications Directory; Current Edition.

N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Keying Requirements Meeting:

1. Schedule a keying meeting prior to securing and installing the door hardware.

2. Attendance Required:

   a. Contractor.

   b. Owner.

3. Agenda:

   a. Establish keying requirements.

   b. Verify locksets and locking hardware are functionally correct for project requirements.

4. Deliver established keying requirements to manufacturers.

5. Furnish keys in the following quantities:

Number of Keys	Type of Key
4 each	Master keys per set
2 each	Change keys each keyed core
6 each	Construction master keys
2 each	Control keys

1.4 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirement of Section 01 33 00 – Submittal Procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).

2. Provide complete description for each door listed.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. All door hardware to be made of stainless steel or aluminum unless noted otherwise.

C. Provide individual items of single type, of same model, and by same manufacturer.

D. Provide door hardware products that comply with the following requirements:

1. Applicable provisions of federal, state, and local codes.

2. Accessibility: ADA Standards and ICC A117.1.

3.

2.2 HINGES

A. Hinges: Comply with BHMA A156.1, Grade 1.

1. Provide hinges on every swinging door.

2. All hinges and pivots shall be of stainless steel unless otherwise specified.

3. Provide ball-bearing hinges at each door with closer.

4. Provide non-removable pins on exterior outswinging doors.

5. Provide following quantity of butt hinges for each door:

a. Doors up to 60 inches High: Two hinges.

b. Doors From 60 inches High up to 90 inches High: Three hinges.

c. Doors 90 inches High up to 120 inches High: Four hinges.

2.3 FLUSH BOLTS

A. Flush Bolts: Comply with BHMA A156.16, Grade 1.

1. Flush Bolt Throw: 3/4 inch, minimum.

2. All flush bolts shall be of stainless steel unless otherwise specified.

3. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.

a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.

4. Manual Flush Bolts: Provide lever extensions for top bolt at over-sized doors.

2.4 LOCK CYLINDERS

A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.

1. Provide cylinders from same manufacturer as locking device.

2. Provide cams and/or tailpieces as required for locking devices.

3. Permanent core face must be the same finish as the lockset finish.

4. Provide locksets with Best 7-pin interchangeable core.

2.5 CYLINDRICAL LOCKS

A. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 2, 4000 Series.

1. Bored Hole: 2-1/8 inch diameter.

2. Latchbolt Throw: 1/2 inch, minimum.

3. Material: Stainless steel unless otherwise indicated.

4. Backset: 2-3/4 inch unless otherwise indicated.

5. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.

a. Finish: To match lock or latch.

6. Provide a lock for each door, unless otherwise indicated that lock is not required.

2.6 TRIM:

A. Provide Stainless Steel lever handle trim on outside of each lock, unless otherwise indicated.

B. Keyed handle to be protected by means of a “Break-Away” mechanism to prevent forced entry.

2.7 CLOSERS

A. Closers: Comply with BHMA A156.4, Grade 1.

1. Type: Surface mounted to door.

2. Provide door closer on each fire-rated and smoke-rated door.

a. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

3. At out swinging exterior doors, mount closer on interior side of door.

2.8 PROTECTION PLATES

A. Protection Plates: Comply with BHMA A156.6.

B. Metal Properties: Stainless Steel.

1. Metal, Standard Duty: Thickness 0.05 inch, minimum.

C. Edges: Beveled, on four sides unless otherwise indicated.

D. Fasteners: Countersunk screw fasteners.

2.9 ARMOR PLATES

A. Armor Plates: Provide on bottom half of push side of doors that require protection from objects moving through openings that may damage door surface.

1. Size: 16 inch high by 1-1/2 inch less door width (LDW) on pull side and 2 inch LDW on push side of door.

2. Armor Plates shall be stainless steel unless otherwise noted.

2.10 KICK PLATES

A. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.

1. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.

2. All kick plates shall be of stainless steel unless otherwise specified.

2.11 FLOOR STOPS

A. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.

1. Type: Manual hold-open, with pencil floor stop.

2. Material: Aluminum housing with rubber insert.

2.12 WALL STOPS

A. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.

1. Type: Bumper, concave, wall stop.

2. Material: Aluminum housing with rubber insert.

2.13 THRESHOLDS

A. Thresholds: Comply with BHMA A156.21.

1. Provide threshold at each exterior door, unless otherwise indicated.

2. Type: Flat surface.

3. Material: Aluminum.

4. Threshold Surface: Fluted horizontal grooves across full width.

5. Field cut threshold to profile of frame and width of door sill for tight fit.

6. Provide non-corroding fasteners at exterior locations.

2.14 WEATHERSTRIPPING AND GASKETING

A. Weatherstripping and Gasketing: Comply with BHMA A156.22.

1. Head and Jamb Type: Adjustable.

2. Door Sweep Type: Encased in retainer.

3. Material: Aluminum, with neoprene weatherstripping.

4. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated; .

5. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.15 SILENCERS

A. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.

1. Single Door: Provide three on strike jamb of frame.

2. Material: Rubber, gray color.

3. Silencers NOT required on doors with weather seals.

2.16 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.

1. Primary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.

2. Secondary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.

   a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.

PART 3 - EXECUTION

3.1 HARDWARE SCHEDULED

A. The hardware schedule is arranged for convenience of locating hardware and does not preclude in any way the requirements that all necessary hardware shall be furnished and properly installed. Hardware not specifically called out shall be similar to that required for similar uses.

1. Hardware Set 1: Each single, exterior door shall have:

Quantity	Description
Per spec	Hinges
1	Lever Lockset Trim at Entrance
1	Interior panic bar
1 set	Surface closer
1	Seals & Wall Stop (provide both),
1	Door Threshold
1 pair	Kick plates
1	Door bottom
1	Drip, head

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

C. Use templates provided by hardware item manufacturer.

D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.

E. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.3 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.4 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

3.5 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION 08 71 00

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work includes furnishing and installing fixed and operable louvers at the location and size shown on the drawings.

1.2 REQUIREMENTS

A. Structural Performance: Provide exterior metal louvers capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. acting inward or outward.

B. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units 48 inches wide by 48 inches high. Test units according to AMCA 500.

1. Perform testing on unpainted, cleaned, degreased units.

2. Perform water-penetration testing on louvers without screens.

C. Weather Louver Effectiveness: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer’s stock units for a 60 minute test in accordance with AMCA Standard 500-L-99, Wind Driven Rain Water Penetration Test.

1.3 SUBMITTALS

A. Product Data: For each type of product specified.

B. Shop Drawings: For louver units and accessories. Include plans; elevations; sections; and details showing profiles, angles, and spacing of louver blades. Show unit dimensions related to wall openings and construction; free area for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

1. For installed louvers and vents indicated to comply with design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Wiring Diagrams: Detail power, signal, and control systems for motorized adjustable louvers and differentiate between manufacturer-installed and field-installed wiring.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209 alloy 3003 or 5005 with temper as required for forming.

C. Aluminum Castings: ASTM B 26/B alloy 319.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated.

E. Anchors and Inserts: Stainless steel.

F. Provide stainless steel where shown.

2.2 MOTOR OPERATED LOUVERS

A. Louver Construction and Operation: Provide combination dual blade adjustable louvers with extruded-aluminum frames and blades, and with operating mechanisms to suit louver sizes.

B. Motor operation, with two-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor; and limit switch wired for grounding; equipped as follows:

1. Toggle switch mounted on louver frame, ready for wiring

2. Loose toggle switch and indicator light, ready for installation

3. Terminals for controlling devices

C. Dual-Blade, Drainable, and Adjustable Louvers: Fixed drainable blades and adjustable blades combined in single frame.

1. Louver Depth: 6 inches

2. Frame Thickness: 0.125 inch

3. Fixed-Blade Thickness: 0.081 inch

4. Adjustable-Blade Thickness: 0.081 inch.

5. Blade Angle: 37.5 or 45 degrees.

6. Performance Requirements: As follows:

a. Maximum Standard Airflow: Not less than 6850 cfm with not more than 0.15 inch wg static pressure loss.

b. Air Leakage: Not more than 1.5 cfm per sq. ft. of louver gross area at a differential static pressure of 0.15 inch wg with adjustable louver blades closed.

c. Minimum percent free area of louver: 35

2.3 SCREENS

A. General: Provide each exterior louver with louver screens complying with the following requirements:

1. Screen Location for Fixed Louvers: Interior face

2. Screen Location for Adjustable Louvers: Exterior face

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes and to comply with the following requirements:

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.

a. Reinforce extruded-aluminum screen frames at corners with clips.

2. Finish: Same finish as louver frames to which louver screens are attached.

3. Type: Non-rewirable, U-shaped frames for permanently securing screen mesh.

4. Louver Screening for Aluminum Louvers: Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2.4 FINISH

A. All louvers shall be finished with a full strength Kynar 500 fluoro-coating. Color to be selected by the Engineer/Owner from Manufacturer's standard color chart. All steel shall be thoroughly cleaned, etched and given a chromate conversion pretreatment before the application of an epoxy baked-on prime coat. The subsequent top finish color coating shall have a minimum baking cycle of 450º F for 20 minutes and shall be no less than 0.8 mils thick. All finishing procedures shall be one continuous operation and take place in the plant of the manufacturer. There shall be no checking, peeling, or caulking.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, to provide weather-tight louver joints. Use proper sealants during louver installation.

END OF SECTION 08 91 00

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Install all non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).

2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.2 REFERENCE STANDARDS

A. ASTM E 119

B. ASTM E 90

C. ASTM E 413

D. ASTM C 754

E. ASTM C 645

1.3 SUBMITTALS

A. Submit manufacturer information in accordance with Section 01 3 00 – Submittal Procedures.

1.4 QUALITY ASSURANCE

A. Fire- Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non- load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. Sound Transmission Characteristics: For STC-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 GENERAL

A. General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

2. Protective Coating: manufacturer's standard corrosion-resistant zinc coating, unless

2.2 SUSPENSION SYSTEM COMPONENTS

A. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

B. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: As indicated on Drawings.

C. Furring Channels (Furring Members):

1. Steel Studs: ASTM C 645.

a. Minimum Base-Metal Thickness: As indicated on Drawings.

b. Depth: As indicated on Drawings.

D. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.

b. Chicago Metallic Corporation; Drywall Furring System.

c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: As indicated on Drawings.

B. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: As indicated on Drawings.

C. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: As indicated on Drawings.

2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mill), 0.068-inch-(1.73- mm-) thick, galvanized steel.

D. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mill), wall attachment flange of 7/8 inch (22.2 mill), minimum bare-metal thickness of 0.0179 inch (0.45 mill), and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

A. Isolation Strip at Exterior Walls: Provide one of the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mill) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

3.2 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.

2. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

END OF SECTION 09 22 16

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SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install gypsum drywall ceilings and walls over framing as shown on the Drawings and as specified herein.

1.2 REFERENCE STANDARDS

A. QQ-W-461H Wire, Steel, Carbon {Round, Bare, and Coated}

B. ANSI A108.11 –Specifications for Interior Installation of Cementitious Backer Units

C. ASTM A118.9 – Specifications for Test Methods and Specifications for Cementitious Backer Units

D. ASTM B211 – Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire

E. ASTM C475 – Specification for Joint Compound and Joint Tape for Finishing Gypsum Board

F. ASTM C514 – Specification for Nails for the Application of Gypsum Board

G. ASTM C645 – Specification for Nonstructural Steel Framing Members

H. ASTM C754 – Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

I. ASTM C840 – Specification for Application and Finishing of Gypsum Board

J. ASTM C919 – Standard Practice for Use of Sealants in Acoustical Applications

K. ASTM C1002 – Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

L. ASTM C1047 – Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

M. ASTM C1177 – Specification for Glass Mat Gypsum Substrate for Use as Sheathing

N. ASTM C1178 – Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel

O. ASTM C1280 – Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing

P. ASTM C1325 – Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units

Q. ASTM C1396 X – Specification for Gypsum Board

R. ASTM C1629 – Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels

S. ASTM D226 – Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

T. ASTM D3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in and Environmental Chamber

U. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials

V. GA-214 – Recommended Levels of Gypsum Board Finish

W. GA-216 – Application and Finishing of Gypsum Board

X. GA-253 – Application of Gypsum Sheathing

Y. GA-600 – Fire Resistance and Sound Control Design Manual

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirement of Section 01 33 00 – Submittal Procedures.

B. Product Data: Provide data on gypsum board indicating material composition, thickness, sizes, and fire resistance. Provide data on glass mat faced gypsum board, accessories, joint finishing system, and acoustical sound isolation clips.

1. Indicate profiles and products for wall and ceiling trim accessories

C. Shop Drawings: Indicate fastener and adhesive patterns for FM wind uplift resistance. Indicate special details associated with acoustic sound isolation clips.

D. Certification: Submit manufacturer’s written certification that produce meets specified fire resistance requirements.

E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five-years of experience.

PART 2 - PRODUCTS

2.1 GENERAL

A. Labeling: All materials shall be delivered to the project site with manufacturer's labels intact and legible. Fire-rated materials shall bear testing agency labels and required fire classification numbers.

B. Assemblies:

1. Provide completed assemblies complying with ASTM C840 and GA-216.

2.2 GYPSUM CEILING PANELS

A. Composition: Provide non-structural, glass mat faced, silicone-treated gypsum core panel. Each panel shall have nominal size of 4 feet by 8 feet dimensions and shall have a minimum 5/8-inch thickness and Type X.

1. Lightweight gypsum wallboard is not allowed.

B. Fire Resistance: Provide gypsum roof panels with Flamespread “0”, smoke developed “0”, when tested in accordance with ASTM E84. Panels shall be non-combustible when tested in accordance with ASTM E136.

1. Firestop Type X: Provide UL Classified Type X when tested in accordance with ASTM E119 where specified.

C. Contact adhesives with hydrocarbon-based solvents require extended open time for solvent vapor evaporation when used with expanded and extruded polystyrene and when adhered to gypsum panels.

D. Mold resistance: score of 10, when tested in accordance with ASTM D3273.

1. Moisture-resistant board is required whenever board is being installed before the building is enclosed and conditioned.

2.3 GYPSUM BOARDS

A. Gypsum Board: Gypsum board shall conform to ASTM C 1396. Unless otherwise specified or shown on Drawings, gypsum board shall be 5/8" type "X" or fireguard board with tapered edges.

B. Gypsum board shall be Georgia Pacific Moisture Resistant DensArmor Plus Fireguard High Performance Interior Panel or equal where indicated in the plans.

C. Where shown on Drawings, water-resistant gypsum board shall conform to ASTM C1396, regular, type “X”.

D. Manufacturers or Equal

1. Flintkote Co.

2. Laticrete International

3. National Gypsum Co.

4. United States Gypsum Corporation

5. G-P Gypsum

6. American Gypsum Co.

7. Or Engineer approved equal.

2.4 ACCESSORIES

A. Metal trim, corner beads, edge, casing beads, and accessories shall be manufactured from galvanized sheet steel unless otherwise specified or shown and shall be manufacturer's standard products. Special shapes shall be provided where specified or shown.

B. Tape and Compound: Provide materials complying with ASTM C475, ASTM C840, and recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.

1. Joint Tape: Paper reinforcing tape, unless otherwise indicated. Use pressure sensitive or staple-attached open-weave glass fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated

2. Drying-Tape Joint Compounds: Factory-prepackaged vinyl-based products complying with the following requirements for formulation and intended use. Use all-purposed compound formulated for use as both taping and topping compound

C. Fasteners: Nails shall conform to ASTM C514, and shall be of the length recommended by the Gypsum Association referenced standards and the Building Code for various gypsum board thickness. Nails for nailing tile backing board to wood studs shall be 1-1/4-inch galvanized roofing nails unless otherwise required by code, and board manufacturer. Screws shall be self-drilling, self-tapping, bugle head for use with power tools, Length as recommended by Gypsum Association referenced standards and the building code.

1. Type "5" for wallboard to sheet metal application

2. Type "W" for wallboard to wood application

3. Type "8" for wallboard to wallboard application

D. Adhesives: Adhesives for fastening gypsum board to gypsum board shall be in accordance with the printed recommendations of the gypsum board manufacturer.

E. Waterproof Membrane: Waterproof membrane shall be asphaltic saturated 43-pound (vapor-retarder) membrane conforming to ASTM D2626 Type 1, 25 pounds per 100 square foot minimum or 10-mil polyethylene film membrane.

F. Corner Bead and Edge Trim: Metal trim, comer beads, edge, casing beads, and accessories shall be manufactured from galvanized sheet steel unless otherwise specified or shown and shall be manufacturer's standard products. Special shapes shall be provided where specified or shown.

G. Metal Support Materials: Furring channels shall be ASTM C645, 25-gauge Hat shaped channels.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify that project conditions are appropriate for work of this section to commence. Start of wall and ceiling system Work will indicate acceptance of surfaces and conditions within each area.

B. Comply with ASTM C840, GA-216, and manufacturer’s instructions. Install to minimize butt end joints, especially in highly visible locations.

C. Provide gypsum panels on drawings using fastening system specified.

D. Use maximum lengths possible to minimize number and joints. Locate edge joints parallel to and located on deck ribs. Stagger end joints of adjacent lengths panel.

E. Gypsum wallboard shall be applied first to ceiling and then to walls. Wall application shall be horizontal (right angles to framing), or vertical (parallel to framing), conforming to reference standards.

F. All gypsum board shall be nail or screw fastened to metal framing and furring. Fastener spacing shall be per reference standards.

G. Gypsum wallboard surface finish shall be three-coat work. Multi-layer application shall be reference standards and manufacturer's recommendations.

H. Installation of steel framing shall be in accordance with ASTM C754 and code.

3.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to the job site in manufacturer’s original packaging, containers and bundles with manufacturer’s brand name and identification intact and legible.

B. Storage and handling: Storage and handle materials to protect against contact with damp and wet surfaces, exposure to weather, breakage and damage to edges. Provide air circulation under covering and around stacks of materials.

3.3 INSPECTION

A. Check framing for accurate spacing and alignment. Verify that spacing of installed framing does not exceed maximum allowable for thickness of wallboard to be used. Do not proceed with installation until deficiencies have been corrected.

3.4 COORDINATION

A. Coordinate with mechanical and electrical sections for the installation of their work in drywall construction.

3.5 CEILING INSTALLATION

A. Place boards with long dimension at right angles to supports and end joints occurring over supports. Perimeters of ceilings and edges of openings shall be placed over solid members.

3.6 FASTENERS

A. Place fasteners not less than 3/8-inch from edges of boards except when using washers or clips with fasteners in joint. Install when using washers or clips with fasteners in joint. Install fasteners with heads dimpled slightly below surface but not so deep as to cut through paper. Use approved type power tools for self-drilling screws. Obtain final set by turning screw down, not by driving. Space fasteners along all abutting edges and ends occurring over supports and in field at 12 inches on center. Stagger fasteners along common joints.

3.7 TRIM

A. Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

B. Install corner beads at external corners.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where "U" bead (semi-finishing type) is indicated.

1. Install "LC" bead where drywall construction is tightly abutted to other construction and back flange can be attached to framing or supporting substrate.

2. Install "LK" bead where substrate is kerfed to receive long flange of trim.

3. Install "L" bead where edge where edge trim can only be installed after gypsum board is installed

4. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

3.8 FINISHING OF DRYWALL

A. Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.

B. Prefill open joints and rounded or beveled edges, if any, using setting-type joint compound.

C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

D. Finish interior gypsum wallboard by applying the following joint compounds in 3 coats (not including prefill of openings in base), and sand between coats and after last coat.

E. Unless otherwise specified, all gypsum board shall be sanded smooth, dusted, and provided with an orange peel finish coat. Gypsum board at non-visible locations, such as within attics, shall be finished as required for fire protection.

3.9 RECESSED LIGHT FIXTURES

A. Light fixtures, speakers, and other recessed items in rated ceilings shall be provided with gypsum board enclosure as required for rated ceiling system.

END OF SECTION 09 29 00

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SECTION 09 90 00 – PAINTING AND COATING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials and equipment as required for all painting and coatings as specified herein. All materials, equipment, piping and miscellaneous surfaces shall be coated except for those indicated under Part 1.7. Work includes but is not to be limited to cleaning and preparation of surfaces, paint materials, and the application of all paint and other materials. Provide third party inspection of surface preparation, application and testing of coating and painting during application.

B. Provide coatings for pipe identification as specified in Section 40 05 97 – Piping Identification.

C. Any painting or coating in contact with potable drinking water, or water that will become potable drinking water, shall be NSF61 Certified.

1.2 DEFINITIONS

A. The term paint, coatings, or finishes as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

B. Dry Film Thickness (DFT): The minimum dry film thickness, without any negative tolerance.

C. Submerged Metal: Steel or iron surfaces below tops of channel or structure walls which will contain water even when above expected water level.

D. Submerged Concrete and Masonry Surfaces: Surfaces which are or will be:

1. Underwater.

2. Inside structures which normally contain water.

3. Below tops of walls of water containing structures.

E. Exposed Surface: Any metal or concrete surface, indoors or outdoors that is exposed to view.

F. Volatile Organic Compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon, as determined by EPA Method 24.

G. Ferrous: Cast iron, ductile iron, wrought iron, and all steel alloys except stainless steel.

H. Where SSPC surface preparation standards are specified or implied for ductile iron pipe or fittings, the equivalent NAPF surface preparation standard shall be substituted for the SSPC standard.

1.3 REFERENCE STANDARDS

A. Codes and Standards: In addition to the requirements of these Specifications, the work to be performed under this Section is to comply with the following codes and regulations:

1. The Society of Protective Coatings Specifications (SSPC):

a.	SSPC SP-1	Solvent Cleaning.
b.	SSPC SP-2	Hand Tool Cleaning.
c.	SSPC SP-3	Power Tool Cleaning.
d.	SSPC SP-5	White Metal Blast Cleaning.
e.	SSPC SP-6	Commercial Blast Cleaning.
f.	SSPC SP-7	Brush-Off Blast Cleaning.
g.	SSPC SP-10	Near-White Blast Cleaning.
h.	SSPC SP-11	Power Tool Cleaning to Bare Metal.
i.	SSPC-SP-12	High- and Ultrahigh-pressure Water Jetting.
j.	SSPC-SP-13	Surface Preparation of Concrete
k.	SSPC-SP-16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

2. Underwriters' Laboratory (UL):

a.	UL 3P83	Drinking Water System Components - Health Effects.

3. National Association of Corrosion Engineers Standards (NACE):

a.	RP0188-06	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

4. Applicable Standards of American National Standards Institute, Inc. (ANSI)

5. National Association of Pipe Fabricators (NAPF):

a.	NAPF 500-03	Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.

6. American Society for Testing and Materials (ASTM):

a.	ASTM D4262	Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
b.	ASTM D4263	Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
c.	ASTM D4285	Test Method for Indicating Oil or Water in Compressed Air.
d.	ASTM D4541	Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.

1.4 QUALITY ASSURANCE

A. Pre-Application Conference: Prior to commencement of any paint application, the Engineer will hold an on-site pre-application meeting. The purpose of meeting is to establish a working understanding between all parties and to discuss items that pertain directly to the paint application.

B. Painter's Qualifications: The work specified under this Section shall be performed by or under the supervision of a qualified painter. The Contractor shall be required to document the painter's experience, competence and ability to comply with the requirements of these Specifications and to complete the work in a timely manner. The Painter or Applicator shall have the following qualifications:

1. Minimum of 5 years of experience applying specified type or types of coatings under conditions similar to those of the Work. Provide qualifications of applicator and references listing five similar projects completed in the past two years.

2. Manufacturer approved applicator when manufacturer has approved applicator program.

C. Coatings Inspection: Surface preparation, mixing, thinning, coating application, and measurement of dry film thicknesses shall be performed by a NACE Certified Coatings Inspector. Each requirement of this specification shall be met and approved by the Inspector prior to moving on to the next step in the progression of the coating’s specification.

D. Standard Products: All paints in a paint system are to be the standard products. All products applied in any paint and coating system shall be from a single manufacturer.

E. The NACE Inspector must approve all surface preparation prior to the application of coatings. This will include surface cleanliness, the degree of sandblast and surface profiles.

F. At a minimum of every four hours or more often when conditions change during surface preparation and coatings application, environmental conditions IE: Relative Humidity, dew-point, surface temperature and the dew-point/surface temperature depression must be measured and recorded. The use of a sling psychrometer and US weather bureau barometric chart or approved equal such as Defelsko or Elcometer test instruments shall be used to measure the environmental conditions.

G. Warranty Inspection: A warranty inspection will be conducted at the end of the one-year warranty period from the substantial completion date. The Contractor and a representative of the coating material manufacturer may attend this inspection. All defective work shall be repaired in accordance with these specifications and to the satisfaction of the Owner. The Owner may, by written notice to the Contractor, reschedule the warranty inspection to another date within the warranty period.

H. Quality Assurance Responsibility: The Contractor is responsible to obtain and pay for the services of the NACE inspector referred to above.

1.5 SUBMITTALS

A. Before any paint materials are delivered to the job site, submit a complete list of all materials proposed to be furnished and applied under this Section. Include schedule of where and for what use coating materials are proposed in accordance with requirements for Product Data. Any coating or paint materials ordered by Contractor prior to receiving submittal response from Engineer indicating that the submitted material is accepted shall be at the risk of the Contractor.

B. For each paint, furnish the paint manufacturer's specific application instructions and the following information:

1. Paint manufacturer’s data sheet for each product proposed, including statements on the suitability of the materials for the intended use.

2. Surface preparation recommendations

3. Type of primer, if required

4. Maximum dry and wet mil thickness per coat

5. Minimum and maximum curing time between coats, including atmospheric conditions for each

6. Curing time before submergence in water

7. Thinner to be used with each paint

8. General ventilation requirements

9. Atmospheric conditions during which the paint is <u>not</u> to be applied

10. Allowable methods of application

11. Maximum allowable moisture content and minimum age of plaster, concrete and wood surfaces at time of paint application

12. Compatibility of shop and field applied coatings (where applicable)

C. Reports: Submit the following to the Engineer:

1. Reports on visits to project site to view and approve surface preparation of structures to be coated.

2. Reports on visits to project site to observe and approve coating application procedures.

3. Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are “shop coated.”

1.6 DELIVERY AND STORAGE

A. Deliver, store, and handle products in accordance with manufacturer’s requirements. All materials are to be delivered to the job site in their original, unopened containers bearing the manufacturer's name, brand, batch number, date of manufacture, and any special directions.

B. Only the approved material shall be stored at the job site and stored only in designated areas restricted to the storage of paint materials and related equipment. All paint is to be stored in enclosed structures and protected from weather and excessive heat or cold. Store coatings in well-ventilated facility that provides protection from the sun, weather, and fire hazards. Maintain ambient storage temperature between 45- and 90-degrees Fahrenheit, unless otherwise recommended by the manufacturer.

C. Store flammable materials to conform with State and local safety codes. Protect emulsion type paints from freezing. Take precautions to prevent fire and spontaneous combustion.

D. Materials exceeding storage life recommended by the manufacturer will be subject to rejection.

E. Remove unspecified and unapproved paints from Project site immediately

1.7 SURFACES NOT REQUIRING PAINTING

A. Nonferrous and corrosion-resistant ferrous alloys such as copper, bronze, aluminum, chromium plate, and weathering steel, except where (1) required for electrical insulation between dissimilar metals, (2) aluminum is in contact with concrete or masonry, and (3) color coding of equipment and piping is required.

B. Copper, bronze, aluminum, weathering steel, and stainless steel,

C. Glass, porcelain, and plastics do not require painting.

D. Prefinished architectural finishes such as acoustical tile, cabinets, and wall panels do not require painting.

E. Prefinished electrical items such as motor control centers, switchboards, switchgear, panelboards, transformers, and disconnect switches do not require painting.

F. Exposed electrical conduits shall be painted to match the color of the adjacent wall or equipment to which they are attached, except that non-submerged conduits attached to unpainted masonry and concrete surfaces need not be painted.

G. Exterior concrete slabs, exterior sidewalks, exterior concrete stairs and exterior concrete curbs.

H. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.

1.8 MAINTENANCE

A. Extra Materials: Include minimum 1 gallon of each type and color of coating applied. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type and color.

PART 2 - PRODUCTS

2.1 PAINT AND COATING SYSTEM APPLICATIONS

A. Prepare surfaces and apply paint and coating systems in accordance with the following schedules for all surfaces.

Surface Preparation	Description
SSPC SP-1	Solvent Cleaning
SSPC SP-2	Hand Tool Cleaning
SSPC SP-3	Power Tool Cleaning
SSPC SP-5	White Metal Blast Cleaning
SSPC SP-6	Commercial Blast Cleaning
SSPC SP-7	Brush off Blast Cleaning
SSPC SP-10	Near White Blast Cleaning
SSPC SP-11	Power Tool Cleaning to Bare Metal
SSPC SP-12	High- and Ultrahigh-Pressure Water Jetting
SSPC SP-13	Surface Preparation of Concrete

SSPC SP-16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
C-1	Abrasive blast clean in accordance with ASTM D4259 and fill all holes and imperfections with Sika Mono Top 615.

Paint and Coating Application Schedule		
Surface to be Painted or Coated	Surface Preparation	Paint System
Ferrous Metal	SSPC – SP-1	System 1
Ferrous Metal (galvanized)	SSPC – SP-1	System 2
Ferrous Metal, Submerged or Buried (Not in Contact with Potable Water)	SSPC – SP-5	System 3
Concrete Block (CMU), Exterior Surfaces, all buildings	Manufacturer's Inst.	System 4
Gypsum Wall Board	Manufacturer's Inst.	System 11
Concrete Floors	SSPC SP-13, ICRI 310.2R, CSP 2-3 or Manufacturer's Inst.	System 18

B. Coatings for Structure C4 are indicated on the Drawings.

2.2 PAINT AND COATING SYSTEMS

A. Furnish primers and finish coatings as shown on the following coating table schedule. If manufacturers have changed their coating products and the products shown below are no longer available, provide the product that the manufacturer recommends as the improved version of the product shown.

B. Where dry film thicknesses are not shown, the DFT shall be as recommended by the manufacturer for the product and service shown in the Application Schedules above.

C. Paint and Coating Systems:

System	Ameron Coatings	ICI Devoe Coatings	Sherwin Williams
1	Amercoat 235 Primer Amershiled Finish 2 coats, 3.0 mils each	Devguard 4160 primer Devguard 4308 finish (4550) finish 2 coats, 3.0 mils each	Kem Bond HS Primer / Urethane Alkyd Enamel
2	SHER-CRYL HPA 2 coats, 3-4 mils each	Same as System 1 but for Devoe Coatings but use Devguard 4120 primer	Same as System 1 but pre-treat galvanizing
3	SHER-GLASS FF 2 coats, 8-10 mils each	Catha-Coat 302H primer Devtar 5A finish 8.0 mils	Targuard Epoxy
11	PrepRite ProBlock 1-1.5 mils Pro Industrial 2.5-4 mils	DevFlex 4020 primer Devflex 4208QD finish	Preprite 200 Latex Primer / Urethane Alkyd Enamel
18	General Polymers 3579 General Polymers 3746 General Polymers 3746	Preprime 167/Devran 124	Or Equal Product

	BASF	Chemical Products, Inc	Sherwin Williams	Prosoco
4	White Roc W	Siloxane CP 200W	1K Siloxane	Block Guard and Graffiti Control I

2.3 OTHER COATINGS

A. Factory Applied Coatings and Touchup: Field touchup shall consist of touching up the shop prime coat to achieve the film thickness, continuity and coating specified in accordance with the paint system data sheets. Badly damaged shop coatings shall be removed and the surfaces recoated in accordance with the specified system requirements.

B. Aluminum Metal Insulation: Where aluminum surfaces come in contact with concrete or with metals not compatible with aluminum, paint the dissimilar materials with a prime coat of zinc-chromate primer or a coating of heavy-bodied bituminous paint.

C. Painting and Identification of Piping: All exposed new piping is to be painted and identified in accordance with Section 40 05 97 – Piping Identification.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Prepare all surfaces prior to application of paint or coatings. Comply with surface preparation requirements of the Society for Protective Coatings (SSPC). If the paint or coating manufacturer recommends a surface preparation different than that shown, follow the more stringent surface preparation requirement.

B. ASTM D4259 – Wet Abrasive Blasting, Vacuum Assisted Dry Abrasive Blasting or Centrifugal Shot Abrasive Blasting

1. Shot Blasting – Before blasting fill defects and holes with filler recommended by the coating manufacturer. Blast with dustless steel shot to remove laitance, residue and loose material to roughen the surface to a texture of No. 40 to 60 grit sandpaper.

C. Surface preparation requirements of the Society for Protective Coatings (SSPC) are as follows:

1. SSPC – SP-1 – Solvent Cleaning

2. SSPC – SP-2 – Hand Tool Cleaning

3. SSPC – SP-3 – Power Tool Cleaning

4. SSPC – SP-5 – White Metal Blast Cleaning

5. SSPC – SP-6 – Commercial Blast Cleaning

6. SSPC – SP-13 – Mechanical or Chemical Cleaning

D. Preparation of Concrete and Masonry Surfaces: Unless otherwise specified, concrete surfaces which are to receive any paint coating shall be allowed to age for a minimum of 28 days. Moisture content shall be tested with a Delmhorst Instrument Company moisture detector prior to application of paint or coating. The moisture content of the concrete shall be within the limits recommended by the manufacturer of the paint or coating before any paint or coating is applied.

3.2 APPLICATION

A. Workmanship: All work shall be done in a workmanlike manner so that the finished surface will be free from runs, drips, ridges, waves, laps and unnecessary brush marks. All coats shall be applied in such a manner as to produce an even film of uniform thickness, completely coating all corners and crevices.

B. The Contractor's coating and painting equipment shall be designed for application of materials specified and shall be maintained in a first-class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Spray equipment shall be equipped with mechanical agitators, pressure gauges, and pressure regulators. Spray nozzles shall be of the proper sizes.

C. Each coat of paint shall be applied evenly and sharply cut to line. Care shall be exercised to avoid overspraying or spattering paint on surfaces not to be coated. Glass, hardware, floors, roofs and other adjacent areas and installation shall be protected by taping, drop cloths or other suitable measures.

D. Paint Properties, Mixing and Thinning. All paint, when applied, shall provide a satisfactory film and smooth, even surface. Glossy undercoats shall be lightly sanded to provide a surface suitable for the proper application, adhesion and subsequent coats. Paints shall be thoroughly stirred, strained and kept at a uniform consistency during application. Coatings consisting of two (2) or more components shall be mixed in accordance with manufacturer's instructions. Where necessary to suit conditions of the surface, temperature, weather and method of application, and with the Engineer's approval, the paint may be thinned immediately prior to use by the addition of not more than one pint per gallon of the proper thinner; provided that in no case shall the paint be reduced more than necessary to obtain the proper application characteristics. Where specifically permitted by the Specifications, certain paints may be thinned more than the maximum indicated above. Paint thinner shall be as recommended by the paint manufacturer.

E. Atmospheric Conditions: Except as specified or required for certain water-thinned paints, paints shall be applied only to surfaces that are thoroughly dry and only under such combination of humidity and temperatures of the atmosphere and surfaces to be painted as will cause evaporation rather than condensation.

1. In no case shall any paint be applied during rainy, misty weather, or to surfaces upon which there is frost or moisture condensation without suitable protection, as accepted by the Engineer. Where painting is permitted during damp weather or when the temperature is at or below 40 degrees F, the surfaces shall be heated to prevent moisture condensation thereof.

2. Bar metal surfaces, except those which may be warped by heat, may be dehydrated by flame-heating devices immediately prior to paint application.

3. While any painting is being done and for a period of at least eight (8) hours after the paint has been applied, the temperature of the surfaces to be painted, the painted surfaces and the atmosphere in contact therewith shall be maintained at or above 40 degrees F and 5 degrees above the dew point.

4. All paint, when applied, shall be approximately the same temperature as that of the surface on which it is applied. The use of fans or heaters shall be required in enclosed areas where conditions causing condensation are severe.

F. Method of Paint Application: Where two (2) or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors. Color additives shall not contain lead or any lead compound which may be destroyed or affected by hydrogen sulfide or any gas likely to be found in wastewater treatment plants.

G. Electrical and mechanical equipment, on which the manufacturer's coating is found, shall be touch-up primed and painted with two (2) coats of the specified paint system to match the color scheduled. This does not apply to electrical and instrumental equipment otherwise specified in Division 26.

H. No paint shall be applied to any surface until it has been prepared as specified and approved by the Engineer. Unless otherwise specified, the primer or first coat of paint shall be applied by brush to ferrous surfaces. All subsequent coats for all ferrous surfaces may be either brush or spray applied. Unless stated otherwise, prime and finish coats shall be applied at the rate recommended by the manufacturer for the services involved. After prime coat is dry, all suction spots shall be touched up before succeeding coats are sprayed. All coats for concrete and masonry shall be brushed or rolled unless otherwise specified. Before painting or repainting existing surfaces, the Contractor shall test-paint a small area on the actual surface to show that the color matches the existing surfaces.

I. Unless otherwise specified, do not apply finish coats until all other work in the area is done and until the prime and intermediate coats have been inspected by the Engineer.

J. Film Thickness and Continuity: The actual surface area covered per gallon of oil and varnish vehicle paint for various types of surfaces shall not exceed those recommended by the manufacturer. All paint and coating thickness stated in this specification are dry film thickness. The first coat on metal surfaces refers to the first full paint coat and not to conditioning or other pretreatment applications. All coatings shall be applied to the thickness in accordance with these Specifications. The minimum thickness at any point shall not deviate more than 25 percent from the required average. Except as specified, no less than two (2) coats shall be applied.

K. Special Requirements: Hangers shall be painted, except for the final coat, prior to installation. Paint underside of all ungalvanized equipment bases and supports with at least two (2) coats of rust inhibiting primer prior to setting the equipment in place. Paint bolt and bolt holes in flanges, such as those used with couplings or wager type valves, where hold and bolt as finally installed will be exposed to weather or moisture, prior to assembly to prevent rusting of the unprotected metal.

3.3 FIELD INSPECTION AND TESTING

A. Where two (2) or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors.

B. Unless otherwise specified, do not apply finish coats until all other work in the area is done and until the underlying coats have been inspected and accepted by the NACE Inspector.

C. Film Thickness: All paint and coating thickness stated in this specification are dry film thickness. The first coat on metal surfaces refers to the first full paint coat and not to conditioning or other pretreatment applications. All coatings shall be applied to the thickness in accordance with these Specifications and the Manufacturer's recommendations as stated in the product data sheets. The dry film thickness of each coating application will be measured using the SSPA-2 standard. The minimum/maximum thickness requirements shall meet the perimeters outlined in this standard. Where the minimums and maximums do not meet the requirements of this standard, corrections must be made.

D. Continuity: Holiday testing will be performed in accordance with NACE RP0188. All surfaces below the waterline shall be tested.

In testing for continuity, all pinholes and holidays located shall be repainted to the required dry film thickness. All ferrous metal surfaces shall meet minimum continuity requirements outlined the NACE RP0188 standard. All holiday repairs will be re-tested following the repairs.

E. It is intended that the dry film thickness and the continuity of painted ferrous metal surfaces be subject to continual field check by the Contractor's quality control subcontractor. Dry-film thickness will be measured by an Elcometer or Mikrotest magnetic type dry-film thickness gauge. Continuity will be tested by a low voltage wet sponge transistorized device, as manufactured by Tinker-Rasor (Model M-1), or equal. The Contractor's quality control subcontractor shall use inspection devices that are in good working condition for detection of holidays and measurement of dry-film thickness. The Contractor's subcontractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of dry-film thickness gauge and certified instrumentation to test accuracy of holiday detectors. Provide safe and suitable ladders or temporary scaffolding and adequate illumination to facilitate inspection.

3.4 PROTECTION OF PAINT SURFACES

A. Where protection is provided for painted surfaces, such protection shall be preserved in place until the paint film has properly dried and the removal is authorized. Items which have been painted shall not be handled, worked on, or otherwise disturbed until the paint coat is completely dry and hard.

B. After delivery at the site of materials for permanent erection or installation, all shop-coated metalwork shall be repainted or retouched from time to time, which specified paint, whenever, in the opinion of the Engineer, it becomes necessary to maintain the integrity of the film.

3.5 CLEANUP

A. Upon completion of all painting, remove all surplus materials, protective coverings and accumulated rubbish and thoroughly clean all surfaces and repair any overspray or other paint-related damage.

END OF SECTION 09 90 00

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SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall furnish and install identification, warning and safety signs as shown on the drawings and as specified herein.

B. The Contractor shall furnish and install nameplates for buildings and rooms as specified herein.

C. The Contractor shall install a bronze plaque as specified herein.

1.2 REFERENCE STANDARDS

A. Provide 1910-OSHA code standard signs where applicable.

B. Regulatory Requirements: Provide signage in accordance with Americans with Disabilities Act as published in the Federal Register, Volume 56, No. 144, Friday, July 26, 1991.

1.3 SUBMITTALS

A. Shop Drawings: The Contractor shall provide shop drawings of all signs in accordance with the requirements of Section 01 33 00 – Submittal procedures.

B. Submit catalog cuts and schedule of proposed fastening system for each sign.

C. Shop Drawing shall consist of full-size layouts of all signs and plaques. Repetitive sign layouts of typical and most restrictive conditions shall be submitted. Details of installation shall be submitted showing fasteners and mountings. Style and color of lettering shall be as selected by the Owner from the manufacturer’s standards.

PART 2 - PRODUCTS

2.1 GENERAL

A. Identification devices shall be installed where indicated by the Engineer. All wording shall be as indicated and shall be verified and approved before fabrication.

2.2 EQUIPMENT SIGNAGE

A. Lift Stations:

1. Every lift point attached to a joist shall be provided with a sign indicating the lifting capacity in pounds with the words “Lifting Capacity”.

2. Every hoist shall have a lifting capacity painted on the hoist in three-inch high letters.

B. Equipment Nametags

1. A stainless steel plate shall be attached to all equipment with lettering embossed into the plate. Lettering shall be the equipment number in the contract documents. Method of attachment shall be as recommended by the signage supplier.

2. Large equipment may have lettering stenciled directly onto the equipment, in letter size and color determined by the Engineer. Furnish the proposed wording to the Engineer for approval.

2.3 WARNING SIGNS

A. Warning Signs shall be enamel painted on semi-rigid butyrates. Signs shall conform to OSHA standards and directions. Lettering sizes shall be 3-inch in height unless indicated otherwise. Provide the following warning signs:

1. No Smoking Sign: 8" x 10" white background with red letters "NO SMOKING" on 20-gauge steel. Signs shall be located in areas which contain flammable or combustible materials – near Generator Enclosure.

2. Equipment Warning Sign: Signs shall be 10" x 12" yellow reflectorized sheeting background with non-reflectorized black screened legend. Sign shall read "CAUTION - THIS MACHINE STARTS AUTOMATICALLY". Mount sign on each side of the machine in a conspicuous place at approximately 64 inches above the floor. Provide one sign for each machine which can be started either automatically or remotely. Supply one for each well pump motor.

3. Exit Sign: Install an "EXIT" sign on the interior side of all exterior doors and interior doors that are means of egress in accordance with the building code if not supplied as an electrical exit sign.

B. Provide Chemical Building signage as specified below and per applicable 2018 IBC requirements. All signs to be plastic with clear protective polyester coating and shall be included with hardware as necessary for mounting in specified locations. Signs to be as manufactured by Emedco or equal.

1. The following signs shall be provided on all access doors to the chemical room in both Structure A and Structure B.

a. DANGER HAZARDOUS CHEMICALS

b. NFPA Hazardous material sign.

2. Provide NFPA chemical hazard label and product identification signage on each chemical tank.

3. Provide chemical identification signs at the entrance to each chemical secondary containment area. The signs shall be chemical information signs containing the information for the chemical stored and associated hazards of each area.

4. Provide a Single right-to-know information station sign for location of the Material Safety Data Sheets. Locate the sign per the Engineer's direction in the MSDS area for the chemical room in Structure A and Structure B.

PART 3 - EXECUTION

3.1 GENERAL

A. All installation of identifying devices shall be vandal-resistant. Fasteners shall be concealed, non-corrosive fasteners appropriate for materials being fastened and as required.

3.2 PREPARATION

A. Protect adjacent surfaces which may be damaged by installation of signs.

B. Prepare substrates in accordance with signs manufacturer's instructions.

C. Remove scale, dirt, grease, and other contaminates from substrates.

3.3 INSTALLATION

A. Install signs in accordance with sign manufacturer's instructions.

B. Fasten signs securely in level, plumb, and true to plane positions.

END OF SECTION 10 14 00

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SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall furnish and install all fire extinguishers and appurtenant Work, as shown on the Drawings, specified herein, and as needed for a complete and proper installation, in accordance with the requirements of the Contract Documents.

1.2 REFERENCE STANDARDS

A. Supply extinguishers that satisfy the Uniform Fire Code (UFC) as published by the Western Fire Chiefs Association Inc., the International Conference of Building Officials and the National Fire Protection Association publications (NFPA), as referenced herein.

1. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Manufacturer's Standards: In addition to the standards listed above, the fire protection products and their installation shall be in accordance with the manufacturer's published recommendations and specifications.

1.3 CONTRACTOR SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 – Submittal Procedures. Manufacturer's literature, installation instructions, and details shall be submitted.

B. Shop Drawings: Clearly indicate dimensions, capacity, anchorage, construction details and method of installation.

1.4 QUALITY ASSURANCE

A. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

B. Coordinate type and capacity of fire extinguishers with brackets to ensure fit and function.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.

b. Faulty operation of valves or release levers.

B. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. All fire prevention equipment shall be from the same manufacturer unless otherwise specified and shall meet the requirements of NFPA -Pamphlet No. 10.

2.2 EXTINGUISHER AND WALL MOUNT BRACKETS

A. Fire Extinguisher: Provide extinguisher in locations indicated on drawings. Provide 20-pound ABC fire extinguisher with minimum UL rating of 10A:120B:C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amerex Corporation.

b. Ansul Incorporated; Tyco International Ltd.

c. Badger Fire Protection; a Kidde company.

d. Buckeye Fire Equipment Company.

e. Fire End & Croker Corporation.

f. J. L. Industries, Inc.; a division of Activar Construction Products Group.

g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.

h. Larsen's Manufacturing Company.

i. Moon-American.

j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.

k. Potter Roemer LLC.

l. Pyro-Chem; Tyco Safety Products.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B

B. Schedule: Provide a fire extinguisher as indicated in the drawings.

C. Bracket: Mounting brackets shall be strap-on type, specially designed for extinguisher.

D. Other Materials: All other materials not specifically described but required for a complete and proper installation of firefighting devices shall be as selected by the Contractor subject to the review of the Engineer.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Manufactured materials shall be delivered in original unbroken packages, or containers, bearing the manufacturer's label with manufacturer's name, product description, and rating.

B. Storage: All materials shall be carefully stored in an area which is protected from deleterious elements as recommended by the material manufacturer. Storage shall be in a manner that will prevent damage to the material and its finish.

3.2 INSPECTION

A. Contractor shall thoroughly examine all substrates, areas and conditions under which installation work of this Section is to be undertaken. Contractor shall not proceed with Work until satisfactory conditions have been corrected.

B. Starting of installation work will be construed as Contractor's acceptance of substrates, surfaces and conditions within any particular area.

3.3 INSTALLATION

A. Brackets: All fire extinguishers shall be provided with and installed on brackets. The Contractor shall block and reinforce wall to support the fire extinguishers.

B. Locations: Fire extinguishers shall be mounted at between 3 and 5 feet above finished floor. Locations shall be verified with the Engineer and Fire Marshall before installation and shall be installed in locations as indicated on the Drawings and where directed per NFPA Pamphlet No.10.

C. Each fire extinguisher shall be serviced, charged and tagged not more than five calendar days prior to the Date of Substantial Completion as that date is determined by the Engineer.

END OF SECTION 10 44 16

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SECTION 22 00 00 - PLUMBING, GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, material and equipment as required for the installation of all plumbing, fixtures and related accessories.

B. Piping, apparatus and equipment are shown on the Project Plans at approximate locations only. Change locations to suit the job conditions, as directed by the Engineer, or rearranged as required for built-in fixtures or equipment. Install all parts of the system to avoid obstructions, preserve headroom (8 feet 0 inches minimum), and to keep openings and passageways clear.

C. No holes are to be made in any structural member without the Engineer's written consent. Where pipes pass through any structural member, or where notching, boring or cutting of structure if necessary, the Contractor shall proceed as directed by the Engineer.

1.2 REFERENCE STANDARDS

A. Comply with the local plumbing code.

B. All applicable code laws and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications.

1.3 SUBMITTALS

A. Submit Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.

B. Where cutting of concrete, masonry, or wood or work by other trades is required, furnish information for all openings, recess and chases for plumbing.

PART 2 - PRODUCTS

2.1 GENERAL

A. All pipes are to be properly graded, according to the applicable plumbing code, and securely supported with pipe brackets and insulating strips, to prevent transmission of noise through pipes.

B. Plumbing piping, fixtures, specialties, and equipment shall be installed as recommended by the manufacturer for the intended usage.

C. Floor sinks shall be provided for all equipment drains. No equipment drains shall discharge to floor slabs.

2.2 DOMESTIC PIPING AND FITTINGS

A. Pressurized Systems (Above-ground): All above-ground pipe and fittings shall be Type L, hard drawn copper tube with wrought copper fittings and lead free solder joints.

B. Pressurized Systems (Below-ground): Unless otherwise specified or indicated, all below ground domestic pipe and associated fittings shall be as indicated below:

1. NPS 3/4" & smaller: Type L, soft drawn copper tube with wrought copper fittings and brazing material having melting point of 1465°F.

2. NPS 1" & larger: Type K, annealed seamless copper tube, hard drawn with wrought copper fittings and brazing material having melting point of 1,465°F.

C. Waste & Vent Systems (Above-ground): Unless otherwise specified or indicated, all above ground waste and vent piping and associated fittings shall be as indicated below:

1. NPS 4" and smaller: Schedule 40 PVC, PVC socket fittings with solvent cemented joints if approved by Authority Having Jurisdiction. Otherwise cast iron pipe and fittings, and hub and spigot joints with gaskets. Cast iron pipe may be no hub joints with neoprene sleeve gaskets and stainless steel shield and fasteners at Contractor's option.

2. NPS 5" and larger: Cast iron soil pipe and fittings with gaskets and compression joints or no hub cast iron soil pipe and fittings with stainless steel couplings and joints, at Contractor's option.

D. Waste and Vent Systems (Below-ground): Unless otherwise specified or indicated, all below ground waste and vent pipe and associated fittings shall be as indicated below:

1. NPS 4" and smaller: Schedule 40 PVC, PVC socket fittings with solvent cemented joints if approved by Authority Having Jurisdiction. Otherwise cast iron pipe and fittings, hub and spigot joints with gaskets. Cast iron pipe may be no hub joints with neoprene sleeve gaskets and stainless steel shield and fasteners at Contractor's option.

E. Pipe Materials shall be as specified in respective specifications.

F. Vent piping passing through the roof shall be flashed. Flashing shall be per roofing manufacturer's requirements for metal roof systems.

G. Fittings: All fittings shall be as specified in related pipe specification sections.

2.3 FLOOR AND EQUIPMENT DRAINS

A. Provide cast iron floor drains and equipment drains where shown. No equipment drains shall discharge to floor slabs. Drains are to be manufactured by Zurn; Josam; Wade; Jay R. Smith; or equal.

B. Equipment drains are to be as shown on the Project Plans.

2.4 CLEANOUTS

A. Where underground or concealed cleanouts are to be brought to floor level or grade and to accessible locations with access covers and frames, cleanouts are to be as shown on the Project Plans.

B. Clean outs shall have a minimum diameter of 3-inches.

C. Stack cleanouts shall be installed at the base of each stack. Cleanouts shall be galvanized cast iron with ABS plastic cleanout plugs.

2.5 PROTECTIVE COATINGS

A. All ferrous metal, except finished, galvanized and machine surfaces, shall have surfaces prepared and primed in the shop in accordance with the requirements of Section 09 90 00 – Painting and Coating. Prime colors shall be compatible with finish coats to be applied in the field.

B. Self contained units such as wall-mounted hose racks shall be supplied with factory applied finish coats of baked enamel.

C. Field painting shall comply with Section 09 90 00 – Painting and Coating.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all piping, fixtures, equipment and accessories in strict accordance with the plumbing laws, rules, and regulations of the State and of the City, whichever represents the higher standard.

B. Plans do not attempt to show exact details of all piping, and no extra payment will be allowed for obstruction by work of other trades or local obstructions to the work under this contract which require offsets where diagrams have been made to show piping connection. These diagrams must not be used for obtaining material quantities. Changes in location of equipment or piping, advisable in the opinion of the Contractor, will be submitted to the Engineer for approval before proceeding with the work. Verify all measurements and dimensions at the site. Adjust all equipment and leave in a condition satisfactory to the Engineer.

C. Pipe sizes shown on the Plans are inside dimension of piping installed unless noted otherwise. Provide all piping which passes through walls, floors, or ceilings with standard weight pipe sleeves. Provide all pipes which pass through finished walls with chrome-plated canopy flanges. Pipe sleeves installed in water-holding basins are to have a 1/4-inch steel seep ring, 4 inches larger in diameter than the OD of the sleeve. Continuously weld ring to sleeve. Make joint between pipe and sleeve watertight with poured and caulked lead. Dry pack sleeves in existing work in place, and provide a finished appearance.

3.2 WORKMANSHIP AND MATERIALS

A. All work shall in strict accordance with the Uniform State Plumbing Code, and codes of the State of Idaho and Bannock County and any other authorities having jurisdiction. The Contractor shall have required certifications and be thoroughly familiar with the local codes. The Contractor shall obtain and pay for all necessary permits.

B. Care shall be taken at all times to protect floors, stairways, and walls during the make-up and erection of piping and placing of equipment. The Contractor shall remove all stains and repair all damage before final acceptance of the Work.

C. If the Engineer finds materials that have identifying marks removed or lack such marks completely, such items will be rejected until the Contractor has furnished proof that said items conform to the Specifications. Adequacy and extent of such proof will be determined by the Engineer.

3.3 OPENINGS

A. The Contractor shall provide all necessary openings in walls, floors, and roofs for the passage of piping and plumbing equipment within and into the buildings. Openings shall be as indicated or as required to provide passage for the plumbing Work.

3.4 DRAINAGE SYSTEM

A. Provide building drain with cleanout; building cleanout; soil, waste and vent stacks, extended through roof and flash; branch piping and fixture traps; connect to fixtures, floor drains, whether equipment indicated or specified, all requiring soil, waste, drain, vent facilities.

B. Drainage Specialties: Floor drains for toilet and other like areas in waterproof floors for trap; cast iron, adjustable c-p brass strainer, double drainage flange with weep holes, flashing clamp device.

C. Traps: Provide traps for fixtures and other equipment requiring connections to drainage system, except where trap is an integral part of unit design; type, size, finish of traps are specified under their fixtures and equipment. Set traps as close as possible to fixtures and equipment.

D. Plastic Risers: Where plastic pipe is used for vertical risers to untrapped floor drains, the vertical section of pipe shall be completely embedded in concrete at least 3 inches thick all around the pipe.

E. Building Cleanout: Set building cleanout flush with the finish floor in the location shown on the Plans.

F. Floor Drains: Provide drains complete with deep seal P-traps where required. Install so that the double drainage flange is cast into the floor concrete.

G. Cleanout, Access Covers: Provide cleanouts where indicated and if not indicated, in following locations: at junction of building drain with building sewer, at points of change in direction in horizontal drains, at intervals of 50 feet in long horizontal runs; at or close to base of leaders soil and waste stacks.

H. Roof Stack Terminal: Provide flashing for stacks passing through roofs according to roof manufacturer's requirements.

I. For Threaded Pipe: Provide cast iron recessed pipe coupling with double threads to connect stack to its extension with a recessed portion to extend over flashing which will serve as counter flashing or rain guard; from recessed coupling enclosed in chimney, carry stack extension to heights above as directed. Paint extensions above on prime and one finished coat asphalt paint outside and at least 12 inches down from top inside page.

3.5 PIPING INSTALLATION

A. Arrange, install piping approximately as indicated, straight, plumb and as directed as possible; form right angles or parallel lines with building walls. Pipes close to wall partitions, ceilings; offset only where necessary to follow walls as directed. Locate groups of pipes parallel to each other; space at distance to permit applying full insulation and to permit for service valves.

B. Routing: Install horizontal piping as high as possible without sags or humps. Grade water piping as specified under Water Supply Distribution. Grade drainage piping in uniform slope of 1/4-inch per foot minimum; where this is possible, maintain slopes as directed, but in no case less than 1/8-inch per foot.

C. Fittings: Where changes in pipe size occur, use only reducing fittings. For drainage piping changes in direction, use long sweep, where possible, otherwise short sweep 1/4 bends, or combination Y and 1/8 bends, also Y's or combination with other bends; use sanitary T branches only for horizontal branches discharging into stacks.

D. Concealed Piping: Where so indicated or specified, conceal piping in building construction or underground. Install such piping in time so as to cause delay to work of other trades and allow ample time for tests and approvals; do not cover before approval is obtained. Keep fixture branches concealed to points above floor close to fixtures; expose only as much as necessary for final connection.

E. Pipes Over Electrical Equipment: Avoid locating water and drain piping over electrical equipment; where this is unavoidable, obtain permission to do so; provide drip pan under such pipes.

F. Protect Open Piping: Keep piping free from scale and dirt; protect open pipe end wherever work is excavated over during construction, to prevent foreign bodies entering and lodging there; use temporary cap plugs, burlap or other approved material for protection.

3.6 FIXTURE INSTALLATION

A. Connect all fixtures shown on the Project Plans to piping as needed to make a complete installation. Provide p-trap and tubing to wall as required. All plumbing faucets, handles, exposed piping, fixtures, and trim shall be brass with chrome-plated finish. Equip all sinks or lavatories mounted in counter with deck rims in satin finished aluminum material on all sinks.

3.7 ACCEPTABLE TESTS

A. Test all piping provided under this section. Test piping to be buried before backfilling or pouring concrete. Where piping is laid below or within concrete, maintain test pressure during concrete pour. Where piping is laid below or within concrete, maintain test pressure during concrete pour. Where air tests are specified, each joint shall be covered with a soap solution or leak detector fluid. Clean piping after completion of soap test. Test shall be as follows:

1. Pressure Lines: Pressurize all pressure systems to twice the working pressure and repair any leaks that develop.

2. Drain Lines: Test all drain lines either as an entire system or by sections. All system openings closed, except highest one in the test section, and the system filled with water. Provide sufficient overlapping of sections so that very joint and connection will be subjected to a static head of at least 10 feet. Allow water to stand for 2 hours before beginning inspection. Repair all leaks which occur and repeat test until a satisfactory job is obtained.

END OF SECTION 22 00 00

SECTION 22 13 13.01 - CAST IRON SOIL PIPE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide cast iron soil pipe, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE STANDARDS

A. ASTM A 74 Cast Iron Soil Pipe and Fittings

B. ASTM C 564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings

C. Standard 301 of the Cast Iron Soil Pipe Institute

1.3 CONTRACTOR SUBMITTALS

A. Submit shop drawings in accordance with requirements listed in Section 40 05 00 – Piping, General.

PART 2 - PRODUCTS

2.1 PIPE MATERIAL

A. Unless otherwise indicated, cast iron waste and vent piping shall be service weight cast iron soil pipe with hub and spigot ends in accordance with ASTM A 74 - Cast Iron Soil Pipe and Fittings, or hubless pipe per Standard 301 of the Cast Iron Soil Pipe Institute. All pipes and fittings shall be lined and coated with the manufacturer's standard protective coating.

2.2 PIPE JOINTS

A. Hub and spigot pipe shall have rubber compression gaskets in accordance with ASTM C 564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

B. Hubless pipe shall have joints made up with Neoprene sleeves and Type 304 or 316 stainless steel clamps with stainless steel bolts per Standard 301 of the Cast Iron Soil Pipe Institute.

2.3 FITTINGS

A. Cast iron soil pipe shall have drainage pattern hub and spigot, hub and hub, or hubless fittings per ASTM A 74, or Standard 301 of the Cast Iron Soil Pipe Institute, respectively. Fittings shall be made of gray cast iron and be of service weight, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cast iron soil pipes shall be installed in a neat and workmanlike manner, in accordance with the prevailing plumbing and building codes. Pipes shall have the required grades for proper drainage. Pipes inside buildings shall be coordinated with the work from all other trades to avoid interferences and to provide sufficient headroom. Installations shall be acceptable to the Engineer and to the local plumbing inspector.

B. Supports: Pipes shall be firmly supported with fabricated or commercial hangers and supports in accordance with Section 40 05 07 – Hangers and Supports for Process Piping. Horizontal runs shall have at least one support for each length of pipe.

C. Transitions to other materials shall be done in an approved manner using manufacturer approved transition fittings.

3.2 PROTECTIVE COATING

A. Exposed pipes shall be coated over the pipe manufacturers standard protective coating, with the manufacturers recommended prime coat and a finished coat per Section 09 90 00 – Painting and Coating.

B. If encased in concrete, pipe shall be encased in a polyethylene plastic jacket.

3.3 INSPECTION AND FIELD TESTING

A. Inspection: Field installations shall be carefully inspected for proper joints and supports, interferences, and damage to pipe, fittings, and coating. Temporary plugs and covers shall be removed from openings and floor drains. Damage shall be repaired to the satisfaction of the Engineer and the plumbing inspector.

B. Field Testing: Prior to enclosure or burying, drains and vents shall be tested in the presence of the local plumbing inspector and the Engineer as required in the Piping Schedule (See Drawings GM-1) and in Section 01 74 20 – Gravity Pipe Testing, for a period of not less than one hour, or as requested by the plumbing inspector. The Contractor shall furnish all test equipment, labor, material, and devices at no extra cost to the Owner. Leaks shall be repaired to the satisfaction of the Engineer and the plumbing inspector, and the system shall be re-tested until no leaks are found.

END OF SECTION 22 13 13.01

CONTRACT DOCUMENTS, SPECIFICATIONS & PLANS

FOR

CITY OF POCATELLO

WELL #2R AND WELL #22R WELL HOUSES

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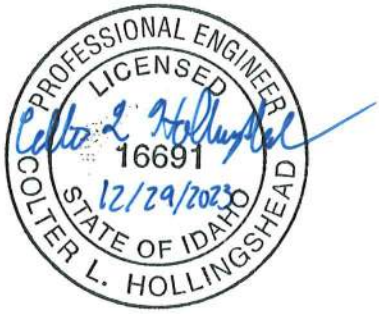

PROJECT NO. 221071-003
December 2023

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SECTION 23 00 00 - GENERAL HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Work consists of, but is not necessarily limited to, the furnishing of all labor, equipment, appliances and materials and the performance of all operations in connection with the installation of all mechanical HVAC work described by these Contract Documents. All Work shall be completed in strict accordance with Specifications, Drawings and applicable codes, including incidental materials necessary and required for their completion.

B. Intent of Drawings: Drawings, plans and schematics, and diagrams indicate general location and arrangement of piping systems.

1. The HVAC Contractor is responsible for installation of satisfactory and complete work in accordance with the intent of Drawings and Specifications. Provide, at no extra cost, incidental items required for completion of work even though not specifically mentioned or indicated in Specifications or on Drawings.

2. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision. Do not proceed with installation in area of question until conflict has been fully resolved.

C. Interferences: Project design took into account potential interferences between trades (e.g. mechanical ductwork with piping or with electrical light fixtures), however, not every interference can be eliminated. It shall be the responsibility of the Bidder and potential Contractor to field verify all mechanical piping and duct routing, making allowances for existing and new beams, pipes, ducts, hangers, and other obstructions. The cost associated with interferences shall be at no additional expense to Owner.

D. Discrepancies: Prior to submitting Bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification. The more stringent provisions shall take precedence where Codes, Specifications and Drawings differ with one another. The Contractor shall bid the more expensive requirement, unless an Addendum prior to bid addresses the discrepancy.

E. Prior Approvals: The Engineer shall receive all proposed substitutions 10 days prior to Bid. Approval requests received after 3 p.m. on the 10th day will be rejected. Supply technical data and dimensional Drawings showing that substitutes are equivalent to product specified.

F. HVAC Contractor shall pay for all permits, inspections, reviews and fees in connection with this work.

G. HVAC Contractor shall provide training to the Owner.

1.2 DEFINITIONS

A. "PROVIDE" - Furnished and installed complete.

B. "OR APPROVED EQUAL" – Items may be deemed equal as approved by submitting a quote to the Engineer, 10 days prior to Bid.

C. Intent of Drawings: Drawings, plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1.3 REFERENCE STANDARDS

A. HVAC Contractor shall conform to the latest edition or the edition adopted by the Local Governing Authority, State and National Codes and Ordinances, the State Fire Marshal, and utility company regulations

B. All material shall conform to applicable standards.

1.4 SUBMITTALS

A. Submit HVAC material and equipment submittals and shop drawings for final and official in accordance with Section 01 33 00 - Submittals.

B. Complete shop drawings and manufacturers literature submittal shall conform to the following:

1. Indicate the type, make, manufacturer’s name, supplier and trade designation of materials and equipment proposed.

2. The submittal shall include outline dimensions sufficiently accurate and complete to permit layout and coordination of pipe and duct connections, foundation, and setting of anchor bolts and base plates, procurement and setting of embedded items, etc. Drawings shall show clearances required for interferences to be avoided. Electrical connections, number of conductors and other pertinent electrical power data shall also be shown.

3. Shop drawings or submittals that cover substitutions or alternates not previously approved will not be acceptable.

1.5 QUALITY CONTROL

A. Warranty: This Contractor shall warrant and guarantee the following:

1. That all HVAC work executed under these Contract Documents will be free from defects of materials and workmanship for a period of one year from the date of final acceptance of this work.

2. The Contractor agrees to, at the Contractor's own expense, repair and replace all such defective materials and work and all other work damaged thereby which becomes defective during the term of warranty. Agreement does not include damages done by Owner.

B. Workmanship: Work shall be accomplished by workmen skilled in particular trade, in conformance with best practices and accepted standards. Work shall contribute to efficiency of operation, accessibility, maintenance and appearance. No part of installation shall interfere with operation of any other system or part of building. Non-satisfactory work shall be corrected at no additional expense to Owner.

1.6 SUBSTANTIAL COMPLETION

A. At substantial completion of Project, the Contractor shall be ready to demonstrate compliance with the list of items below. If this is not possible, the Contractor shall inform the General Contractor and Engineer no less than one week prior to substantial completion site visit.

1. Provide documentation that HVAC has been tested and balanced.

2. Demonstrate that labeling of all mechanical and ducting systems are 100 percent complete in accordance with Specification.

1.7 RECORD DOCUMENTS

A. Provide two (2) full size sets (Mechanical and HVAC drawings), one for Engineer, one for Owner. In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes and terminal units requiring periodic maintenance or repair.

2. Main and branches of piping systems, with valves and control devices located and numbered, and with items requiring maintenance located. Indicate actual inverts and horizontal locations of underground piping.

3. Equipment locations (exposed and concealed) dimensioned from prominent building lines.

4. Addendum items, change order items and all changes made to drawings from bidding phase through to project completion.

1.8 OPERATIONS & MAINTENANCE MANUALS

A. In accordance with Section 01 78 23 - Operation and Maintenance Manuals, prepare three (3) copies of Operating and Maintenance manuals for the mechanical systems and equipment as described below. Partial or separate data will be returned for completion.

1. Manuals shall be assembled in three ring binders. All information shall be arranged in sections, with each section having a heavy paper divider with a protruding tab clearly labeled. Sections shall be arranged in the same order that the equipment is listed in the Specification.

2. Include a cover page which lists project name, date and Contractor’s name, address and telephone number.

3. Include index sheet for each specification section indicating equipment, with supplier and supplier's telephone number.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 SYSTEM TESTING

A. System Balancing: After completion of all required work, the CONTACTOR shall have the system, as a whole, checked and balanced by an independent air balancing company, registered by the Associated Air Balancing Council (AABC) or the National Environmental Balancing Bureau (NEBB), with one member of the agency certified by the National Examination Board as a test and balance engineer. System balancing shall include the following:

1. Testing, Adjusting and Balancing (TAB) shall be independent of the Mechanical, Plumbing or Temperature Controls Contractors.

B. Perform TAB work as outlined by ASHRAE guidelines and methods contained in ASHRAE 2003 Applications Handbook, Chapter 37 "Testing, Adjusting, and Balancing."

C. Perform TAB procedures on each system in accordance with referenced standards.

1. Adjusting fans, dampers, diffuser, registers, valves, and other devices so that the quantities of air called for on the Drawings are supplied, returned, or exhausted.

2. Measuring and recording at least once the air temperatures delivered through each coil on full heating and full cooling. Make all necessary adjustments to obtain the specified conditions.

3. Measuring and recording on each fan and motor, and checking for proper operation of all equipment.

4. Adjusting any adjustable blade registers and volume dampers to the correct setting to obtain the design conditions.

5. Test interlock of air conditioning unit condensing fan and opening of motorized damper on condensing unit air supply.

D. Record all data obtained during TAB procedures in accordance with, and on the forms recommended by the referenced standards. Submit report to Engineer for approval.

E. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

F. TAB contractor is to return to project site 2 months after premises has been occupied for final balancing of airflows according to owners requirements based on individual heating and cooling comfort conditions. Coordinate with contractor and owner for appropriate time.

G. System Training

1. Contractor to initiate and coordinate training schedule with the Owner.

2. Provide two-hour training and demonstration at the site.

3. Training shall include:

a. Overview of the HVAC system

b. System control strategy

c. Control panel demonstration

1) How to adjust setpoint

d. Operations and maintenance procedures for all equipment

END OF SECTION 23 00 00

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SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units, condenser fans and motorized dampers, exhaust fans and motorized dampers that are not supplied with factory-wired controls.

B. Control system consists of sensors, indicators, actuators, final control elements, interface equipment, adjustment and other apparatus and accessories to control mechanical systems.

C. Furnish and provide programming and control equipment as required to satisfy sequences of operation as described on the Drawings.

1.2 REFERENCE STANDARDS

A. NFPA 70, Article 100

B. NFPA 90A Installation of Air Conditioning and Ventilation Systems

C. AMCA 500D

1.3 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device in accordance with Section 01 33 00 – Submittal Procedures. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials and installation and startup instructions for each type of product indicated.

B. Each control device labeled with setting or adjustable range of control.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components and location and size of each field connection.

1. Schematic flow diagrams showing fans, coils, dampers, valves and control devices.

2. Wiring Diagrams: Power, signal and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

3. Written description of sequence of operation.

4. Schedule of dampers including size, leakage and flow characteristics.

5. Schedule of valves including leakage and flow characteristics.

D. Maintenance Data: Include the following for systems to include in maintenance manuals specified in Section 01 78 23 – Operation and Maintenance Data.

1. Maintenance instructions and lists of spare parts for each type of control device.

2. Interconnection wiring diagrams with identified and numbered system components and devices.

3. Inspection period, cleaning methods, cleaning materials recommended and calibration tolerances.

4. Calibration records and list of setpoints.

E. Project Record Documents: Record actual locations of control components including control units, thermostats and sensors. Revise shop drawings to reflect actual installation and operating sequences.

1.4 QUALITY CONTROL

A. Installer Qualifications: An experienced installer who is a certified installer of the automatic control system manufacturer for both installation and maintenance of units required for this project.

B. Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature control systems similar to those indicated for this project and with a record of successful in-service performance.

C. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

D. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems”

1.5 COORDINATION

A. Coordinate with the Mechanical contractor for actual mechanical equipment being supplied to the project site. Low voltage actuators for outside air damper operation are required to be interlocked with ducted condenser air conditioning units and laboratory fume hood exhaust fan.

B. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.

C. Coordinate supply of conditioned electrical circuits for control units.

D. Coordinate equipment with Division 26 to achieve compatibility with starter coils and annunciation devices.

PART 2 - PRODUCTS

2.1 THERMOSTATS

A. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater.

B. Room thermostat accessories include the following:

1. Insulating Bases: For thermostats located on exterior walls.

C. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

D. Manufacturers, or Equal:

1. Chromalox, Inc.

2. Delta Controls, Inc.

3. Hayward Industrial Products, Inc.

4. Honeywell, Inc.; Home & Building Control

5. ICM Corp

6. Johnson Controls, Inc.; Controls Group

7. Sensidyne, Inc.

8. Texas Instruments, Inc.; Commercial Sensors & Controls

2.2 FAN CONTROL PANEL

A. The Contractor shall provide Fan Control Panels as part of the HVAC package.

B. Fan Control Panels shall be designed and certified by a UL 508a listed shop.

C. Fan Control Panel design shall include all components necessary to meet the intent of the HVAC Sequence of Operation, FCP design details, and Control Strategy as outlined in the Project Plans.

D. Fan Control Panels designs shall be submitted for approval prior to construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to control units and operator workstation.

B. Verify that duct-, pipe- and equipment-mounted devices and wiring are installed before proceeding with installation.

3.2 INSTALLATION

A. Install equipment level and plumb.

B. Verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate all 54-inches above the floor, unless noted otherwise.

C. Install labels and nameplates to identify control components according to Section 43 05 50 – Equipment Mounting.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes and cabinets according to Division 26.

B. Install building wire and cable according to Division 26.

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.

2. Install exposed cable in raceway.

3. Install concealed cable in raceway.

4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.

5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

3.4 CONNECTIONS

A. Ground all equipment per Division 26 requirements.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 4868.

3.5 CONTROL SEQUENCES

A. Refer to Drawings.

END OF SECTION 23 09 00

SECTION 23 34 23 – HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section includes requirement for Exhaust and Propeller Fans.

1.2 REFERENCE STANDARDS

A. AMCA 99

B. AMCA 210 Laboratory Methods of Testing Fans for Rating

C. AMCA 300 Reverberant Room Method for Sound Testing of Fans

D. AMCA 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data

E. NFPA 70, Article 100

F. UL 705

G. AMCA Compliance

H. NEMA Compliance

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties and accessories for each type of product indicated in equipment schedules in accordance with Section 01 33 00 – Submittal Procedures. At a minimum, include the following:

1. Certified fan performance curves with system operating conditions indicated.

2. Certified fan sound-power ratings.

3. Motor ratings and electrical characteristics, plus motor and electrical accessories.

4. Material gauges and finishes including color charts.

5. Dampers including housings, linkages and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components and location and size of each field connection.

1. Wiring Diagrams: Provide information defining power signal and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: Provide technical manuals in accordance with Section 01 78 23 – Operation and Maintenance Data.

1.4 QUALITY ASSURANCE

A. All electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. All motors and electrical accessories shall comply with NEMA standards

D. All power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

2.1 GENERAL

A. Sound-Power Level Ratings: Comply with AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data. Factory test fans according to AMCA 300 - Reverberant Room Method for Sound Testing of Fans. All fans shall be labeled with AMCA - Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation and efficiency by factory tests and ratings according to AMCA 210, Laboratory Methods of Testing Fans for Rating.

2.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on actual site elevations. See Drawings for listed project elevation.

B. Operating Limits: Classify according to AMCA 99.

2.3 CENTRIFUGAL EXHAUST FANS

A. Description: Provide belt-driven or direct-driven centrifugal exhaust fans consisting of housing, wheel, fan shaft, bearings, and complete with motor and disconnect switch, drive assembly, and accessories.

B. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

C. Belt-Driven Drive Assembly: Resiliently mounted to housing with the following features:

1. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.

2. Shaft Bearings: Permanently-lubricated, permanently-sealed, self-aligning ball bearings.

3. Pulleys: Cast-iron adjustable-pitch motor pulley.

4. Coatings: All exhaust fans are to have a Polyester Powder Coating or equal. – similar to ACME-SEAL.

D. Accessories: Provide the following accessories with each fan:

1. Disconnect Switch: Non-fusible type with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

2. Birdscreens: Removable, ½-inch mesh, aluminum or brass wire.

E. Manufacturers, or Equal:

1. Acme Engineering & Mfg. Corp.

2. Aerovent; a Twin City Fan Company.

3. Carnes Company HVAC.

4. Cook, Loren Company

5. Greenheck Fan Corp.

6. Penn Ventilation Companies, Inc.

2.4 MOTORS

PART 3 - COMPLY WITH REQUIREMENTS IN 40 05 93 - COMMON MOTOR REQUIREMENTS FOR PROCESS EQUIPMENT. EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

3.2 COORDINATION

A. Coordinate size and location of structural support members.

B. Coordinate installation of roof curbs, equipment supports and roof penetrations.

3.3 INSTALLATION

A. Install power ventilators level and plumb.

B. Support suspended units from structure using threaded steel rods.

1. In seismic zones, restrain support units.

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 15.

3.4 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section - 23 33 00 – Air Duct Accessories.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 4866.

3.5 FIELD QUALITY CONTROL

A. Equipment Startup Checks:

1. Verify shipping, blocking and bracing are removed.

2. Verity unit is secure on mountings and supporting devices and connections to ducts and electrical components are complete. Verify proper thermal-overload protection is installed in motors, starters and disconnect switches.

3. Verify cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts and install belt guards.

5. Verify lubrication for bearings and other moving parts.

6. Verify manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

7. Disable automatic temperature-control operators.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.

2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Section 23 00 00 – General HVAC Requirements for testing, adjusting and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.7 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt and construction debris and repair damaged finishes.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owners maintenance personnel to adjust, operate and maintain power ventilators.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing and maintaining equipment and schedules.

2. Review data in maintenance manuals provided under Section 01 78 23 – Operation and Maintenance Data.

3. Schedule training with Owner, through Engineer, with at least seven days' advance notice.

END OF SECTION 23 34 23

SECTION 23 83 23 – ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section includes industrial Electric Unit Heaters with electric-resistance coils.

1.2 SUBMITTALS

A. Product Data: Product Data and Shop Drawings shall be submitted in accordance with Section 01 33 00 – Submittals. Include rated capacities, furnished specialties, and accessories for each unit type and configuration.

B. Shop Drawings: Submit the following for each unit type and configuration:

1. Plans, elevations, sections, and details.

2. Wiring Diagrams: Power, signal, and control wiring.

3. Equipment schedules include rated capacities, furnished specialties, and accessories.

C. Operation and Maintenance Data: Industrial heaters to be included in operation and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Reznor

2. Indeeco

3. Markel

4. Modine Manufacturer Company.

5. Sterling Radiator.

B. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

C. Comply with UL 2021 and D. Comply with UL 823.

D. Casing:

1. Cabinet: Removable panels for maintenance access to controls.

2. Cabinet Finish: Manufacturer's standard powder coat finish applied to factory-assembled and -tested galvanized steel propeller unit heater before shipping.

3. Discharge Louver: Adjustable outlet grille with 45° angled louvers.

E. Manufacturer provided wall or ceiling mounting hardware.

F. Electrical-Resistance Heating Elements:

1. Heating element are to be type 304 stainless steel finned tubular construction.

G. Fan: Propeller type, aluminum wheel directly mounted on motor shaft in the fan venturi.

2.2 FAN MOTORS

A. Motor Type: High performance permanently lubricated, total enclosed, multi-speed with integral thermal-overload protection.

2.3 CONTROLS

A. Unit heater will be controlled externally by a remote thermostat. Refer to plans and HVAC Instrumentation and Controls spec for more information.

B. Refer to Sheet MH-001 for unit heater control strategy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install propeller unit heaters level and plumb.

B. Install propeller unit heaters to comply with NFPA 90A.

C. Suspend propeller unit heaters from structure with factory supplied mounting brackets. Hanger rods and attachments to structure are specified in Section 40 05 07 - Hangers and Supports.

D. Where required install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls.

3.2 CONNECTIONS

A. Installation per manufacturer recommendations.

B. Ground Equipment.

3.3 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing.

1. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Operate electric heating elements through each stage to verify proper operation and electrical connections.

3. Test and adjust controls and safeties.

B. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.

2. Review data in maintenance manuals. Refer to Section 01 77 00 - Closeout Procedures.

3. Schedule training with Owner, through ENGINEER, with at least seven days advance notice.

END OF SECTION 23 83 23

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SECTION 26 05 00 – ELECTRICAL, GENERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to all of Division 26 Specifications. This Specification section applies to all Division 26 Specifications and Electrical Drawings.

B. Division 26 contractor shall review all other division specifications and drawings for additional requirements.

1.2 QUALITY ASSURANCE

A. Comply with latest NEC, NFPA, UBC, UFC, UL and applicable Local and State Codes. Also comply with Utility Company regulations and industry standards and these Drawings.

B. Work shall be done by only trained, licensed and experienced workmen familiar with the requirements.

C. All microprocessor based equipment and software with equipment shall utilize 4 digits for the year part of all dates. A two digit date shall be an option for printing at Owner's preference.

1.3 EXTENT OF DRAWINGS / SPECIFICATION

A. Drawings indicate intent and general layout of electrical systems for the Project. Drawings are partly diagrammatic and do not indicate all fittings and accessories which may be required. Provide such fittings and accessories as required to form a complete and operating system in general conformance with Specifications and Drawings.

1.4 PRIOR APPROVALS

A. Unless directed otherwise by Division 1, all products submitted for prior approval shall be received by the Engineer 10 business days prior to Bid. Supply technical data, photometrics and dimensional Drawings showing that substitutes are equal to product specified. Faxed prior approvals will not be accepted.

1.5 DISCREPANCIES

A. Prior to submitting Bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification. The more stringent provisions shall take precedence where codes, Specifications and Drawings differ with one another. The Contractor shall Bid the more expensive requirement, unless discrepancy is addressed by Addendum prior to Bid.

1.6 TEMPORARY LIGHTING/POWER

A. Provide temporary electrical power and lighting for all trades that require service during the course of this Project. Provide temporary service and distribution as required. Provide temporary power for all electrical equipment that will need to be installed due to the phased construction of this project. Comply with the NEC and OSHA requirements. Energy Costs by General Contractor.

1.7 SHOP DRAWING SUBMITTALS

A. General: Follow the procedures specified in Section 01 33 00 – Submittal Procedures. Submit for final and official approval through the General Contractor.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate electrical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.

C. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning prior to closing in the building.

E. Coordinate connecting electrical service to components furnished under other Sections.

F. Coordinate connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Coordinate requirements for access panels and doors where electrical items requiring access are concealed by finished surfaces.

1.9 SUBSTANTIAL COMPLETION

A. At Substantial Completion of Project, be ready to demonstrate the following list of items below. If this is not possible, inform the General Contractor and Engineer no less than 1 week prior to Engineer’s visitation of the site for Substantial Completion.

B. Demonstrate the operation and test of the emergency lighting system.

C. Demonstrate the main service ground, bonding to neutral and resistance readings obtained at time of installation. This will involve having some covers removed from the main panels at the time of the Engineer's visitation.

D. All electrical systems and items specified shall be installed and operational.

E. Demonstrate exterior lighting controls.

F. Demonstrate the operation of all emergency power systems including generators, uninterruptible power supplies and inverter systems.

G. Demonstrate compliance with IEEE 519 for harmonic distortion within "Idaho Power Company's" distortion limit requirement of "8%". Distortion limits apply to the entire plant load measured at the primary meter. This point in the system shall be defined as the point of common coupling (PCC). Meeting these requirements is a condition of service and a requirement of this project. Refer to Section 26 29 23 – Variable-Frequency Motor Controllers (VFCs/VFDs), Part 2.3.I.

1.10 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements in Section 01 77 00 – Closeout Procedures. In addition to the requirements specified in Division 1, indicate the following installed conditions:

B. Actual location of all electrical service gear/feeders, panel/motor/special equipment feeders, all major underground or underslab conduits, all conduit stubs for future use, any change in branch circuitry from Drawings, key junction boxes and pull boxes not indicated on Drawings, any control locations or indicator lights not shown on Drawings.

C. Addendum items, Change Order items and all changes made to Drawings from Bidding phase through to Project completion.

D. Actual equipment and materials installed. Where manufacturer and catalog number are indicated on Drawings, generally or in fixture or equipment schedules, change to reflect actual products installed.

E. Change service panel and branch panel breaker locations and schedules to reflect actual installed conditions.

1.11 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Section 01 77 00 – Closeout Procedures. In addition to the requirements specified in Division 1 assemble O & M Manuals as follows:

1. Compile Operating and Maintenance Manuals for the electrical systems and equipment. The manuals shall be provided to the Engineer for approval complete and at one time, prior to requesting final payment. Partial or separate data will be returned for completion.

2. Manuals shall be assembled in three-ring binders. Binders shall be 3 inch thick or less and have slip sleeve jacket on binder side and front. More than one binder shall be used for each set of data if required to prevent overfilling of one binder. All information shall be arranged in Sections and each Section shall have a blank buff colored, heavy paper divider with a protruding tab clearly labeled. Sections shall be arranged in the same order that the equipment is listed in the Specification and each Specification section shall have a separate tab. Shop Drawings which are larger than 8-1/2-inch by 11 inch shall be individually folded so they are 8-1/2-inch by 11 inch or less and inserted behind the appropriate tab.

3. Tabs shall be labeled and arranged as follows:

   a. Index: Furnish under the first tab an index of Sections listing name of Section and Specification numbers.

   b. Equipment Manufacturers: Furnish under the second tab a complete typed list of equipment suppliers and manufacturers representative including type of equipment, name, address and phone number. The company listed here should be the one which could furnish replacement parts and offer technical information about the equipment.

   c. Product Literature: Each tab, starting with the third shall contain the name of a Specification Section. Behind each tab shall be the previously submitted and approved Shop Drawing, factory published operation and maintenance instructions and parts lists. Also include description of function, normal operating characteristics and limitations, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions. Servicing instructions and lubrication charts and schedules.

4. Upon completion and approval of the booklets, one copy shall be given to the Architect, and two to the Owner. Using the booklet, the Electrical Contractor shall explain in detail and instruct the Owner's operating personnel in the correct operation and maintenance of the equipment.

PART 2 - PRODUCTS

2.1 CONCRETE EQUIPMENT BASES

A. Forms and Reinforcing Materials: As specified in Section 03 30 00 – Cast-In-Place Concrete.

B. Concrete: 3000 psi, 28-day compressive strength as specified in Section 03 33 00 – Cast-In-Place Concrete.

2.2 RACEWAY AND CABLE LABELS

A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

   1. Color: Black letters on orange field.

   2. Legend: Indicates voltage.

B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.

C. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.

D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

E. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.

1. Not less than 6 inches wide by 4 mils thick.

2. Compounded for permanent direct-burial service.

3. Embedded continuous metallic strip or core.

4. Printed legend indicating type of underground line.

F. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

2.3 NAMEPLATES

A. Engraved Plastic Nameplates: Engraving stock, melamine plastic laminate, minimum 1/16-inch thick for signs up to 20 sq. in. and 1/8-inch thick for larger sizes.

1. Engraved legend with white letters on black face.

2. Punched or drilled for mechanical fasteners.

2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16-inch.

2. Tensile Strength: 50 lb minimum.

3. Temperature Range: Minus 40 to plus 185 deg F.

4. Color: According to color-coding.

B. Paint: Formulated for the type of surface and intended use.

1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.

2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.

3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.

4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION REQUIREMENTS

A. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated.

B. Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Give right of way to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING METHODS

A. Damp Locations and Outdoors: Hot-dip galvanized materials, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Conform to manufacturer's recommendations for selecting supports.

E. Strength of Supports: Adequate to carry all present and future loads, times a safety factor of at least 4; 200 lb minimum design load.

3.3 GENERAL INSTALLATION OF MATERIALS

A. Install wires according to manufacturer's written instructions and NECA's "Standard of Installation."

B. Conductor Splices: Keep to the minimum and comply with the following:

1. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

2. Use splice and tap connectors that are compatible with conductor material.

C. Connect outlets and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

D. Install concrete pads and bases where indicated.

E. Install utility-metering equipment according to utility company's written requirements. Provide grounding and empty conduits as required by company.

3.4 LABEL INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Install painted identification according to manufacturer's written instructions and as follows:

1. Clean surfaces of dust, loose material, and oily films before painting.

2. Prime surfaces using type of primer specified for surface.

3. Apply one intermediate and one finish coat of enamel.

F. Color Identification of Junction boxes: Identify with spray paint. Apply colors as follows:

1. Emergency lighting and power: Orange.

2. Mechanical/Electrical Supervisory System: Blue

3. Security System: Yellow.

G. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.

H. Circuit Identification Labels on Boxes: Install labels externally.

1. Exposed Boxes: Permanent black marker indicating panel and circuit designation.

2. Concealed Boxes: Permanent black marker indicating panel and circuit designation.

I. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

J. Color-Coding of Secondary Phase Conductors: Use the following colors for service, feeder and branch-circuit phase conductors:

1. 208/120-V Conductors:

a. Phase A: Black.

b. Phase B: Red.

c. Phase C: Blue.

d. Neutral: White.

e. Ground: Green.

2. 480/277-V Conductors:

a. Phase A: Brown.

b. Phase B: Orange

c. Phase C: Yellow.

d. Neutral: Gray.

e. Ground: Green.

3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:

a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1 inch wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.

K. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.

1. Legend: 1/4-inch steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.

2. Tag Fasteners: Nylon cable ties.

3. Band Fasteners: Integral ears.

L. Apply identification to conductors as follows:

1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.

2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.

3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

M. Apply warning, caution, and instruction signs as follows:

1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

N. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch high lettering on 1-1/2 inch high label; where two lines of text are required, use labels 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:

1. Panelboards, electrical cabinets, and enclosures.

2. Access doors and panels for concealed electrical items.

3. Electrical switchgear and switchboards.

4. Emergency system boxes and enclosures.

5. Disconnect switches.

6. Enclosed circuit breakers.

7. Motor starters.

8. Push-button stations.

9. Power transfer equipment.

10. Contactors.

11. Remote-controlled switches.

12. Control devices.

13. Transformers.

14. Battery racks.

15. Power-generating units.

O. For panelboards, provide framed type circuit schedules with identification of items controlled by each breaker. Indicate room numbers of items controlled or room name where appropriate for Owners convenience. Final schedules shall be typed or printed for clarity. Hand written schedules are not acceptable. Schedules shall be posted inside each panel door mounted in transparent card holder upon project completion.

END OF SECTION 26 05 00

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes wires, cables and connectors for power, lighting, signal, control and related systems rated 600 V and less.

1.2 SUBMITTALS

A. Furnish in accordance with Section 01 33 00 – Submittal Procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers complying with the Quality Assurance requirements are acceptable.

2.2 WIRES AND CABLES

A. General: Provide wire and cable suitable for the temperature, conditions and location where installed.

B. Power Conductors: Provide solid conductors for power and lighting circuits No. 10 AWG and smaller. Provide stranded conductors for sizes No. 8 AWG and larger.

C. Control Conductors: Provide stranded conductors.

D. Conductor Material: Copper for all wires and cables. Aluminum conductors are not acceptable.

E. Insulation: Provide THHN/THWN insulation for all conductors size 500 kcmil and larger, and No. 8 AWG and smaller. For all other sizes provide THW, THHN/THWN or XHHW insulation as appropriate for the locations where installed. Type THHN insulation may be used for branch circuit and feeder sizes for 100 amp under. Adjust conduit size.

F. Color coding for phase identification in accordance with Section 26 05 00 –Electrical, General.

2.3 CONNECTORS FOR CONDUCTORS

A. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

PART 3 - EXECUTION

3.1 WIRING METHOD

A. Use the following wiring methods as indicated:

1. Wire: Install all wire in raceway, minimum size for light and power circuits shall be #12 AWG. Minimum size for control wire shall be 14 AWG.

3.2 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical cables, wires, and connectors in compliance with NEC.

B. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.

C. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. No joints or taps permitted in service or feeder circuits.

D. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.

E. Install VFD cables per VFD manufacturer requirements. VFD cable shielding must be connected at both the drive and the motor ends unless the drive manufacturer provided different guidelines. The shielding must be connected at a 360° contact.

3.3 FIELD QUALITY CONTROL

A. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

1.2 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 26 05 19 – Low-Voltage Conductors and Cables.

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

E. Grounding Electrode Conductors: Stranded cable.

F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

G. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.

2. Assembly of Stranded Conductors: ASTM B 8.

H. Copper Bonding Conductors: As follows:

1. Bonding Conductor: Sized per NEC 250.102, stranded copper conductor.

2. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

I. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Sectional type; copper-clad steel.

1. Size: 3/4 inch in diameter by 120 inches in length.

PART 3 - EXECUTION

3.1 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.

F. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:

1. Feeders and branch circuits.

2. Lighting circuits.

3. Receptacle circuits.

4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.

6. Flexible raceway runs.

7. Armored and metal-clad cable runs.

D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

E. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

F. Water Heater: Bond conductor to heater units, piping, connected equipment, and components.

G. Signal and Communication Systems: Provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

H. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.

1. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

A. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NEC. If concrete foundation is less than 20 feet long, coil excess conductor within the base of the foundation. Bond grounding conductor by cadweld process to reinforce steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

B. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 6 inches below finished floor or final grade, unless otherwise indicated.

2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

C. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

E. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

H. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

3.5 FIELD QUALITY CONTROL

A. Test ground resistance of entire system and at each building/structure where electrical equipment is installed.

B. Where maximum allowable ground resistance of 5 ohms is exceeded, install additional grounding mats or ground rods until ground resistance is equal to or below maximum allowable ground resistance.

C. Terminate ground and shield for VFD cables per VFD manufacturer requirements. VFD cable shielding must be connected at both the drive and the motor ends unless the drive manufacturer provided different guidelines. The shielding must be connected at a 360° contact. Provide and install cable claps or metal fittings as required for proper connection.

END OF SECTION 26 05 26

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SECTION 26 05 29 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers complying with the Quality Assurance requirements are acceptable.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

C. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:

1. Thomas & Betts.

2. Power-Strut.

3. Unistrut.

4. Cooper B-Line.

5. Robroy.

6. Aickinstrut.

2.2 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.3 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:

1. Expansion Anchors: Carbon steel wedge or sleeve type.

2. Toggle Bolts: All steel springhead type.

3. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.

C. U-Channel Systems: 16 gauge steel channels, with 9/16-inch diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.

2.4 FABRICATED SUPPORTING DEVICES

A. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snap lock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:

a. 3 inch and smaller: 20 gauge.

b. 4-inch to 6-inch: 16 gauge.

c. Over 6-inch: 14 gauge.

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

3. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:

1. Conform to manufacturer's recommendations for selection and installation of supports.

2. Strength of each support shall be adequate to carry the load plus a minimum of 200 lbs safety allowance.

3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

4. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2 inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For

hanger rods with spring steel fasteners, use 1/4-inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

5. Space supports for raceways in accordance with NEC.

6. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

D. In open overhead spaces, support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

E. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with "Fire Resistant Joint Sealers" requirement of Section 07 92 00 – Joint Sealants.

F. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. All device boxes in sheetrock walls will be tight before, during and after installation of sheetrock.

G. Cutting and Patching: Obtain Engineer's approval before cutting and patching on structural members of building surfaces.

END OF SECTION 26 05 29

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SECTION 26 05 33.16 – CABINETS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this Section include:

1. Outlet and device boxes.

2. Pull and junction boxes.

3. Cabinets.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers complying with the Quality Assurance requirements are acceptable.

1. Industrial Enclosures.

a. Hoffman EWMW482425 or comparable

b. Panduit

2.2 GENERAL

A. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

B. Provide conduit entrance boxes for large motors connections when parallel conduits are required for proper motor assembly, reference specification 40 05 93 – Common Motor Requirements for Process Equipment.

2.3 MATERIALS AND FINISHES

A. Sheet Steel: Flat-rolled, code-gage, galvanized steel.

B. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.

C. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

D. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.

E. Painted Interior Finish: Where indicated, white baked enamel.

F. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Zinc plated steel for conduit hubs, bushings, box connectors and couplers. Set screw type. Use insulated throat connectors.

2.4 METAL OUTLET, DEVICE, AND SMALL WIRING BOXES

A. General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application. Minimum size 4 inch square x 2-1/8 inch deep.

B. Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.

2.5 PULL AND JUNCTION BOXES

A. General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.

B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.

C. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.

2.6 CABINETS

A. Comply with UL 50, "Electrical Cabinets and Boxes."

B. Construction: Sheet steel, NEMA 12 class except as otherwise indicated. Cabinet shall consist of a box and a front consisting of a one piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24 inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24 inches apart and not over 6 inches from top and bottom of door. For flush cabinets, make the front approximately 3/4-inch larger than the box all around. For surface mounted cabinets make front same height and width as box.

C. Doors: Double doors for cabinets wider than 24 inches. Telephone cabinets wider than 48-inches may have sliding or removable doors.

D. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power, and lighting cabinets located within wire closets and mechanical/electrical rooms. Locks shall be of a type to permit doors to latch closed without locking.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locations: Install items where indicated and where required to suit code requirements and installation conditions.

B. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

C. Support and fasten items securely in accordance with Section 26 05 29 – Support Devices.

D. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.

E. Remove sharp edges where they may come in contact with wiring or personnel.

3.2 INSTALLATION OF OUTLET BOXES

A. Gasketed Boxes: At the following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:

1. Exterior locations.

2. Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).

3. Where exposed to moisture laden atmosphere.

4. Where indicated.

B. Mounting: Mount outlet boxes for switches and receptacles with the long axis vertical or as indicated. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.

C. Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4 inches square by 2-1/8 inches deep minimum.

D. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.

E. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

F. Concrete Boxes: Use extra deep boxes to permit side conduit entrance without interfering with reinforcing, but do not use such boxes with over 6 inch depth.

G. Do not install boxes back-to-back.

H. Provide hazardous location rated boxes where required.

3.3 INSTALLATION OF PULL AND JUNCTION BOXES

A. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.

B. Size: Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by Article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

3.4 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES

A. Mount with fronts straight and plumb.

B. Install with tops 78 inches above floor.

C. Set cabinets in finished spaces flush with walls.

3.5 GROUNDING

A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

3.6 CLEANING AND FINISH REPAIR

A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.

B. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the tray manufacturer.

C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION 26 05 33.16

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways for electrical wiring. Types of raceways in this Section include only the following:

1. Electrical metallic tubing (EMT).
2. Flexible metal conduit.
3. Intermediate metal conduit.
4. Liquidtight flexible metal conduit.
5. Rigid metal conduit.
6. Rigid nonmetallic conduit.
7. Wiremold.
8. Wireway.

1.2 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers complying with the Quality Assurance requirements are acceptable.

2.2 METAL CONDUIT AND TUBING

A. Rigid Metal Conduit (RMC): ANSI C80.1.

B. Intermediate Metal Conduit (IMC): UL 1242.

C. Electrical Metallic Tubing (EMT) and Fittings: ANSI C80.3.

D. Flexible Metal Conduit: UL 1, zinc-coated steel.

E. Liquidtight Flexible Metal Conduit and Fittings: UL 360. Fittings shall be specifically approved for use with this raceway.

F. PVC Coated Metal Conduit:

1. Use PVC Coated Rigid Metal Conduit and fittings in all wet and hazardous areas.

    a. PCS:

        1) The steel conduit, before PVC coating, shall be new, unused, hot-dip galvanized material, conforming to the equipment for Type GRC.

        2) Coated conduit NEMA Standard RN-1

        3) The galvanized coating may not be disturbed or reduced in thickness during the cleaning and preparatory process.

    b. Factory-bonded PVC jacket:

        1) The exterior galvanized surfaces shall be coated with primer before PVC coating to ensure a bond between the zinc substrate and the PVC coating.

        2) Nominal thickness of the exterior PVC coating shall be 0.040 inch except where part configuration or application of the piece dictates otherwise.

        3) PVC coating on conduits and associated fittings shall have no sags, blisters, lumps, or other surface defects and shall be free of holes and holidays.

        4) The PVC adhesive bond on conduits and fittings shall be greater than the tensile strength of the PVC plastic coating:

            I. Confirm bond with certified test results.

    c. A urethane coating shall be uniformly and consistently applied to the interior of all conduits and fittings:

        1) Nominal thickness of 0.002 inch

        2) Conduits having areas with thin or no coating are not acceptable

        3) All threads shall be coated with urethane.

    d. The PVC exterior and urethane interior coating applied to the conduits shall afford sufficient flexibility to permit field bending without cracking or flaking at temperature above 30 degrees Fahrenheit (-1 degree Celsius).

    e. PCS conduit bodies and fittings:

        1) Malleable iron

        2) The conduit body, before PVC coating, shall be new, unused material and shall conform to appropriate UL standards.

3) The PVC coating on the outside of conduit bodies shall be 0.040 inch thick and have a series of ribs to protect the coating from tool damage during installation

4) 0.002-inch interior urethane coating.

5) Utilize the PVC coating as an integral part of the gasket design.

6) Stainless steel cover screw heads shall be encapsulated with plastic to ensure corrosion protection.

7) A PVC sleeve extending 1 conduit diameter or 2 inches, whichever is less, shall be formed at each female conduit opening.

I. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used.

II. The sleeve shall provide a vapor- and moisture-resistant seal at every connection.

f. Interlocking design formed from continues metal strip for integrity and flexibility

g. Manufactured in accordance with:

1) UL-1

2.3 NONMETALLIC CONDUIT AND DUCTS

A. Rigid Nonmetallic Conduit (RNC): NEMA TC 2 and UL 651, Schedule 80 PVC.

B. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

C. Liquidtight Flexible Nonmetallic Conduit and Fittings: UL 1660. Fittings shall be specifically approved for use with this raceway.

D. Conduit, Tubing, and Duct Accessories: Types, sizes, and materials complying with manufacturer's published product information. Mate and match accessories with raceway.

E. Electrical Nonmetallic Tubing (ENT): Is not allowed.

2.4 CONDUIT BODIES

A. General: Types, shapes, and sizes as required to suit individual applications and NEC requirements.

B. Provide matching gasketed covers secured with corrosion-resistant screws.

C. Metallic Conduit and Tubing: Use metallic conduit bodies. Use bodies with threaded hubs for threaded raceways.

2.5 WIREWAYS

A. General: Electrical wireways shall be of types, sizes, and number of channels as indicated. Fittings and accessories including but not limited to couplings, offsets, elbows, expansion joints, adapters, hold-down straps, and end caps shall match and mate with wireway as required for complete system.

B. Where features are not indicated, select to fulfill wiring requirements and comply with applicable provisions of NEC.

2.6 SURFACE RACEWAYS

A. General: Sizes and channels as indicated. Provide fittings that match and mate with race-way.

B. Surface Metal Raceway: Construct of galvanized steel with snap-on covers, with 1/8-inch mounting screw knockouts in base approximately 8 inches o.c. Finish with manufacturer's standard prime coating suitable for painting. Provide raceways of types suitable for each application required.

C. PVC coated rigid shall be provided in the areas that have process equipment, moisture or susceptible to moisture. Conditioned areas such as electrical room, office and restroom where conduit is concealed in the wall. EMT is acceptable.

PART 3 - EXECUTION

3.1 WIRING METHOD

A. Outdoors: Use the following wiring methods:

1. Exposed: PVC coated rigid metal conduit, elbows to be PVC coated RMC.

2. Concealed: Rigid metal conduit, elbows to be PVC coated RMC.

3. Underground: Rigid nonmetallic conduit (sched 80), elbows to be PVC coated RMC.

4. Indoors or Outdoors: Connection to vibrating equipment including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment in moist or humid location or corrosive atmosphere, or where subject to water spray or dripping oil, grease, or water: liquid tight flexible metal conduit.

B. Indoors: Use the following wiring methods:

1. Connection to Vibrating Equipment: Including transformers and hydraulic, pneumatic or electric solenoid or motor-operated equipment: flexible metal conduit.

2. Exposed: Electrical metallic tubing, rigid metal conduit.

3. Concealed: Electrical metallic tubing. AC/MC cable NOT ALLOWED.

4. Underslab: Sch 80 PVC, elbows to be PVC coated RMC.

C. Hazardous Locations

1. As required by the NEC

3.2 INSTALLATION

A. General: Install electrical raceways in accordance with requirements of NEC, and as follows:

B. Conceal Conduit and EMT, unless indicated otherwise, within finished walls, ceilings, and floors. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install raceways level and square and at proper elevations.

C. Elevation of Raceway: Where possible, install horizontal raceway runs above water and steam piping.

D. Complete installation of electrical raceways before starting installation of conductors within raceways.

E. Provide supports for raceways as specified in Specification Section 26 05 00 – Electrical, General.

F. Prevent foreign matter from entering raceways by using temporary closure protection.

G. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

H. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

I. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For rigid metal conduit and intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated. EMT set screw connectors and couplers are to be steel.

J. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated. This does not apply to conduits in crawl spaces.

K. Raceways embedded in slabs: Not allowed without engineering approval.

L. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.

M. Run exposed, parallel, or banked raceways together.

N. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.

O. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

P. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

Q. Install pull wires in empty raceways. Use monofilament plastic line having not less than 200 lb tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

R. Communication and Signal System Raceways 2 Inch Trade Size and Smaller: In addition to the above requirements, install raceways 2 inch and smaller trade size in maximum lengths at 150 feet and with a maximum of two, 90 deg bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.

S. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver operated threaded flush plugs flush with floor.

T. Flexible Connections: Use short length (maximum of 6 ft.) of flexible conduit for recessed and semi-recessed lighting fixtures, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid tight flexible conduit in wet locations. Install separate ground conductor across flexible connections.

U. Surface Metal Raceway: Install a separate green ground conductor in raceway from the junction box supplying the raceway to receptacle or fixture ground terminals.

V. Raceway Installed Above Accessible Ceilings: Raceway located above accessible ceilings shall be a minimum of 24 inches above finished ceiling or mounted direct to structure, whichever is less.

3.3 ADJUSTING AND CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

END OF SECTION 26 05 33

SECTION 26 21 00 - SERVICE ENTRANCE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Coordinate existing incoming power service with Idaho Power Company. Idaho Power Company contact is Jon Zollinger (208) 236-7783.

B. Coordinate demolition of existing power feed to existing Well #3R Well House as indicated on the plans.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Install, modify or demolish service-entrance equipment as indicated on the plans. New equipment to be installed, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that service-entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC, UL, ANSI, IEEE, and NEMA standards.

B. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B, and the NEC.

END OF SECTION 26 21 00

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SECTION 26 22 00 – LOW VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

2. Control and signal transformers.

1.3 SUBMITTALS

A. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Wiring and connection diagrams.

C. Source quality-control test reports.

D. Output Settings Reports: Record of tap adjustments specified in Part 3.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C 57.12.91.

C. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified Section 26 05 00 – Electrical, General.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Siemens.

2. GE Electrical Distribution & Control.

3. Square D/Group Schneider NA.

4. Eaton

2.2 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices, except for taps.

1. Internal Coil Connections: Brazed or pressure type.

3. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.

D. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor Corrosion Protection."

1. Finish Color: Gray.

E. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

F. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

G. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.

2. Include special terminal for grounding the shield.

3. Shield Effectiveness:

a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.

b. Common-Mode Noise Attenuation: Minus 120 dBA minimum at 0.5 to 1.5 kHz; minus 65 dBA minimum at 1.5 to 100 kHz.

c. Normal-Mode Noise Attenuation: Minus 52 dBA minimum at 1.5 to 10 kHz.

2.4 CONTROL AND SIGNAL TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty, complying with NEMA ST 1, and listed and labeled as complying with UL 506.

B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls and floors for suitable mounting conditions where transformers will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install floor-mounting transformers level on concrete bases. Construct concrete bases of dimensions not less than 4 inches larger in both directions than supported unit and 4 inches high.

1. Anchor transformers to concrete bases according to manufacturer's written instructions, seismic codes at Project, and requirements in Section 26 05 00 – General, Electrical.

3.3 CONNECTIONS

A. Ground equipment according to Section 26 05 26 – Grounding and Bonding.

B. Connect wiring according to Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 26 22 00

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this Section.

1.2 SUMMARY

A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:

1. Branch-circuit panelboards.

2. Distribution panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.

b. Bus configuration, current, and voltage ratings.

c. Short-circuit current rating of panelboards and overcurrent protective devices.

d. UL listing.

e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Panelboard Schedules: For installation in panelboards. Scheduling shall be typewritten indicating loads served by each breaker.

D. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.6 EXTRA MATERIALS

A. Keys: Six spares of each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Siemens Energy & Automation, Inc.

b. Square D Co.

c. Eaton

2.2 FABRICATION AND FEATURES

A. Enclosures: Flush or Surface mounted cabinets as indicated. NEMA PB 1, Type 1, to meet environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

B. Front: Secured to box with piano hinged door in door trim. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

C. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

D. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

E. Bus: Copper.

F. Main and Neutral Lugs: Compression type suitable for use with conductor material.

G. Equipment Ground Bus: Copper only Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

H. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

I. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

J. Gutter Barrier: Arrange to isolate individual panel sections.

K. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

L. Feed-through Lugs: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals, unless otherwise stated. Series rating not allowed.

2.4 LOAD CENTERS - NOT ALLOWED.

2.5 BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 DISTRIBUTION PANELBOARDS

A. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Circuit breaker.

C. Branch overcurrent protective devices shall be one of the following:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Circuit Directory: Create a directory to indicate installed circuit loads. Use a computer or typewriter to create the directory; handwritten directories are not acceptable.

E. Install filler plates in unused spaces.

F. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 26 05 00 – Electrical, General.

B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, section 7.5 for switches and section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

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SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.4 SUBMITTALS

A. Product Data: For each product specified.

B. Shop Drawings: Legends for receptacles and switch plates.

C. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NEMA WD 1.

C. Comply with NFPA 70.

1.6 COORDINATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:

a. Cooper Wiring Devices

b. Hubbell, Inc.; Wiring Devices Div.

c. Leviton Manufacturing Co., Inc.

d. Pass & Seymour/Legrand; Wiring Devices Div.

2. Wiring Devices for Hazardous (Classified) Locations:

a. Crouse-Hinds Electrical Co.; Distribution Equipment Div.

b. Killark Electric Manufacturing Co.

c. Pyle-National, Inc.; an Amphenol Co.

2.2 RECEPTACLES

A. Straight-Blade and Locking Receptacles: Industrial grade Leviton 5362 or equal.

B. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle. Do not connect downstream receptacles to load side of GFCI. Design units for installation in a 2-3/4-inch-deep outlet box without an adapter.

C. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap.

1. Devices: Listed and labeled as isolated-ground receptacles.

2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.

2.3 SWITCHES

A. Toggle Switches: Commercial-duty, quiet type.

1. Single Pole Switch: 20 A, 120/277-V AC. Leviton CSB 120 or approved equal.

2. 3-Way Switch: 20A 120/277-V AC: Leviton CSB 320 or approved equal.

2.4 WALL PLATES

A. Single and combination types match corresponding wiring devices. Provide the following wall plate types:

1. Finished Spaces: Nylon/Lexan - White (Emergency receptacle and switch plates shall be red in color and be engraved with the label “Emergency” and be labeled with the panel circuit number).

2. Unfinished spaces: Galvanized steel (Emergency receptacle and switch plates shall be red in color and be engraved with the label “Emergency” and be labeled with the panel circuit number).

3. Exterior non-continuous use: Die cast aluminum or impact resistant thermoplastic with spring loaded flip cover and weather-resistant gasket.

4. Exterior continuous use: Die cast aluminum or impact resistant thermoplastic with 3-1/2" deep "in-use" flip cover and weather-resistant gasket.

2.5 RAISED COVERS, SURFACE MOUNTED

A. Single and double device types to match the corresponding wiring device.

1. Interior spaces only.

2. Cover to be mounted to a 4 square device box.

3. Finish to be galvanized steel.

2.6 FINISHES

A. Color: White, unless otherwise indicated or required by Code.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

F. Protect devices and assemblies during painting.

G. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Section 26 05 00 – Electrical, General.

3.3 CONNECTIONS

A. Connect wiring device grounding terminal to outlet box with bonding jumper.

B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

C. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

D. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Replace damaged or defective components.

END OF SECTION 26 27 26

SECTION 26 28 00 - OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes overcurrent protective devices (OCPDs) rated 600 V and below and switching devices commonly used with them.

1.2 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 specification sections.

B. Product data for fuses, fusible switches, circuit breakers, and OCPD accessories specified in this Section, including descriptive data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cartridge Fuses:
    a. Bussmann Div., Cooper Industries, Inc.
    b. Gould Inc.
    c. Littelfuse Inc.
2. Fusible Switches:
    a. General Electric Co.
    b. Square D Co.
    c. Siemens
    d. Eaton
3. Molded-Case Circuit Breakers:
    a. General Electric Co.
    b. Square D Co.
    c. Siemens

d. Eaton

4. Combination Circuit Breaker and Ground Fault Circuit Interrupters:

a. General Electric Co.

b. Square D Co.

c. Siemens

d. Eaton

5. Molded-Case Circuit Breakers With Solid-State Trip Devices:

a. General Electric Co.

b. Square D Co.

c. Siemens

d. Eaton

2.2 OVERCURRENT PROTECTIVE DEVICES (OCPD'S), GENERAL

A. General: Provide OCPD's in indicated types, as integral components of panelboards, switchboards, and also as individually enclosed and mounted single units.

B. Enclosures: NEMA 250 "Enclosures for Electrical Equipment (1,000 Volts Maximum)."

2.3 CARTRIDGE FUSES

A. General: NEMA Standard FU1, "Low-Voltage Cartridge Fuses." Unless indicated otherwise, provide nonrenewable cartridge fuses of indicated types, classes, and current ratings that have voltage ratings consistent with the circuits on which used.

B. Class RK1 and RK5 Dual Element Time-Delay Fuses: UL 198E, "Class R Fuses."

2.4 FUSIBLE SWITCHES

A. General: UL 98 "Enclosed and Dead Front Switches" and NEMA KS 1 "Enclosed Switches," quick-make, quick-break heavy-duty units.

B. Rating: Load-breaking capacity in excess of the normal horsepower rating for the switch.

C. Withstand Capability: In excess of the let-through current permitted by its fuse when subject to faults up to 100,000 RMS symmetrical amperes.

D. Operation: By means of external handle.

E. Interlock: Prevents access to switch interior except when in "off" position.

F. Fuse Clips: Rejection type.

G. Padlocking Provisions: For 2 padlocks, whether open or closed.

H. Enclosure for Independent Mounting: NEMA Type 1 enclosure except as otherwise indicated or required to suit environment where located.

2.5 NON-FUSED SWITCHES

A. General: UL 98 "Enclosed and Dead Front Switches" and NEMA KS 1 "Enclosed Switches," quick-make, quick-break heavy-duty units.

B. Rating: Load-breaking capacity in excess of the normal horsepower rating for the switch.

C. Withstand Capability: In excess of the let-through current permitted by its fuse when subject to faults up to 100,000 RMS symmetrical amperes.

D. Operation: By means of external handle.

E. Interlock: Prevents access to switch interior except when in "off" position.

F. Padlocking Provisions: For 2 padlocks, whether open or closed.

G. Enclosure for Independent Mounting: NEMA Type 1 enclosure except as otherwise indicated or required to suit environment where located.

2.6 MOLDED-CASE CIRCUIT BREAKERS

A. General: UL 489, "Molded Case Circuit Breakers and Circuit Breaker Enclosures," and NEMA AB 1, "Molded Case Circuit Breakers."

B. Construction: Bolt-in type, except breakers 225-ampere frame size and larger may be plug-in type if held in place by positive locking device requiring mechanical release for removal.

C. Characteristics: Indicated frame size, trip rating, number of poles, and a short-circuit interrupting capacity rating of 10,000 amperes symmetrical, unless a greater rating as indicated.

D. Tripping Device: Quick-make, quick-break toggle mechanism with inverse-time delay and instantaneous overcurrent trip protection for each pole.

E. Adjustable Instantaneous Trip Devices: Factory adjusted to low-trip-setting current values.

F. Enclosure for Independent Mounting: NEMA Type 1 enclosure, except as otherwise indicated or required to suit environment where located.

G. Combination Circuit Breakers and Ground Fault Circuit Interrupters: UL 943 "Ground Fault Circuit Interrupters," arranged for sensing and tripping for ground fault current in addition to overcurrent and short-circuit current. Provide features as follows:

1. Match features and module size of panelboard breakers and provide clear identification of ground fault trip function.

2. Trip Setting for Ground Fault: 30 milliamperes.

2.7 OCPD ACCESSORIES

A. Shunt-Trip Devices for Circuit Breakers: Where indicated, arrange to trip breaker from an external source of power through a control switch or relay contacts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Independently Mounted OCPD's: Locate as indicated and install in accordance with manufacturer's written installation instructions.

B. OCPD's in distribution equipment shall be factory installed.

3.2 CONNECTIONS

A. Check connectors, terminals, bus joints, and mountings for tightness. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.3 GROUNDING

A. Provide equipment grounding connections for individually mounted OCPD units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.4 FIELD QUALITY CONTROL

A. Visual and mechanical inspection: Include the following inspections and related work.

1. Overcurrent-Protective-Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall recommend final protective device ratings and settings. Use accepted revised ratings or settings to make the final system adjustments.

2. Inspect for defects and physical damage, NRTL labeling, and nameplate compliance with current single line diagram.

3. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.

4. Check tightness of electrical connections of OCPD's with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

5. Clean OCPD's using manufacturer's approved methods and materials.

B. Retest: Correct deficiencies identified by tests and observations and provide retesting of OCPD's. Verify by the system tests that specified requirements are met.

3.5 CLEANING

A. Upon completion of installation, inspect OCPD's. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 26 28 00

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SECTION 26 29 23 – VARIABLE-FREQUENCY MOTOR CONTROLLERS)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes solid-state, PWM and VFD, VFCs for speed control of three-phase, induction motors. These VFCs are to be enclosed in freestanding NEMA 250, Type 12, unless otherwise indicated to comply with environmental conditions at installed location, see Electrical Drawings and Divisions 40-46 and 46 specifications.

B. VFC vendor to provide VFC that will operate at installed altitude. Vendor shall verify altitude.

1.2 SUBMITTALS

A. Product Data: For each type of VFC, provide dimensions; mounting arrangements; location for conduit entries; shipping and operating weights; and manufacturer's technical data on features, performance, electrical ratings, characteristics, and finishes.

B. The following shall be included in the bid package:

1. Description of equipment and tests included in bid to meet the indicated power quality requirements.

2. Nearest factory authorized service center meeting all points of 1.03A.

3. Qualification and name of engineering and technical persons responsible for support and warranty of this project.

C. The following shall be included in the submittal package and be approved by the engineer prior to any construction of the VFC system:

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.

b. Nameplate legends.

c. Short-circuit current ratings of integrated unit.

2. Wiring Diagrams: Power, signal, and control wiring for VFC. Provide schematic wiring diagram for each type of VFC.

3. Detailed description of the filter equipment and sample graphs and data to meet IEEE 519-1992.

4. Carrier frequency information.

D. Field Test Reports: Written reports specified in Part 3.04D below.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For VFCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 26 05 00 – Electrical, General, include the following:

1. Routine maintenance requirements for VFCs and all installed components.

2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and 24 hour emergency maintenance and repairs.

B. Source Limitations: Obtain VFCs of a single type through one source from a single manufacturer.

C. The system shall be pre-integrated with the necessary harmonic mitigation equipment.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70, IEEE 519-1992, ANSI C37, and ANSI C57.

1.4 COORDINATION

A. Match features of VFCs, installed units, and accessory devices with pilot devices and control circuits to which they connect.

B. Match features, accessories, and functions of each VFC and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load. See Division 40 sections for information on motor control sequence.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: To match existing parts and integration requirements, provide products by the following:

1. Eaton

2. Allen Bradley; Rockwell Automation.

B. Contractor job site integration of reactors, harmonic filters, power components, etc. may be required. Start-up, harmonic testing and warranty support services must be supplied by the above or other qualified company approved by engineer. Allowable harmonic limits to be coordinated with Avista Utilities.

2.2 VARIABLE FREQUENCY CONTROLLERS

A. Description: NEMA ICS 2, IGBT, PWM, VFD, VFC; listed and labeled as a complete unit and arranged to provide variable speed of a NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency. Refer to Divisions 40 – 43 and 46 for additional information on motors controlled by VFCs.

B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

C. Output Rating: 3-phase; 6 to 120 Hz, with horsepower constant throughout speed range.

D. Unit Operating Requirements:

1. Input ac voltage tolerance of 480 V, plus or minus 10 percent.

2. Input frequency tolerance of 60 Hz, plus or minus 6 percent.

3. Output Rating: 3-phase; 6 to 66 Hz, with amperage equal or greater to motor nameplate amperage including altitude derating.

4. Minimum Inverter Efficiency: 96 percent at 60 Hz, full load.

5. Minimum Displacement Primary-Side Power Factor: 96 percent lagging.

6. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.

7. Starting Torque: Default to be 50% with adjustment to 120%.

8. Speed Regulation: Plus or minus 1 percent.

9. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.

E. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.

2. Maximum Speed: 80 to 100 percent of maximum rpm.

3. Acceleration: Adjustable from .01 to 3600 seconds.

4. Deceleration: Adjustable from .01 to 3600 seconds.

5. Current Limit: 50 to a minimum of 110 percent of maximum rating.

6. Input transient protection by means of surge suppressors.

7. Snubber networks to protect against malfunction due to system voltage transients.

8. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.

9. Filtering to prevent noise interference with other electronic equipment.

10. Motor Overload Relay: Adjustable.

11. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.

12. Instantaneous line-to-line and line-to-ground overcurrent trips.

13. Loss-of-phase protection.

14. Reverse-phase protection.

15. Short-circuit protection.

16. Motor overtemperature fault.

F. Automatic Reset and Restart: To attempt three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bi-directional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.

G. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped. VFC to automatically re-start motor after outage.

H. Carrier Frequency Adjustment: Provide ability to manually adjust drive carrier frequency. VFCs 100HP and less shall provide carrier frequency adjustment capability from 1 to 10kHz. VFCs over 100HP shall include carrier frequency adjustment information recommended by the manufacturer.

I. Torque Boost: Automatically vary starting and continuous torque to at least 1.5 times the minimum torque to insure high-starting torque and increased torque at slow speeds.

J. Motor Temperature Compensation at Slow Speeds: Adjustable current fallback based on output frequency for temperature protection of self-cooled fan-ventilated motors at slow speeds.

K. Provide line and load side filtering to minimize total harmonic distortion.

L. Status Lights: Door-mounted LED indicators shall indicate the following conditions:

1. Power on.

2. Run.

3. Fault.

M. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches and elapsed time meter.

N. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:

1. Output frequency (Hz).

2. Motor speed (rpm).

3. Motor status (running, stop, and fault).

4. Motor current (amperes).

5. Motor torque (percent).

6. Fault or alarming status (code).

7. PID feedback signal (percent).

8. DC-link voltage (VDC).

9. Set-point frequency (Hz).

10. Motor output voltage (V).

O. Control Signal Interface: Provide VFC with the following:

1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.

2. Pneumatic Input Signal Interface: 3 to 15 psig (20 to 104 kPa).

3. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:

a. 0 to 10-V dc.

b. 0-20 or 4-20 mA.

c. Potentiometer using up/down digital inputs.

d. Fixed frequencies using digital inputs.

e. RS485.

f. Ethernet connectivity using Ethernet/IP or MODBUS protocol

g. Keypad display for local hand operation.

h. Remote start/stop input

4. Output Signal Interface:

a. Provide two analog output signals (0/4-20 mA), which can be programmed for the following:

b. Output frequency (Hz).

c. Output current (load).

d. DC-link voltage (VDC).

e. Motor torque (percent).

f. Motor speed (rpm).

g. Set-point frequency (Hz).

5. Remote Indication Interface: Provide dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

a. Motor running.

b. Set-point speed reached.

c. Fault and warning indication (overtemperature or overcurrent).

d. PID high or low speed limits reached.

e. Drive system is in remote.

P. Integral Disconnecting Means: Provide HACR rated breaker as indicated on drawings.

2.3 ACCESSORIES

A. Devices shall be factory installed in motor control center.

B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

D. Control Relays: Auxiliary and adjustable time-delay relays.

E. Standard Displays:

1. Output frequency (Hz).

2. Set-point frequency (Hz).

3. Motor current (amperes).

4. DC-link voltage (VDC).

5. Motor torque (percent).

6. Motor speed (rpm).

7. Motor output voltage (V).

F. Historical Logging Information and Displays:

1. Real-time clock with current time and date.

2. Running log of total power versus time.

3. Total run time.

4. Fault log, maintaining last four faults with time and date stamp for each.

G. Harmonic Mitigation: Complying with IEEE Standard 519-1992 shall be a requirement of this project. Harmonic filters, 18 pulse converter configurations, phase multiplication devices, or any other components required to mitigate harmonic voltage and current to IEEE Std. 519-1992 shall be an integral part of the VFC system. Designs which are not pre-integrated and factory wired as part of the UL label will not be acceptable.

1. Designs which cause voltage rise at the VFC terminals must document coordination with the total system variation to prevent nuisance tripping.

2. Designs which do not provide both true and displacement, measured at the VFC terminals, of at least 95% or better at full load are not acceptable. Designs that allow leading power factor at minimum loads are not acceptable.

H. Relevant data for VFC vendor calculations to meet IEEE Std. 519-1992 requirements are as follows:

1. The point of common coupling (PCC) shall be defined per 3.1.C below.

2. The calculated load current (I_L) shall be the total combined full load current of each ASD system supplied as part of this project or the total combined amperage of loads designated as “non-linear”.

3. The VFC vendor is responsible for determining the short circuit current (I_{SC}) available at the PCC.

2.4 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Select features of each VFC to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, drive, and load.

B. Select rating of controllers to suit motor controlled. The VFC vender shall certify that the supplied equipment is properly matched to the loads being fed.

C. The drive shall be capable of operating in compliance with IEEE 519-1992, with point of common coupling (PCC) defined as the point at which each individual device is connected to the electrical distribution system. Drive manufacturer shall provide harmonic calculations and on-site post installation harmonic testing with certified reports prior to final acceptance of installation. See 3.04D.

3.2 IDENTIFICATION

A. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

3. All tests necessary to prove compliance with IEEE Standard 519-1992.

B. Testing: Perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections 7.5, 7.6, and 7.16. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including pretesting and adjusting VFCs.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 sections.

C. Complete installation and startup checks according to manufacturer's written instructions.

3.6 ADJUSTING

A. Set field-adjustable switches.

3.7 CLEANING

A. Clean VFCs internally, on completion of installation, according to manufacturer's written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain VFCs.

END OF SECTION 26 29 23

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SECTION 26 32 13 – ENGINE GENERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Extent of engine generator set Work is indicated by drawings and is hereby defined to include, but not by way of limitation, engines, electrical generators, engine starting systems including batteries, instrument control panel, transfer switches, annunciator panel, exhaust silencer, and accessories required for a complete generator installation.

B. Generator set required for the project is a diesel engine-driven unit.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data on engine-driven generator sets and components. Submit wiring diagrams for engine-driven generator units showing connections to electrical power panels, feeders, automatic transfer switches, and ancillary equipment. Differentiate between portions of wiring that are manufacturer-installed and portions that are field-installed.

B. Maintenance data for materials and products, for inclusion in Operating and Maintenance Manual specified in Section 26 05 00 – Electrical, General. Include complete Operations and Maintenance Manual, Illustrated Parts List and Maintenance Schedule.

C. Certifications: Provide engine-driven generator sets certified test record of the following final production testing:

1. Single-step load pickup.

2. Transient and steady state governing. The generator will serve loads controlled by VFD’s. Manufacturer shall take appropriate measures. Refer to drawings for loads served.

3. Safety shutdown device testing.

4. Voltage regulation.

5. Rated power.

6. Maximum power.

D. Provide certified test record prior to engine-driven generator set being shipped from factory to project location.

E. Unit Responsibility: The complete standby emergency generator systems are to be tested under full load conditions, as a unit, before being shipped to the job site from factory. Installation and hook-up to be under direct supervision of factory trained personnel.

F. The automatic transfer control shall be supplied per specification Section 26 36 00 – Transfer Switches and integrated with the engine-generator.

G. Generator support shall be a factory authorized service center located within a 200 mile radius of the project site.

1.3 DELIVERY, STORAGE AND HANDLING

A. Deliver engine-driven generator properly packaged and mounted on pallets, or skids to facilitate handling of heavy items. Utilize factory-fabricated type containers or wrappings for engine-generator and components that protect equipment from damage.

B. Store engine-driven generator equipment in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.

C. Handle engine-driven generator equipment carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diesel generator sets which may be incorporated in the Work include the following:

1. Caterpillar Tractor Co.

B. Generator Sets

1. General: Except as otherwise indicated, provide manufacturer's standard engine-driven generator sets and auxiliary equipment as indicated by published product information, and as required for a complete installation.

2. Engine-Driven Generator: Provide packaged electrical power engine-driven generator assembly unit rated as indicated on drawings, at a governed speed of 1800 RPM, and rated 80 percent power factor for continuous operation, 480/277 volt, 3-phase, 4-wire, 60 Hz, at installed altitude (verify altitude), at 110 deg. F. Equip generator with a turbo-charged, 1800 RPM, engine, and fueled as noted; liquid cooled. Engine shall meet all EPA Tier level requirements at time engine is manufactured. Provide unit-mounted radiator, blower fan, water pump, and thermostat. Connect engine drive directly to 4-pole revolving-field type single, maintenance-free, bearing generator through semi-flexible steel disk coupling; equip set with associated control equipment to automatically start engine, transfer load to standby power upon failure of normal power source, transfer load back to normal power upon its restoration, and stop engine. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees Centigrade. Cushion-mount engine-generator on heavy steel base with spring type vibration isolators to reduce possibility of torsional vibration. Provide water-cooled type engine with unit-mounted radiator. Equip engine with low-oil pressure, high-water temperature, and automatic overspeed safety shutdown devices. Equip generator with exciter and voltage regulator to maintain voltage within 2 percent of rated value. Direct-connect generator to fly wheel by semi-flexible steel disk coupling. Provide unit capable of voltage recovery, within regulated range, of 7 seconds following sudden load increase from 0 to 100 percent of rated load, and with voltage dip not to exceed 35 percent upon application of rated load at rated power factor. Construct unit in compliance with applicable standards; and with additional construction features as indicated:

   a. Motor Starting Accessories: The generator will be used to feed motor loads that are controlled via variable frequency drives. Provide items for improved motor starting and generator regulation such as permanent magnet generator end, electronic governor, voltage regulators, etc..

   b. Starting System: Provide engine-generator units with 24-volt, 3-wire, negative ground, starting systems including 24-volt positive engagement solenoid shift-starting motors, batteries and 35-ampere, or greater, automatic battery charging alternators with solid-state voltage regulation.

   c. Instrument Control Panel: Provide engine-generator units with engine oil-pressure and water-temperature indicators, battery charge-rate ammeter, START - STOP switch for manual operation of unit, reset circuit breaker, static voltage regulator, voltage-adjusting rheostat, voltmeter, ammeter with phase selector switch with an OFF position, and with running time indicator and frequency meters. Select type circuitry of plug-in design capable of quick replacement, and of accepting a plug-in device that allows maintenance to test control panel performance without operating the engine.

   d. Controller: Provide a set mounted controller that complies with applicable NFPA standards. Controller shall provide all indicators, alarms, and monitoring functions that a Cummins Power Command Control 2100 provides per NFPA 110 level one requirement. Controller shall be accessible without the use of ladders, steps, etc.

e. Connection to Data Link: Provide a ethernet connection to SCADA. The controls shall have the ability to communicate in a common protocol with the programmable logic controller for the following:

1) Engine high-temperature shutdown.

2) Lube-oil low-pressure shutdown.

3) Overspeed shutdown.

4) Remote emergency-stop shutdown.

5) Engine high-temperature pre-alarm.

6) Lube-oil low-pressure pre-alarm.

7) Fuel tank, low-fuel level.

8) Low coolant level.

9) Over crank shutdown.

10) Coolant low-temperature alarm.

11) Control switch not in auto position.

12) Battery-charger malfunction alarm.

13) Battery low-voltage alarm.

f. Provide hardwired dry contact connection to SCADA for the following signals:

1) Generator Running

2) Generator Fault

3) Generator not in Auto.

2.2 ENGINE-GENERATOR SET ACCESSORIES

A. Provide factory-fabricated automatic load-transfer switch control, mated to generator to automatically start generator unit when line voltage drops to 70 percent normal value, transfer load to generator, and transfer load back to normal source when voltage is restored to 90 percent normal, and when line voltage reaches 115% rated voltage, restoring at 100% rated voltage. Equip electrically operated, mechanically held, and electrically and mechanically interlocked, transfer switch with limiter that opens starting circuit after 45 seconds when engine fails to start. Also provide time-delay features to prevent excessive transfer and retransfer operation during momentary line voltage dips, load retransfer, and engine shutdown. Equip unit with indicator for starting, test switch for manual simulation of power outages including standby unit operation and load transfer, and time-clock exerciser circuit for automatic periodic exercise under load of engine-generator unit. Provide 120V control circuit for control of louvers. Provide service rated main circuit breaker mated to generator. Breaker shall be accessible without the use of ladders, steps, etc.

B. Provide battery rack, battery warmers, battery cables, 12-volt battery(ies) capable of delivering the minimum cold-cranking amps required at zero degrees Fahrenheit per SAE Standard J-537.

C. Provide gas proof, seamless, stainless steel, flexible exhaust connector.

D. Provide flexible fuel line(s) rated 300 degrees F and 100 PSI ending in pipe thread.

E. Provide engine exhaust silencer, coated to be temperature and rust resistant, rated for critical applications 35dB reduction. Exhaust silencer to be housed inside of weatherproof enclosure.

F. Provide block heater of proper wattage and voltage, thermostatically controlled to maintain engine coolant at 90 degrees Fahrenheit (32 degrees Celsius). The block heater shall be installed with shut-off valves for maintenance. Valves to be field installed.

G. Provide 10-ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/- 10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambients from -40 degrees C to +60 degrees C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.

H. Provide a U.L. 142 label double wall sub base fuel tank of adequate capacity to operate generator 24 hours at full load. Tank shall be of steel construction and installed under the generator. Provide Sub Base Tank to include C Channel or I beam welded beneath the tank spaced 40 inches apart to accept neoprene pads between support beams and concrete floor. Tank shall be equipped with normal and emergency venting. Provide all necessary piping for a complete venting system. Venting shall comply with applicable requirements of IFC. Tank openings and overflow protection shall comply with IFC. Tank to be equipped with supply/return lines installed to engine, low fuel level switch, leak detection, and tank heater. Install tank and accessories per applicable codes, standards, and manufacturers requirements.

I. Provide U.L listed weatherproof sound attenuated (79dB at 23 feet) housing. Housing to be finished inside and out with a rust-inhibiting primer, and then a top coat paint. Side panels to be removable for maintenance and lockable. Provide necessary louvers and exhaust silencer connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which diesel engine-driven generator units are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLATION OF DIESEL ENGINE-DRIVEN GENERATOR SETS

A. Install engine-driven generator unit as indicated, in accordance with the equipment manufacturer's written instructions, and with recognized industry practices, to ensure that engine-generator unit fulfills requirements. Comply with NFPA and NEMA standards pertaining to installation of engine-generator sets and accessories.

B. Coordinate with other work, including raceways, electrical boxes and fittings, fuel tanks, piping and accessories, as necessary to interface installation of engine-generator equipment work with other work.

C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A, B and the National Electrical Code.

D. Align shafts of engine and generator within tolerances recommended by engine-generator unit manufacturer.

E. Contractor to fill tank prior to testing.

3.3 GROUNDING

A. Provide equipment grounding connections for diesel engine-driven generator units as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.

3.4 FIELD QUALITY CONTROL

A. Start-up Testing

1. Engage local equipment manufacturer's representative to perform start-up and load tests upon completion of installation, with the Engineer in attendance; provide certified test record. Tests are to include the following:

a. Check fuel, lubricating oil, and antifreeze in liquid cooled models for conformity to the manufacturer's recommendations under environmental conditions present.

b. Test, prior to cranking engine for proper operation, accessories that normally function while the set is in a standby mode.

c. Check, during start-up test mode, for normal and emergency line-to-line voltage and phase rotation.

d. Test, by means of simulated power outage, automatic start-up by remote-automatic starting, transfer of load, and automatic shutdown. Prior to this test adjust, for proper system coordination, transfer switch timers. Monitor throughout the test, engine temperature, oil pressure, battery charge level, generator voltage, amperes, and frequency. All tests shall be conducted with generator under full (100%) load. Full load test shall be minimum 4 hours under full load.

2. Upon completion of installation demonstrate capability and compliance of system with requirements. Where possible, correct malfunctioning unit at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit, and proceed with retesting. Initial testing and retesting to be at no cost to Owner.

3. Upon completion of all tests and Owner acceptance, Contractor to top off fuel tank.

3.5 PERSONNEL TRAINING

A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating diesel engine-driven generator sets. In addition, train Owner's personnel in periodic maintenance of batteries.

END OF SECTION 26 32 13

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SECTION 26 36 00 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this Section.

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

C. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces for the area/location installed.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, Section 01 78 23 - Operation and Maintenance Data, include the following:

1. Features and operating sequences, both automatic and manual.

2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a 100 mile radius of project location.If an independent testing agency is required, see Division 1 Section "Quality Requirements" for general testing and inspecting agency qualification requirements. If additional control is needed, use first paragraph below to specify 29 CFR 1910.7 or other more specific criteria (e.g., NETA). 29 CFR 1910.7 defines a nationally recognized testing laboratory as it applies to testing and inspecting for safety, and lists, labels, or accepts equipment and materials that meet certain OSHA criteria.

B. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 110.

G. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactor Transfer Switches:

a. Caterpillar; Engine Div.

b. Schneider; ASCO Power Technologies, LP.

c. Onan/Cummins Power Generation; Industrial Business Group.

d. Kohler Power Systems.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.

2. Switch Action: Double throw; mechanically held in both directions.

3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

H. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

I. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

J. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 16050 "Electrical Identification."

K. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated/required.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

B. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

C. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

E. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

F. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

G. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.

H. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

5. Test Switch: Simulate normal-source failure.

6. Switch-Position Pilot Lights: Indicate source to which load is connected.

7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.

11. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.

b. Push-button programming control with digital display of settings.

c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details.

B. Identify components according to Section 26 05 00 – Electrical, General.

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Section 26 05 26 – Grounding and Bonding for Electrical Systems.

C. Connect wiring according to Section 26 05 19 – Low-Voltage Power Conductors and Cables.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.

2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.

3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.

b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.

c. Verify that manual transfer warnings are properly placed.

d. Perform manual transfer operation.

5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.

b. Simulate loss of phase-to-ground voltage for each phase of normal source.

c. Verify time-delay settings.

d. Verify pickup and dropout voltages by data readout or inspection of control settings.

e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.

f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.

B. Coordinate this training with that for generator equipment.

END OF SECTION 26 36 00

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SECTION 26 43 13.A - SURGE PROTECTIVE DEVICES (SPD) FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers (MCC). Refer to related sections for surge requirements in:

1.2 RELATED SECTIONS

A. Section 16426A – Metal Enclosed Draw out Switchgear (Magnum DS) – Low Voltage

B. Section 16426B – Metal Enclosed Draw out Switchgear (DSII) – Low Voltage

C. Section 16428 – Switchboards – Low Voltage (Compartmentalized Feeders – Pow-R-Line i)

D. Section 16429 – Switchboards – Low Voltage (Group Mounted Feeders – Pow-R-Line C)

E. Section 16431 – Switchboards – Low Voltage (Commercial Metering)

F. Section 16466 – Busway – Low Voltage

G. Section 16470 – Panelboards

H. Section 16482A & B – Motor Control Centers – Low Voltage (Freedom and Advantage)

1.3 REFERENCES

A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable standards.

1. ANSI/UL 1449 4th Edition or later

2. ANSI/UL 1283 5th Edition or later (Type 2 applications)

3. IEEE C62.41.1

4. IEEE C62.41.2

5. IEEE C62.43-2005

6. IEEE C62.45-2002

7. IEEE C62.48-2005

8. IEEE C62.62-2010

9. UL 96A

10. NFPA 780

11. FCC Part 15, Subpart B and ICES-003 – Radiated Emissions (for surge protection devices with communication capabilities)

12. FCC Part 15, Subpart B and ICES-003 – Conducted Emissions (for surge protection devices with communication capabilities)

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Provide verification that the SPD complies with the required ANSI/UL 1449 4th Edition or later listing by Underwriters Laboratories (UL). Compliance may be in the form of a file number that can be verified on UL's website www.ul.org, the website should contain the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current In.

B. Where applicable the following additional information shall be submitted to the engineer:

1. Descriptive bulletins

2. Product sheets

1.5 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Section 1.04 and shall incorporate all changes made during the manufacturing process.

1.6 QUALIFICATIONS

A. The manufacturer of the electrical distribution equipment shall be the manufacturer of the SPD within the listed electrical distribution equipment.

B. For the equipment specified herein, the manufacturer shall be ISO 14001 and ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of twenty-five (25) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU and have a visible label showing compliance.

E. The SPD shall be UL 1449 current edition listed, 20 kA I_n Type 1 or Type 2 for use in UL 96A systems.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Operation and maintenance manuals shall be provided with each SPD shipped.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton

1. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.

2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.

3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards. End of life mode to be open circuit. Unit with end of life short-circuit mode are not acceptable.

4. Unit shall operate without the need for an external overcurrent protection device (OCPD) and be listed by UL as such. Unit must not require external OCPD or replaceable internal OCPD for the UL Listing.

5. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

Protection Modes				
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

6. Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.

7. ANSI/UL 1449 4th Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

B. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable single-mode modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

3. Electrical Noise Filter – Each Type 2 unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.

4. Type 2 units with filtering shall conform to UL 1283 5th Edition.

5. Type 1 units shall not contain filtering or have a UL 1283 5th Edition Listing.

6. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.

7. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:

   a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.

      1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.

      2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes

      3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

   b. Remote Status Monitor (optional) – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

   c. Audible Alarm and Silence Button (optional) – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

d. Surge Counter (optional) – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

e. Advanced Monitoring Display (AMD) (optional) - The SPD shall be equipped with an LCD display that indicates to the user the quantity and magnitude of surges that have occurred on each phase.

1) AMD shall display remaining surge protection levels as a percentage with 0% = unprotected, 1-99% = partially protected, 100% = fully protected.

2) In addition to the green/red monitoring solid-state indicator LED (reference 2.E.a) the LED shall include a yellow status to indicate the unit as partially protected

3) AMD shall provide a surge counter for each phase with three categories as defined by IEEE standards (C62.41) as follows:

4) Low Level surge (IEEE Category A)

5) Medium Level surge (IEEE Category B)

6) High Level surge (IEEE Category C)

7) AMD shall provide local access to the following information and data: Surge counts for each phase and per category, total surge counts, event logs with time & date stamps (last 20 events of each category per phase), SPD Protection Level percentage, alarm status, device catalog number, style number, serial number, date code, firmware version, PCB serial number, device name, IP address, ethernet MAC address, and customer support contact information.

8) User shall be capable of inputting the following info into the AMD: set date and time, set device name, change password, clear surge counts & event logs, edit MODBUS status, Edit IP Address, Edit Subnet Mask, and Edit Gateway.

9) User shall be capable of testing the display.

10) The AMD option shall provide a RJ45 ethernet connection port on the surge device, which shall provide a means for secure firmware updates to the SPD.

11) Time and date stamped events to be capable of being downloaded through a RJ45 ethernet connection port.

f. Remote Monitoring (optional with AMD) – The SPD shall be capable of Ethernet communications via Modbus/TCP and BACnet protocols and contain an onboard webpage which complies with UL 2900 standards.

g. BACnet and Modbus/TCP shall be user configurable with access to the following registers:

h. Remaining surge protection levels as a percentage with 0% = unprotected, 1-99% = partially protected, 100% = fully protected

i. LED status for each indicator color (red/yellow/green)

j. Surge counter for each phase with three categories defined using the resultant current from IEEE waveforms (C62.41.2) as follows: Low Level surge (IEEE Category A), Medium Level surge (IEEE Category B), High Level surge (IEEE Category C)

k. Access to the following information and data: Surge counts for each phase and per category, total surge counts, event logs with time & date stamps (last 2000 low, 1500 medium, and 1000 high events on each phase), SPD Protection Level percentage, alarm status, device catalog number, style number, serial number, date code, firmware version, PCB serial number, device name, IP address, ethernet MAC address, and customer support contact information.

l. User shall be capable of remotely inputting the following information: set date and time, set device name, change password, clear surge counts & event logs, change sensitivity settings, edit MODBUS status, edit IP Address, edit Subnet Mask, and edit Gateway.

m. The onboard webpage shall provide a pre-configured user interface with access to the following information:

n. Remaining surge protection levels as a percentage with 0% = unprotected, 1-99% = partially protected, 100% = fully protected

o. LED status for each indicator color (red/yellow/green)

p. Surge counter for each phase with three categories defined using the resultant current from IEEE waveforms (C62.41.2) as follows: Low Level surge (IEEE Category A), Medium Level surge (IEEE Category B), High Level surge (IEEE Category C)

q. Access to the following information and data: Surge counts for each phase and per category, total surge counts, event logs with time & date stamps (last 2000 low, 1500 medium, and 1000 high events on each phase), SPD Protection Level percentage, alarm status, device catalog number, style number, serial number, date code, firmware version, PCB serial number, device name, IP address, ethernet MAC address, and customer support contact information.

r. User shall be capable of remotely inputting the following information: set date and time, set device name, change password, clear surge counts & event logs, edit MODBUS status, edit IP Address, edit Subnet Mask, and edit Gateway.

C. Thermal MOV Protection

1. The unit shall contain thermally protected MOVs. These self-protected MOVs shall have a thermal protection element integrated with the MOV and a mechanical disconnect with arc quenching capabilities in order to achieve overcurrent protection of the MOV. The thermal protection assembly shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur, that would cause them to enter a thermal runaway condition.

2. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. The use of plug in single-mode modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

D. Safety Requirements

1. The SPD shall minimize potential arc flash hazards by containing no single-mode plug in user serviceable / replaceable parts and shall not require periodic maintenance. SPDs containing items such as replaceable single-mode plug in modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

2. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.3 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

2.4 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.

2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.

3. The panelboard shall be capable of re-energizing upon removal of the SPD.

4. The SPD shall be integral to the panelboard and connected directly to the bus. Alternately, an integral SPD can be connected to a circuit breaker for disconnecting purposes, in the case a disconnect is required.

5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.

6. The SPD shall be of the same manufacturer as the panelboard.

7. The complete panelboard including the SPD shall be UL67 listed.

2.5 SWITCHGEAR, SWITCHBOARD, MCC AND BUSWAY REQUIREMENTS

A. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.

B. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, or busway.

C. The SPD shall be factory installed integral to the switchgear, switchboard, MCC, and/or bus plug at the assembly plant by the original equipment manufacturer.

D. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.

E. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.

F. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.

G. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.6 SERVICE ENTRANCE REQUIREMENTS

A. Service entrance located SPDs shall be tested and designed for applications within ANSI/IEEE C62.41 Category C environments.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA, IEEE, and UL standards.

3.2 INSTALLATION

A. The installation of the SPD shall be factory installed integral to the distribution equipment. The Contractor shall install all distribution equipment per the manufacturer's recommendations, applicable electrical codes, and the contract drawings.

3.3 WARRANTY

A. The manufacturer shall provide a ten (10) year warranty (15 year warranty with registration) that covers replacement of the complete unit, including lightning, from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local electrical code.

END OF SECTION 26 43 13.A

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this Section.

1.2 SUMMARY

A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, LED light engines, LED drives, lamps, ballasts, emergency lighting units, and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:

1. Dimensions of fixtures.
2. LED drivers.
3. LED light engine.
4. Fluorescent and high-intensity-discharge ballasts.
5. Types of lamps.

B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

C. Product Certificates: Signed by manufacturers of lighting fixtures certifying that products comply with requirements.

D. Dimming Ballast Compatibility Certificates: Signed by manufacturer of ballast certifying that ballasts are compatible with dimming systems and equipment with which they are used.

E. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NFPA 70.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

B. Exterior Building Lights: Coordinate exterior conduit penetrations for connections to the back of building mounted fixtures. Coordinate locations and install back boxes as required during construction of walls, framing and other related construction.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty for Batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Special Warranty Period for Batteries: Manufacturer's standard, but not less than 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for last nine years.

C. Special Warranties for LED Drivers and Fluorescent Ballasts: Written warranty, executed by manufacturer agreeing to replace LED drivers and fluorescent ballasts that fail in materials or workmanship within specified warranty period.

1. Special Warranty Period for LED Drivers and Electronic Ballasts: Five years form date of manufacture, but not less than four years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation:

1. Light Fixtures: As indicated on Drawing fixture schedule.

2. LED Drivers: Compatible with LED light engine.

3. LED Light Engine: Per manufacturer on Drawing fixture schedule.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during maintenance and relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.

2. Lens Thickness: 0.125-inch minimum, unless greater thickness is indicated.

2.3 LED DRIVERS

A. General Requirements: Unless otherwise indicated, features include the following:

1. Shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47, Part 15.

2. Total Harmonic Distortion Rating: Less than 20 percent at all input voltages.

3. Sound Rating: A.

4. Minimum efficiency of 85%.

B. LED Drivers: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:

1. Dimmable drivers shall be 0-10V type.

2. Dimmable drivers shall be capable of dimming without LED flicker or strobing across their full dimming range.

2.4 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.

B. Internally Lighted Signs: As follows:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

2.5 EMERGENCY LED AND FLUORESCENT POWER SUPPLY UNITS

A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.

1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space. Test switch shall illuminate LEDs or lamps for minimum of 3 minutes when pushed momentarily.

2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 5-year nominal life.

3. Charger: Fully automatic, solid-state, constant-current type.

4. Operation: Relay automatically energizes LEDs or lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects LEDs or lamp, and battery is automatically recharged and floated on charger.

5. Lumen output: Minimum 700 lumens (LED), Minimum 1350 lumens (T8 minimum lamps), Minimum 750 lumens (compact fluorescent 4-pin lamps).

2.6 LED LIGHT ENGINES

A. LED Color Temperature: 3500 K, unless otherwise indicated.

B. CCT tolerances are to be kept within a 3-step MacAdam ellipse and are to maintain a Min CRI of 80.

2.7 LAMPS

A. Fluorescent Color Temperature: 3500 K, unless otherwise indicated. See construction document light fixture schedule for exact lamp types.

B. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid-start circuits.

2.8 FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 05 00 – Electrical, General for channel- and angle-iron supports, and nonmetallic channel and angle supports.

B. Single-Stem Hangers: ½ -inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.9 FINISHES

A. Fixtures: Manufacturer's standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.

2. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer’s written instructions and approved Shop Drawings. Support fixtures according to requirements of Section 26 05 00 –Electrical, General.

B. Support for Recessed and Semi-recessed Grid-type Fixtures:

1. Pendant-hung lighting fixtures shall be supported directly from the structure above using No. 9-gauge wire or an approved alternate support without using the ceiling suspension system for direct support.

2. Lighting fixtures weighing less than 56 pound shall have, in addition to the requirements outlined above, two No. 12 gauge hangers connected from the fixture housing to the structure above. These wires may be slack.

3. Lighting fixtures weighing 56 pound or more shall be supported directly from the structure above by approved hangers.

C. Support for Suspended Fixtures: Brace pendants and rods over 48 inches long to limit swinging. Support stem-mounted, single-unit, suspended fixtures with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.

D. Surface-mounted lighting fixtures shall be attached to the ceiling system with positive clamping devices that completely surround the supporting members. Safety wires shall be attached between the clamping device and the adjacent ceiling hanger or to the structure above. In no case shall the fixture exceed the design carrying capacity of the supporting members.

E. Exterior-mounted lighting fixtures shall be mounted according to the manufacturer's instructions. Conduit shall be concealed within walls or installed within the building and then penetrate to exterior fixture. Surface mounted conduit on exterior of the building is not acceptable. All penetrations are to be sealed.

3.2 CONNECTIONS

A. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 467, UL 486A, and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Tests: As follows:

1. Verify normal operation of each fixture after installation.

2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.

3. Verify normal transfer to battery source and retransfer to normal.

C. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

D. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust amiable fixtures to provide required light intensities.

END OF SECTION 26 51 00

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this Section.

1.2 SUMMARY

A. This Section includes exterior lighting fixtures, lamps, ballasts, poles standards, and accessories.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data describing fixtures, lamps, ballasts, poles, and accessories. Arrange product data for fixtures in order of fixture designation. Include data on features, poles, accessories, and the following:

1. Outline Drawings of fixtures and poles indicating dimensions and principal features.

2. Electrical ratings and photometric data with certified results of laboratory tests.

C. Maintenance data for materials and products, for inclusion in Section 01 78 23 – Operation and Maintenance Data and Section 26 05 00 – Electrical, General. Include service bulletin(s).

1. Submit maintenance data and parts list for each roadway and parking area lighting fixture and accessory; including "trouble-shooting" maintenance guide. Include that data, product data, service bulletin(s), and illustrated parts list in a maintenance manual; in accordance with requirements of Division 1.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of exterior lighting units, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with exterior lighting installation work similar to that required for this Project.

PART 2 - PRODUCTS

2.1 FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs and sharp edges and corners.

B. Sheet Metal Components: Corrosion-resistant aluminum, except as indicated. Form and support to prevent warping and sagging.

C. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed fixtures.

D. Doors, Frames, and Other Internal Access Provisions: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position. Provide for door removal for cleaning or replacing lens. Arrange for door opening to disconnect ballast.

E. Exposed Hardware Material: Stainless steel.

F. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

G. Plastic Parts: Resistant to yellowing and other changes due to aging and exposure to heat and UV radiation.

H. Lenses and Refractors: Materials as indicated. Use heat-and aging-resistant, resilient gaskets to seal and cushion lens and refractor mounting in fixture doors.

I. Photoelectric Relay: UL 773.

1. Contact Relays: Single-throw, arranged to fail in the "on" position and factory set to turn light unit on at 1.5 to 3 footcandles and off at 4.5 to 10 footcandles with 15 seconds' minimum time delay.

2. Relay Mounting: In fixture housing.

2.2 FIXTURE SUPPORT COMPONENTS

A. Mountings, Fastenings, and Appurtenances: Provide mountings that will correctly position the luminaire to provide the indicated light distribution.

2.3 FINISH

A. Metal Parts: Manufacturer's standard finish except as otherwise indicated. Finish applied over corrosion-resistant primer after fabrication, free of streaks, runs, holidays, stains,

blisters, and similar defects. Remove poles, fixtures, and accessories showing evidence of corrosion or finish failure during Project warranty period and replace with new items.

B. Other Parts: Manufacturer's standard finish except as otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units plumb, square, level, and secure according to manufacturer's written instructions and shop drawings.

B. Fixture Attachment: Fasten to indicated structural supports.

C. Fixture Attachment with Adjustable Features or Aiming: Attach fixtures and supports to allow aiming for indicated light distribution.

D. Lamp fixtures with indicated lamps according to manufacturer's instructions. Replace malfunctioning lamps.

3.2 FIELD QUALITY CONTROL

A. Inspect installed units for damage.

B. Provide advance notice of dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source. Include the following:

1. Check for excessively noisy ballasts.

2. Check for uniformity of illuminations.

E. Replace or repair damaged and malfunctioning units and retest.

3.3 ADJUSTING AND CLEANING

A. Clean components on completion of installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 26 56 00

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SECTION 28 31 11 – BUILDING INTRUSION DETECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide intrusion detection devices, complete and operable, in accordance with the Contract Documents. The intrusion switch shall be magnetic or mechanical single point switch type mounted as recommended by the manufacturer's installation instructions for optimum accuracy.

B. This Section describes the requirements for intrusion switches.

1.2 REFERENCE STANDARDS

A. Commercial Standards

1. ISA – S 5.1 Instrumentation Symbols and Identification

1.3 SUBMITTALS

A. General: Follow the procedures specified in Section 01 33 00 – Submittal Procedures.

B. Each switch shall be identified with its equipment number as indicated. The following shall be included in the submittal for this Section:

1. Data Sheets and Catalog literature for the intrusion switches.

2. Connection diagrams for equipment wiring.

3. Material of construction, cable lengths and dimensional data.

C. Technical Manual: Furnish 5 identical copies of complete operation and maintenance instruction of all the intrusion switches including instrumentation and controls.

D. Spare Parts List: The Contractor shall furnish a list of manufacturer's recommended spare parts

1.4 SUBSTANTIAL COMPLETION

A. At Substantial Completion of Project, be ready to demonstrate that all intrusion switches are installed and operational.

1.5 QUALITY ASSURANCE

A. Accuracy Requirements: n/a

B. Warranties: After completion, the Contractor shall furnish to the Owner the manufacturer's written guarantees, that the switch will operate within the published accuracies and ranges and meet these specifications. The Contractor shall also furnish the manufacturer's warranties as published in its literature.

PART 2 - PRODUCTS

2.1 GENERAL

A. Field adjustable mounting options shall be included.

2.2 INTRUSION SWITCH

A. The intrusion switch shall be magnetically activated.

B. Exterior applications will be NEMA 6P.

C. Miniature Size 1.5-inch x 5/8-inch, Heavy Duty extruded aluminum, Wide Gap 1-inch standard, 18-inch armored cable and lead. SPDT Type C Contact.

D. Contact shall open on door/hatch open.

E. The intrusion switch shall be GRI 4462A series, GE 2500 series or approved equal.

F. An interposing relay will be used if connected to voltages greater than 24VDC

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall assemble and install all equipment specified herein, in strict accordance with the manufacturer's published instructions. All installations shall be accomplished by competent craftsman in a workmanlike manner.

3.2 INSTALLATION

A. Intrusion switches shall be mounted in such a way that it is free to operate without obstruction.

B. The intrusion switches shall be installed to prevent false alarms from door/hatch vibrations due to wind when the door/hatch is closed.

C. Wiring between intrusion switch and SCADA RTU shall use cable type and procedures as per the manufacturer's recommendations.

D. Final acceptance of the equipment is contingent on satisfactory operation after installation.

3.3 SPARE PARTS

A. One spare intrusion switch shall be provided to the Owner.

END OF SECTION 28 46 11.23

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SECTION 31 00 00 - EARTHWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all labor, materials, and equipment as required for all excavation, grading, providing borrow materials, hauling, placing and compacting earthwork materials to construct the site to the grades shown on the plans.

B. Prior to commencement of any earthwork, the Contractor shall review the geotechnical reports. The geotechnical report is on file at the office of the Engineer for information only and the Contractor is responsible for making any interpretations there from.

C. Submit to the Engineer's Field Representative load tickets on all materials delivered to the site.

1.2 REFERENCE STANDARDS

A. ASTM D 136 Sieve Analysis of Fine and Coarse Aggregates

B. ASTM D 422 Method for Particle - Size Analysis of Soils

C. ASTM D 698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregated Mixtures, Using 5.5-lb Rammer and 12-inch Drop

D. ASTM D 1556 Density of Soil by the Sand-Cone Method

E. ASTM D 1557 Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures, Using 10 lb. Rammer and 10 inch Drop

F. ASTM D 1633 Test Method for Compressive Strength of Molded Soil-Cement Cylinders

G. ASTM D 2419 Test Method for Sand Equivalent Value of Soils and Fine Aggregate

H. ASTM D 2487 Classification of Soils for Engineering Purposes

I. ASTM D 2901 Test Method for Cement Control of Freshly-Mixed Soil Cement

J. ASTM D 2922 Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

K. ASTM D 4254 Test Methods for Minimum Index Density of Soils and Calculative of Relative Density

L. OSHA - 1926.650-651 and other applicable sections.

1.3 SUBMITTALS

A. The Contractor shall submit test results of all materials proposed to be used in work in accordance with the requirements of Section 01 33 00 - Submittal Procedures.

B. Submit sieve analysis, moisture density relationship test for both ASTM D698 and D1557, and sand equivalency. The sieve analysis and moisture density relationship tests must have been completed within 12 calendar months from the date of submittal.

1.4 DEFINITIONS

A. Backfill or Fill: (a) Material used to replace material removed during construction or (b) The act of replacing or placing material during construction.

B. Backfill Operation or Fill Operation: The method and the activity required to fill surface depressions and excavations, or to construct fills to required grades.

C. Common Fill: Fill or borrow materials which are naturally occurring and not meeting a specific gradation or classification.

D. Structural Fill: The act of placing common or imported fill material under controlled operation to a certain density.

PART 2 - PRODUCTS

2.1 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

A. The following types of suitable materials are defined:

1. Sand Backfill (Bedding Sand): Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a Number 4 sieve and less than 3% passing the No. 200 sieve.

2. Crushed Stone Backfill (Bedding Chips): Manufactured angular, crushed stone, crushed rock, or crushed slag with the following gradation requirements:

Sieve Size	Percent Passing By Weight
1”	100
3/4"	80 - 100
3/8”	20 - 70
No. 4	5 - 20
No. 200	0 - 3

3. Foundation Stabilization Backfill: Uncrushed gravel, and sand with the gradation requirements below. The material shall have a minimum sand equivalent value of 28, sand equivalent not required if less than 5% passing the No. 200 sieve.

Sieve Size	Percent Passing By Weight
3”	100
No. 4	25 - 60
No. 200	0 - 12

4. Coarse Gravel (Drain Rock): Crushed rock or gravel which is free of shale, clay, friable materials, and or debris that conforms to the gradation below. Drain Rock shall have a minimum of 35% Air Voids as determined by ASTM C 29 Standard Test Method for Unit Weight and Voids in aggregate, Jigging Procedure.

Sieve Size	Percent Passing By Weight
3”	100
1”	25 - 60
3/8”	0 - 4
200	0 - 2

5. Aggregate Base (3/4” Road Mix): Crushed aggregate base material of such nature that it can be compacted readily by watering and rolling to form a firm, stable base. The material shall meet the following gradation requirements:

Sieve Size	Percent Passing By Weight
1”	100
3/4"	90 - 100
No. 4	40 - 65
No. 8	30 - 50
No. 200	3 - 9

a. The sand equivalent value shall be not less than 30, sand equivalent not required if less than 5% passing the No. 200 sieve

b. The material shall have a Los Angeles Abrasion of 35% or less.

6. Aggregate Subbase (6” Pit Run): Uncrushed rock aggregate subbase material that can be compacted readily by watering and rolling to form a firm stable subbase. The material shall meet the following requirements:

Sieve Size	Percent Passing By Weight
6”	100
No. 4	30-75
No. 200	0 – 15.0

a. The sand equivalent value shall be not less than 30, sand equivalent not required if less than 5% passing the No. 200 sieve.

b. The material shall have a Los Angeles Abrasion of 40% or less.

7. Imported Trench Backfill (8” Pit Run): Uncrushed rock aggregate material that can be compacted readily by watering and rolling to form a firm stable trench. The sand equivalent value shall be not less than 25, sand equivalent not required if less than 5% passing the No. 200 sieve, and the material shall meet the following requirements:

Sieve Size	Percent Passing By Weight
8”	100
No. 4	15 - 60
No. 200	0 - 12

8. Granular Borrow: Provide sand, sand and gravel, or sand and rock mixtures with a sand equivalent greater than 30. Sand equivalent is not required if the material has less than 5 percent passing the No. 200 sieve.

9. Trench Plug Material: Low permeable fill material, a non-dispersible clay material having a minimum plasticity index of 10.

10. Top Soil: Excavated material, up to 18 inches below stripped surface, free of rocks larger than 3 inches, organics, roots, refuse, brush or other debris.

11. Rip Rap: Riprap material shall be hard, durable, angular in shape and free from overburden and organic material. The breadth or thickness of any stone shall not be less than one-third of its length. The minimum unit weight of the stone shall be 165 pounds per cubic foot. Riprap material shall have less than 10 percent loss after five cycles in the sulfate soundness tests and shall conform to the following gradation:

Weight of Stones	Percent of Total Weight Less than the Stone Weight
200 lbs	100
130 lbs	80
90 lbs	50
25 lbs	10 max.

12. Non-Frost Susceptible Material: Granular material with the following gradation and a Plastic Index less than 6 for the material passing the No. 40 sieve. The material shall meet the following requirements:

Sieve Size	Percent Passing By Weight
3/4"	100
1/2"	70 - 95
No. 4	40 - 75
No. 8	25 - 55
No. 40	10 - 30
No. 200	0 - 6

2.2 UNSUITABLE MATERIALS

A. Unsuitable material include the materials listed below:

1. Soils which, when classified under ASTM D 2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System), fall in the classification of Pt, OH, CH, MH, or OL.

2. Soils which cannot be compacted sufficiently to achieve the density specified for the intended use.

3. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.

4. Soils that contain greater concentrations of chloride or sulfate irons, or have a soil resistively or pH less than the existing on-site soils.

PART 3 - EXECUTION

3.1 PREPARATION

A. Notify Engineer prior to starting any grading operations.

B. Identify required lines, levels, contours and datum.

C. Identify and flag surface and aerial utilities, known underground utilities locations.

D. Maintain and protect existing utilities which pass through the work area.

3.2 SITE CONTROL

A. Unfavorable Weather: Do not place, spread, or roll any fill material during unfavorable weather conditions. Do not resume operations until moisture content of material is satisfactory.

B. Flooding: Provide berms or channels to prevent flooding or saturation of subgrade. Promptly remove all water collecting in depressions.

C. Softened Subgrade: Where soil has been softened or eroded by flooding or placement during unfavorable weather, remove all damaged areas and recompact as specified for fill.

D. Dust Control: Use all means necessary to control dust on and near the work and on and near all off-site borrow areas as specified in Section 01 50 00 – Temporary Facilities and Controls. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors, residents, properties, and concurrent performance of other work on the site.

E. Noise Control: Use equipment that is equipped with adequate noise attenuation devices.

3.3 OFF-SITE IMPACTS

A. Comply with all traffic and hauling requirements of the State, County, and City of Pocatello.

B. Provide all signing, flagmen, or other special traffic control required to provide for the safety of the public.

C. Use only vehicles approved for highway use and comply with all load requirements.

D. Provide wheel cleaning as required to minimize the tracking of materials onto public roadways.

3.4 PROTECTION

A. Protect trees and other features to remain as a portion of the final landscaping or project.

B. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from equipment and vehicular traffic.

C. Protect above and below grade utilities which are to remain.

D. Notify Engineer of unexpected subsurface conditions and discontinue affected work in the area until notified to resume work.

E. Protect bottom of excavations and soil adjacent to and beneath foundation from frost.

F. Grade excavation top perimeter to prevent surface water runoff into excavation.

3.5 EXCAVATION

A. Excavate all cut areas to the grades shown on the plans.

B. Excavate all areas that have excessive moisture content and cannot be compacted to the required densities.

C. Correct unauthorized excavation at no cost to the Owner.

D. Excavate or scarify and aerate soils with excessive moisture content and allow to dry.

3.6 SUBGRADE PREPARATION

A. Excavate to subgrade elevation.

B. In the presence of a materials testing company, thoroughly proofroll with a loaded tandem-axle dump truck with a minimum weight of 20 tons, or 40-ton static roller.

C. Areas where soft or disturbed conditions are identified, excavate, remove and dispose of unsuitable soft spot material. If the material is suitable except for excessive moisture content, scarify and dry the material to the acceptable moisture content, or replace with Engineer approved materials, and recompact to the density of the material to place over the area. Soft sport repair shall be incidental to the Work. No special payment will be made for soft spot repair.

D. The Contractor’s materials testing company to submit a subgrade inspection report noting the means and methods used to proofroll the subgrade and any corrections or repairs made.

3.7 PREPARATION OF FOUNDATION

A. Building Subgrade:

1. Per Geotechnical Report and drawings.

B. All other areas:

1. Per Geotechnical Report and drawings.

3.8 CONSTRUCTION OF EMBANKMENTS

A. Fill areas to contours and elevations as shown on the plans. Do not use frozen materials.

B. Place and compact fill materials in continuous lifts not exceeding six (6) inches in depth, unless specifically allowed.

C. Employ a placement method so as not to disturb or damage utilities in trenches.

D. Maintain optimum moisture content of materials to attain required compaction density.

E. Make smooth changes in grade. Blend slopes into level areas.

3.9 IMPORTED STRUCTURAL FILL

A. Aggregate Subbase and Base, granular borrow, and common fill material under parking areas, drive lanes, and vehicle traffic areas, shall be compacted to at least 95% of the maximum dry density as determined in accordance with ASTM D698. Maximum loose lift thickness for aggregate base shall not exceed 8 inches. Maximum loose lift thickness for aggregate subbase, granular borrow, and common fill shall not exceed 8 inches.

B. Aggregate Subbase and Base material under buildings, including 4 feet outside the building area, and under equipment pads shall be compacted to at least 95% of the maximum dry density as determined in accordance with ASTM D-698. Maximum loose lift thickness for aggregate base shall not exceed 8 inches and aggregate subbase shall not exceed 8 inches.

C. Granular material with more than 30% by weight retained on the 3/4-inch sieve shall be compacted to a minimum 75 percent of maximum index density as determined by ASTM D4253 and D4254. Drain rock and crushed stone backfill material does not require compaction.

3.10 DISPOSAL OF WASTE SOIL

A. Contractor shall dispose of waste material at an off-site location determined and paid for by the Contractor.

3.11 QUALITY CONTROL

A. Material & Compaction Testing: All soils testing of samples submitted by the Contractor will be done by an independent testing laboratory mutually agreed upon by Contractor and Owner and at the Contractor's expense. If tests indicate work does not meet specific compaction requirements, remove work, replace, and retest at the Contractor's expense.

1. Qualifications of testing company

a. Basic requirements of ASTM E 329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials as Used in Construction" and ASTM D 3666, "Standard Specification for Minimum Requirements for Agency Testing and Inspecting Bituminous Paving Materials", as applicable.

b. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

2. Frequency of Compaction Tests

a. Curbs and sidewalks: In horizontal plane, test at start with subsequent tests a maximum of every 250 feet. At every horizontal location, obtain one test at subgrade. Perform subsequent tests every 12 inches of compacted depth and at top of backfill or when materials or procedures change. Perform a minimum of two (2) tests at finished grade.

b. Parking and vehicle areas, roadways: In horizontal plane, test each backfill area with subsequent test for every 1,000 square feet of backfill surface area. At every horizontal location, obtain one test at subgrade. Perform subsequent tests every 12 inches of compacted depth and at top of backfill or when materials or procedures change.

c. Concrete slabs for buildings, patios, concrete plaza, and entry slabs: In horizontal plane, test each backfill area with subsequent test for every 500 square feet of backfill surface area. At every horizontal location, obtain one test at subgrade. Perform subsequent tests every 12 inches of compacted depth and at top of backfill or when materials or procedures change.

d. Linear foundations and footings: In horizontal plane, test at start with subsequent tests a maximum of every 50 feet, and where elevation changes between adjacent footings. At every horizontal location, obtain one test at subgrade. Perform subsequent tests every 12 inches of compacted depth and at top of backfill or when materials or procedures change. Perform a minimum of two (2) tests at finished grade.

e. Along exterior basement walls and retaining walls: In horizontal plane, test each backfill area with subsequent test for every 50 lineal feet of wall, a minimum of two test per exterior wall side, at every horizontal location, obtain one test at subgrade. Perform subsequent tests every 12 inches of compacted depth and at top of backfill or when materials or procedures change.

3.12 TOLERANCES

A. Finished grade of graded areas shall meet the following requirements:

1. In paved areas including roadways, sidewalks, parking lots, etc., plus or minus 0.10 feet from the grade shown on the plans.

2. Building pads, plus or minus 0.05 feet from the grade shown on the plans.

3. In landscaped areas or similar areas, plus or minus two (2) inches.

4. Differential grades between walking surfaces shall not exceed 1/4-inch.

5. Landscape finish grade adjacent to concrete walks shall be minus 1-inch from walking surface elevation.

END OF SECTION 31 00 00

SECTION 31 05 19.13 - GEOTEXTILES FOR EARTHWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install geotextiles as specified herein and as indicated on the drawings.

1.2 SUBMITTALS

A. Certificates: Submit geotextile manufacturer's certified test results showing that the geotextiles meet the requirements of these specifications.

B. Submit manufacturer's installation instructions and maintain copy at the jobsite.

PART 2 - PRODUCTS

2.1 GENERAL

A. Geotextiles shall be composed only of long chain polymeric (at least 85% polyolephins, polyesters or polyamides) filaments or yarns oriented into a stable network that retains its relative structure (including selvages) during handling, placement, and design service life.

2.2 SUBGRADE SEPARATION GEOTEXTILE

A. Verify geotextile delivered to the site meets the requirements of this specification.

B. Subgrade Separation Geotextile fabric shall be woven or non-woven, with the following minimum properties:

Geotextile Property (Roll Values)	Test Method	Requirement
*Grab Tensile Strength – lb (in either principal direction)	ASTM D 4632	270 / 180
*Grab Elongation (%)	ASTM D 4632	<50% / ≥50%
*Puncture Strength – lb	ASTM D 6241	100 / 75
*Trapezoidal Tear Strength – lb	ASTM D 4533	100 / 75
Apparent Opening Size (AOS) (Standard Sieve)	ASTM D 4751 COE CW-002215	#30 or finer
Permittivity (sec-1)	ASTM D 4491	0.02

*For geotextiles with elongation which is less than 50%, the first strength value is applied. For geotextiles with elongation which is equal to or greater than 50%, the second strength value is applied. Higher strength is required for geotextiles with lower elongations.

2.3 DRAINAGE GEOTEXTILE

A. Drainage Geotextile fabric shall be non-woven, with the following minimum properties:

Geotextile Property (Roll Values)	Test Method	Requirement
Grab Tensile Strength – lb (in either principal direction)	ASTM D 4632	≥80
Puncture Strength – lb	ASTM D 6241	≥300
Apparent Opening Size (AOS) (Standard Sieve)	ASTM D 4751	#70 or finer
Permittivity (sec-1)	ASTM D 4491	0.7

2.4 WEED BARRIER

A. Woven geotextile shall be used as weed barrier. Woven geotextile fabric made from polypropylene, shall contain UV inhibitors.

B. Woven fabric shall meet the minimum properties:

Geotextile Property (Roll Values)	Requirement
Unit Weight (oz/yds2)	3.0
Tensile Strength (lbs)	135
Elongation at Break (%)	70
Puncture Strength (lbs)	35
Apparent Opening Size (AOS) (Standard Sieve)	60/70
Trap Tear (lbs)	50
Air Permeability (cm/sec)	3x10-2
Flux (gal/ft2/min)	70
Permitivity (sec-1)	1.2
Thickness	15.0

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect geotextiles against damage and excessive sunlight during shipment and storage.

3.2 EXAMINATIONS

Verify that surfaces upon which the geotextile is to be installed are graded to a smooth, uniform condition free of obstructions, depressions, and debris.

3.3 GENERAL PLACEMENT REQUIREMENTS

A. Spread geotextile immediately ahead of the covering operation. Do not drag the geotextile on the ground or mishandle in any way. Place the geotextile loosely and without wrinkles so that placement of the overlying material will not tear the geotextile.

B. Place the cover material on the geotextile in such a manner that a minimum of 12 inches of material will be between the equipment tires or tracks and the geotextile at all times.

C. Cover the geotextile with the specified cover material as soon as possible. Geotextiles which have not been ultraviolet stabilized shall not remain uncovered for longer than 7 days. Ultraviolet stabilized materials shall not remain exposed longer than 30 days.

3.4 PLACEMENT IN SOFT GROUND

A. Where geotextiles will be placed over soft ground, construction vehicles shall not drive directly on the geotextile material. End-dumping the cover material directly on the geotextile will not be permitted. Under no circumstances shall cover material be dropped on unprotected geotextile from a height greater than 3 ft. above the surface of the geotextile.

B. Limit compaction of the first lift above the geotextile over soft ground to operation of placing and spreading equipment only. No sheep foot type equipment will be allowed on the first lift. Subsequent lifts will be closely observed during compaction. If any foundation failures occur during compaction operations, lightweight compaction equipment shall be used. Use pegs, pins, or the manufacturer’s recommended methods as needed to hold the geotextile in place until the specified cover material is placed. Seams that have separated will require the removal of fill and the required overlap reestablished. Repair at no cost to the Owner.

3.5 REPAIRS

A. Should the geotextile be torn, punctured or the overlaps joints disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or pad or roadbed distortion, remove the backfill around the damaged or displaced area and repair or replace the damaged geotextile at no cost to the Owner.

B. The repair shall consist of a patch of the same type of geotextile placed over the ruptured area. The patch shall overlap the existing geotextiles a minimum of 2 feet from the edge of the rupture.

3.6 JOINT OVERLAP

A. Subgrade Separation: Overlap the geotextile a minimum of 2 feet at all joints.

B. Drainage Application: Overlap the geotextile a minimum of 12 inches at all joints. In trenches less than 12 in. wide, overlap shall be the width of the trench.

C. Weed Barrier: Overlap the geotextile a minimum of 6 inches at all joints.

END OF SECTION 31 05 19.13

SECTION 31 11 00 - CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide removal of trees, stumps, shrubs, grass and other vegetation within the construction limits to permit construction of the new facilities and waterlines.

B. Protect the adjoining properties from damage during clearing and grubbing operations.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Clearing and grubbing shall extend to no more than 2 feet outside of the construction limits. The clearing and grubbing operation shall be conducted in a manner which will not damage any vegetation outside of the clearing and grubbing limits. All brush, roots, and other debris within the grubbing limits shall be removed to a depth of 6". Completely remove stumps and other debris protruding through the subgrade surface. The Contractor shall chop all brush and debris resulting from the Clearing and Grubbing operation and haul to a disposal site located by the Contractor off-site. Burning of debris on-site will not be allowed.

3.2 STRIPPING

A. Areas within the limits of the project shall be stripped to remove topsoil containing organic material before construction begins over such areas. The topsoil shall not be used in construction of onsite fills or trench backfills. The topsoil shall be hauled to a disposal site located by the Contractor off-site.

END OF SECTION 31 11 00

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SECTION 31 23 33 - TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all excavation of trenches, bedding, and backfilling work for construction of piping.

B. Excavation of trenches shall include all material excavated or removed regardless of type, character, composition or condition of the material.

1.2 SUBMITTALS

A. The Contractor shall submit samples of all materials proposed to be used in work. Sample sizes shall be determined by the testing laboratory.

1.3 DEFINITIONS

A. Pipe Zone: That portion of the vertical trench cross-section lying between a plane below the bottom surface of the pipe and a plane 6 inches above the top of the pipe.

B. Trench Zone: The portion of the vertical trench cross-section lying between the Pipe Zone and a point 18 inches below the finished grade.

C. Final Backfill: The portion of the vertical trench cross-section within 18 inches of finished grade.

D. Pipe Bedding: Material placed below the pipe and in the Pipe Zone.

E. Springline: The center axis of the pipe.

F. Trench Backfill: Material placed from the top of the Pipe Zone to finished grade.

G. Trench Foundation Material: Material placed below the Pipe Bedding.

PART 2 - PRODUCTS

2.1 PIPE BEDDING MATERIAL

A. Pipe bedding shall consist of crushed stone backfill (bedding chips) or bedding sand material per Section 31 00 00 – Earthwork and ISPWC.

2.2 TRENCH BACKFILL MATERIAL

A. Excavated trench material may be used as follows:

1. Excavated trench material shall be free from cinders, ashes, refuse, organic and frozen material, boulders with any dimension exceeding 8 inches, or other unsuitable material per Section 31 00 00 - Earthwork.

2. Material with excessive or deficient moisture content will not be considered as unsuitable if the moisture content can be adjusted to a level that allows obtaining compaction.

3. Imported backfill material shall conform to imported trench backfill (6” Pit Run) per Section 31 00 00 - Earthwork.

2.3 FOUNDATION STABILIZATION

A. Trench foundation material shall consist of foundation stabilization backfill material per Section 31 00 00 - Earthwork.

2.4 IDENTIFICATION TAPE AND LOCATING WIRE

A. Locating wire shall be No. 12 AWG insulated cooper locating wire with 1/64” PVC insulation.

B. Identification tape shall be 3-inches wide, 4 mil polyethylene vinyl. Tape text and color shall meet the following requirements

Pipe Contents	Text	Color
Potable Water	“CAUTION – WATER LINE BURIED BELOW”	Blue
Pressure Irrigation	“CAUTION – IRRIGATION LINE BURIED BELOW”	Purple
Gas	“CAUTION – GAS LINE BURIED BELOW”	Yellow
Telephone/Fiber	“CAUTION – PIPE LINE BURIED BELOW”	Yellow
Electric	“CAUTION – ELECTRICAL LINE BURIED BELOW”	Red

PART 3 - EXECUTION

3.1 EXISTING UTILITIES:

A. The Contractor shall be fully responsible for any and all damage to existing or constructed utilities, and shall repair damages in accordance with utility owner’s requirements at no additional cost to the Owner. It shall be the Contractor’s responsibility to coordinate and notify all affected utility owners. Call 811 Dig-Line before commencing construction.

1. Parallel Utility Support: Work associated with parallel utility support and utility crossings shall be incidental to the work unless a specific bid items is provided for parallel utility support.

2. Utility Crossing Support: All utilities that interfere with the construction of the trenching and pipe installation shall be temporarily supported in accordance with the utility owner's requirements. Work associated with utility crossings support shall be incidental to the work unless a specific bid items is provided for utility crossing support.

3. All crossing utilities shown on the plans and marked by Dig-Line shall be vertical and horizontally located, in a non-destructive manner, prior to construction to verify pipe elevation, materials, and diameter. This information shall be provided to the Engineer for evaluation of conflicts prior to construction. All potholes shall be backfilled immediately after obtaining information.

3.2 TRENCH EXCAVATION

A. Trenches shall be excavated to lines and grades shown on the drawings, with a minimum width at the top or crown of the pipe not to exceed the outside diameter of the pipe plus 2'. In the event the Contractor should over excavate in width or depth without the Engineer's approval, he shall provide pipe bedding for the full length of the over excavation. No special payment will be made for work caused by over excavation.

B. Trench shall be kept free from water at all times to facilitate fine grading, proper laying and joining of pipe, and prevention of damage to completed joints.

C. If the trench bottom is disturbed during excavation, compact trench bottom to 95% maximum density of the standard proctor, ASTM D698.

D. The Contractor shall conduct trench operations in such a manner as to provide adequate safety precautions for workmen, adjacent property, or the public at all times by use of adequate sheeting, shoring, or bracing to sustain stability of the trench floor and walls. The Contractor shall furnish, place, and maintain such shoring as may be required to support sides of the trench. Costs of shoring and bracing shall be considered incidental to trench excavation and backfill.

E. The Contractor shall conduct trench operations in such a manner as to provide adequate safety precautions for workmen, adjacent property, or the public at all times by use of adequate sheeting, shoring, or bracing to sustain stability of the trench floor and walls. The Contractor shall furnish, place, and maintain such shoring as may be required to support sides of the trench.

3.3 PIPE BEDDING

A. Place bedding in layers no thicker than 6 inches. Allow for bedding depth around pipe bells. Place bedding at least 4 inches below the pipe and 6 inches above the pipe.

B. Shovel slice and tamp to ensure that the bedding material is firmly placed.

C. Following placement of pipe, place additional bedding material up to the springline of the pipe. Shovel slice and tamp to ensure that the bedding material fills in and supports the pipe haunch area.

D. In 6-inch lifts, place additional bedding layers from the pipe springline to 6 inches above the pipe.

3.4 TRENCH BACKFILL

A. All backfill material shall be placed in layers not to exceed 8-inch maximum loose lift thickness for native material and 12-inch maximum loose lift thickness for imported aggregate backfill.

B. The entire trench shall be compacted to 95% maximum density of the standard proctor as determined by ASTM D-698.

C. Trenches under buildings and structures shall be compacted, the entire depth, to 95% maximum density of the modified proctor determined by ASTM D1557.

3.5 IDENTIFICATION TAPE AND LOCATING WIRE PLACEMENT

A. Unless indicated otherwise, attach locating wire to the crown of all buried pipelines using electrical tape, except gravity irrigation, sanitary sewer, or storm sewer mains having visible manholes or clean-out structures at all angle points. Provide 12” of slack wire above ground at each location of valve or wire box.

B. Unless indicated otherwise, identification tape shall be placed above all buried pipelines, 18” - 24” above the crown of the pipe, except gravity irrigation, sanitary sewer, or storm sewer mains having visible manholes or clean-out structures at all angle points.

C. Unless indicated otherwise, identification tape shall be placed above all buried pipelines that are installed with locating wire. Identification tape shall be placed 18” - 24” above the crown of the pipe.

3.6 QUALITY CONTROL

A. Material & Compaction Testing: All soils testing of samples submitted by the Contractor will be done by a testing laboratory mutually agreed upon by Contractor and Engineer and at the Contractor’s expense. If tests indicate work does not meet specific compaction requirements, remove work, replace, and retest at the Contractor’s expense.

1. Qualifications of testing company

a. Basic requirements of ASTM E 329, “Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials as Used in Construction” and ASTM D 3666, “Standard Specification for Minimum Requirements for Agency Testing and Inspecting Bituminous Paving Materials”, as applicable.

b. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

2. Frequency of Compaction Tests

a. Test section shall be a test at 2-feet above top of pipe and every 1-foot lift thereafter and at the top of the trench backfill.

b. Two (2) test sections, at different locations for every trench less than 200 feet in length, but not less than once per day.

c. One (1) test section per every 200 feet of additional trench and at locations where materials or construction procedures change, but not less than once per day.

3.7 CLEANUP

A. Surplus excavated material or stripped material not salvaged as topsoil and excavated material not meeting the requirements for backfill shall become waste. All waste material shall be disposed of by the Contractor at a site located by the Contractor. Costs to haul excess material offsite will be at the Contractor's expense.

END OF SECTION 31 23 33

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SECTION 32 12 16 – ASPHALT PAVING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all labor, equipment and materials as required to provide new pavement, and to repair existing asphalt surfaces, streets, roads, driveways, or other similar improved areas damaged or removed by excavations.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Superpave Hot Mix Asphalt: Submit job mix formula and ITD approval letter of previously approved Mix Design. Prepare a submittal that includes:

1. The original approved mix design that includes the confirmed JMF from the previous project;

2. adjustments made to the JMF that make it the C-JMF;

3. adjustments made to the C-JMF during production;

4. documentation supporting these adjustments.

5. Current Stockpile Quality Control testing that includes the following to confirm the material in stockpile is similar to the material used for the original mix design, including RAP:

   a. Sieve analysis on the stockpiles to be used, including crusher control charts;

6. Note: Previously used mix designs that are used during the calendar year of confirmation may omit Step 5 if the stockpiles consist of the crushed material, including RAP, from the original mix design. Previously used mix designs that more than one calendar year has elapsed from the time of confirmation must include Step 5.

7. JMF with a content of more than 30% recycle asphalt pavement (rap) will not be accepted, regardless of prior ITD approval.

C. Material Test Reports: For each paving material.

1.3 QUALITY CONTROL

A. Testing Agency Qualifications: Qualified according to ASTM D3666 for testing indicated.

   a.

PART 2 - PRODUCTS

2.1 PLANT MIX PAVEMENT

A. General: Superpave hot mix asphalt shall conform to the latest edition of Idaho Department of Transportation Standard Specifications for Highway Construction, Section 405.

1. Mixture Type: SP3

2. Grade of Asphalt: PG 64-28

3. Aggregate Size: 1/2”

4. Anti-Stripping Additive: Provide anti-stripping additive if the immersion compression retained strength (ASTM T165) of the design mix is less than 70 percent of the dry compressive strength. Anti-stripping additive shall be added at the refinery at a rate of 0.5 to 1.0 percent of asphalt cement as determined by laboratory test.

2.2 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, or crushed gravel.

C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, or combinations thereof.

1. For plant mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

2.3 AUXILIARY MATERIALS

A. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

PART 3 - EXECUTION

3.1 GENERAL

A. Do not place pavement on a wet or frozen surface or when weather or surface conditions will otherwise prevent the proper handling or finishing of the pavement placement.

B. Air and Surface Temperature Limitations:

Compacted Thickness of Individual Courses	Top Course	Leveling and Courses Below the Top Course
Less than 1.5”	60°F	-
1.5” to 3”	50°F	40°F
Greater than 3”	40°F	40°F

C. Asphalt concrete shall not be placed when the surface and atmospheric temperature is below 40 degrees F, if rain is imminent or expected before time required for adequate cure, or if subgrade is wet or excessively damp.

3.2 SURFACE PREPARATION

A. Aggregate base shall be provided where indicated to the thickness indicated. The compacted surface of the finished aggregate shall be hard, uniform, smooth and at any point shall not vary more than 0.02 feet from the indicated grade or cross-section.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed at no cost to the Owner.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Verify that subgrade is dry and in suitable condition to begin paving.

E. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, plant mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying plant mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 PATCHING

A. Plant Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches minimum into adjacent sound pavement. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Patching: Fill excavated pavements with plant mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.4 SUPERPAVE HOT MIX ASPHALT PAVING

A. Machine place Hot Mix Asphalt on prepared surface, spread uniformly, and strike off. Place Hot Mix Asphalt by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place Hot Mix Asphalt base course in number of lifts and thicknesses indicated.

2. Place Hot Mix Asphalt surface course in single lift.

3. Spread mix at minimum temperature of 250 deg F (121 deg C).

4. Begin applying Hot Mix Asphalt along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.

5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place Hot Mix Asphalt in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with plant mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of Hot Mix Asphalt courses.

1. Clean contact surfaces and apply tack coat to joints.

2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.

3. Offset transverse joints, in successive courses, a minimum of 24 inches.

4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method.

5. Compact joints as soon as Hot Mix Asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.6 COMPACTION

A. General: Begin compaction as soon as placed plant mix paving will bear roller weight without excessive displacement. Compact plant mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Do not operate vibratory rollers in the vibratory mode when the internal mix temperature is less than 175 °F or when checking or cracking of the mat occurs at a higher temperature.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while plant mix asphalt is still hot enough to achieve specified density. Continue rolling until plant mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while plant mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, plant mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Surface Course: 1/8 inch.

2. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Corrective Actions:

1. Grind the asphalt pavement to within the surface smoothness tolerance, if thickness permits in accordance with the above criteria.

2. All grinding shall be done parallel to centerline. Adjacent grinder passes within any single ground area shall be extended to produce a neat rectangular area having a uniform surface appearance. At transverse boundaries between ground and unground areas, smoothly feathered transitions shall be made.

3. The Contractor shall check the pavement for smoothness after grinding, in accordance with this specifications and shall make any additional corrections necessary to the pavement to achieve smoothness.

4. After grinding has been completed, the ground pavement surface shall receive a fog coat at a rate approved by the Engineer.

5. The cost of such grinding or milling, and all related work such as fog coat, disposal of milled material, traffic control, flagging, profiling, surface repair of ground or milled areas, and temporary pavement markings shall be at the Contactor’s expense.

6. If correction of the pavement as listed above will not produce satisfactory results as to smoothness, or will reduce pavement thicknesses and serviceability excessively, the pavement shall be removed and replaced or overlaid to correct the deficiency at no additional cost to the project.

3.8 FIELD QUALITY CONTROL & ACCEPTANCE

A. Thickness: The Contractor shall extract core samples from the in-place compacted plant mix pavement. Thickness will be determined according to ASTM D 3549.

1. Take two samples minimum. Take one core samples for every 3,500 square feet, at least one sample every day.

2. Tolerance: Plus 1/4 inch (6 mm), no minus.

3. If more than 25% of pavement core samples fail to meet thickness requirements with a tolerance of 0-1/4" minus of the project requirements, or if more than 10% fail to meet thickness requirements with a thickness deficit greater than 1/4", corrective actions shall be taken at no additional cost to the Owner.

4. Corrective Actions:

   a. Install 1.5-inch asphalt overlay with same Job Mix Formula and Plant Mix Pavement, if grades allow, or

   b. Remove and replace pavement to specified thickness, grades, and smoothness.

   c. If allowed by the Engineer, adjusts price for asphalt pavement that does not meet thickness requirements in accordance with the following pay factor (PF) reductions:

      1) If thickness is ≥ 100% of Required Thickness, PF = 1.0.

      2) If thickness is 1/4" less than the Require Thickness, PF = 0.80.

      3) If thickness is 1/2" less than the Require Thickness, subject to rejection, if allowed to remain in place, the PF will be 0.75.

5. Core Samples during Pavement Placement: If cores are taken during placement of pavement, fill core sample holes with hot mix asphalt.

6. Core Samples after Pavement Placement: If cores are taken after placement of pavement, fill core sample hole with 4,000 psi concrete. Prevent concrete from staining asphalt pavement by using a plastic sheet around the core hole while filling with concrete. Tap plastic sheet down.

B. The relative density after compaction shall be 92-96 percent of the density obtained by using ASTM D 1188 or D 2726. A properly calibrated nuclear asphalt testing device shall be used for determining the field density of compacted asphalt concrete, or slabs or cores may be laboratory tested in accordance with ASTM D 1188.

3.9 CLEAN-UP

A. After Work of this Section is complete, remove all debris, rocks, gravel, excess asphalt.

END OF SECTION 32 12 16

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SECTION 32 13 13 - CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all labor, materials, and equipment required for concrete work including forming, reinforcing steel, anchor bolts and site concrete.

B. Anchor bolt templates to be supplied by light pole manufacturer.

1.2 JOB CONDITIONS

A. In hot and cold weather, comply with the requirements of ACI 305 and 306.

B. Do not place concrete on frozen ground. Unless adequate protection is provided, do not place concrete during rain, sleet, or snow.

C. Do not allow rain water to increase mixing water or damage surface finish.

D. When temperature of surrounding air is expected to be below 40°F, during placing, or within 24 hours thereafter, do not allow concrete temperature to drop below 55°F, for sections less than twelve inches (12”) in any dimension, or 55°F, for any other sections.

1. Keep the temperature of concrete, when placed, under 80°F, to preclude loss of slump, flash set, or cold joints.

2. When temperature of steel is greater than 120°F, spray steel forms and reinforcement with water just prior to placing concrete. Do not allow any water to pond in forms.

1.3 SUBMITTALS

A. Submit mix design to be used for each class of concrete.

B. Submit location of materials source, admixtures to be used, and other related data.

C. Submit test reports showing suitability of aggregates used in concrete mixes.

D. Indicate sizes, spacing, locations of reinforcing steel, wire fabric, bending and cutting schedules, splicing, stirrup spacing, supporting, and spacing devices.

E. Alkali-Silica Reaction (ASR) test results.

F. Control joint placement plan.

G. The Contractor shall pay any material testing expenses associated with material submittals.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: Use Portland cement conforming to the requirements of ASTM C 150 Type II for low alkali cement.

B. General Admixtures: Admixtures, other than air-entraining agents, may be used when the type and amount to be used are approved. Calcium chloride will not be allowed as an admixture.

C. Air-Entraining Agents: Use air-entraining agents conforming to the requirements of ASTM C 260. Air entraining admixtures shall be added to the mixing water.

D. Water Reducing Agents: Water reducing admixtures may be used to increase workability of the concrete when approved by the Engineer. Use water reducing admixtures conforming to ASTM C 494.

E. Water: Use potable water for mixing concrete.

F. General Aggregate Requirement: The proposed aggregate for the mix shall be tested for expansion and Alkali-Silica Reaction (ASR) in accordance with AASHTO T 303. Where testing indicates aggregates are reactive, the contractor shall use fly ash, lithium compound admixtures, or both to produce a concrete mix that successfully mitigates ASR. Contractor shall provide test results of successful mitigation, using ASTM C 1567, with results showing a linear expansion at 14 days not exceeding 0.10 percent when tested.

G. Coarse Aggregate: Use coarse aggregate that consists of gravel, crushed slag, crushed stone or other approved inert materials, composed of hard, strong and durable particles, free of injurious coatings, and conforming to the requirements of ASTM C 33, except as modified herein.

1. Use only aggregates that include deleterious substances not exceeding the following:

	Percent (by weight)
Soft Fragments	0.20
Coal and Lignite	0.30
Clay Lumps	.30
Other Deleterious Substances	2.0
Minus 200 Material	1.75

2. Use coarse aggregate meeting the following gradations when tested in accordance to the requirements of ASTM C 136.

	Percent Passing (by weight)

Course Aggregate Size	1"	3/4”	3/8"	No. 4	No. 8
3/4” to No. 4	100	90-100	20-55	1-10	0-5

H. Fine Aggregate: Use aggregate of natural sand or other approved inert materials composed of hard, strong, and durable particles conforming to the requirements of ASTM C 33 except as modified herein.

1. Use only aggregates that include deleterious substances not exceeding the following:

	Percent (by weight)
Clay Lumps	.50
Coal and Lignite	.30
Other Deleterious Substances	2.00
Minus 200 Material	1.75

2. Moisture content of fine aggregate shall not exceed 8 percent.

3. Use fine aggregate that is uniformly graded from coarse to fine within the following gradation, when tested in accordance to the requirements of ASTM C 136.

Sieve Size	Percent Passing (by weight)
3/8"	100
No. 4	95 100
No. 8	80 100
No. 16	50 85
No. 30	25 60
No. 50	10 30
No. 100	2 10

I. Patch Mortar: Make patching mortar using portland cement and sand to form a workable mortar suitable for filling defects in concrete surfaces.

1. Mortar: 1 part portland cement to 2 parts sand by damp loose volume.

2. Mix white and gray portland cement as required to match surrounding concrete.

3. Keep mixing water to a minimum.

4. Mix patching mortar in advance and allow to stand with frequent manipulation, without addition of water, until it has reached stiffest placeable consistency.

J. Curing Compounds: Use curing compounds that meet the requirements of ASTM C 309.

K. Sealer: Use Conspec Silane 40 or approved equal.

L. Joint Sealant: Use Sikaflex 1c SL or approved equal. Use Sonolastic Polysulfide Sealant or approved equal for submerged in water applications. Color to match that of concrete.

2.2 REINFORCING STEEL AND WELDED WIRE MESH

A. Reinforcement Steel: ASTM A 615 Grade 60

B. Welded Wire Fabric: 12x12 W5.4/5.4

2.3 FORMING MATERIALS

A. Smooth Forms: Faced with material which will produce smooth, hard, uniform texture on concrete.

B. Form accessories that are to be partially or wholly embedded in concrete are to be a commercially manufactured type:

1. Use form ties constructed so that ends or end fasteners can be removed without causing appreciable spalling of concrete faces.

C. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

D. Contraction Joint Material: Wood strips; maximum possible length.

E. Dobie Blocks: Commercial grade blocks to support horizontal reinforcement.

2.4 READY MIX CONCRETE

A. Furnish commercial ready mix shall have the following properties:

Construction Type	Minimum Compressive Strength	Minimum Cement Content	Maximum Water / Cement Ratio	Air Entrainment Percentage	Maximum Slump
Curbs, Gutters	4,500 psi	560 LB/CY	0.44	6.5 ±1.5	2.5 ±1
Walking Surfaces – Sidewalks, Patios, Driveways, Fence Foundations	4,500 psi	564 LB/CY	0.44	6.5 ±1.5	4 ±1

B. Fly ash may be used to replace a portion of the Portland cement in the concrete mix. The fly ash used shall not exceed twenty five percent of the total cement material in the mix. The cement material in the mix includes both Portland cement and fly ash. Fly Ash shall be Class F conforming to AASHTO M 295 with the additional requirement that the available alkalies in the fly ash shall not exceed 2 percent.

C. Ready-mixed concrete shall conform to the provisions in ASTM C 94 regarding batching, mixers and agitators, mixing and delivery, inspection, consistency and air content, and certification of batches.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall not incorporate ready mix concrete into the work that does not meet these specifications. The ready mix concrete that is in non-compliance shall be removed from the project.

3.2 FORMING

A. Make forms sufficiently tight to prevent loss of cement paste. Arrange facing material orderly and symmetrical, keeping number of seams to a practical minimum.

B. Place chamfer strips in corners of forms to produce beveled edges on permanently exposed surfaces.

C. To maintain specified finish tolerances, chamfer formwork to compensate for anticipated deflections.

D. Provide positive means of adjustment using wedges or jacks, or shores and struts, and take up all settlement during concrete placing operation.

E. Securely brace forms against lateral deflection.

F. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

G. At construction joints, overlap forms over hardened concrete at least six inches (6"). Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain true surface.

H. Anchor formwork to shores or other supporting surfaces or members so that upward or lateral movement of any part of formwork system is prevented during concrete placement.

I. Anchor formwork to shores or other supporting surfaces or members so that upward or lateral movement of any part of formwork system is prevented during concrete placement.

J. Position expansion joint material and other embedded items accurately and support against displacement.

3.3 REINFORCING

A. Place all reinforcement in the exact position shown on the plans and approved shop drawings and secure in position during the placing and compacting of concrete. Wire bars together with No. 16 gage wire with ties at all intersections except where spacing is less than 12 inches in each direction, in which case tie alternate intersections.

B. Place dobie blocks to maintain clearance from subgrade.

3.4 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

B. Install accessories in accordance with manufacturer's instructions, level and plumb with templates where necessary. Ensure items are not disturbed during concrete placement.

3.5 CONVEYING CONCRETE MIX

A. Unless specifically approved by the Engineer prior to placement of ready mix concrete, all concrete mix shall be placed and discharged completely within 90 minutes of the introduction of water into the mix or before the drum has been revolved 300 revolutions, whichever comes first.

B. Handle concrete from mixer to location of final placing as rapidly as practicable by methods which prevent segregation or loss of ingredients, and assure that quality is maintained.

C. Use only equipment conforming to ASTM C 94.

D. Use only approved pumping equipment that is rated for the lift and the capacity required for placement.

1. Control pneumatic placement to prevent segregation.

2. Loss of slump in pumping or pneumatic conveying equipment shall not exceed two inches (2”).

3. Do not use aluminum or aluminum alloy pipes.

3.6 CONTROL JOINTS

A. For flatwork, place control (contraction) joints of the type indicated in the plans prior to concrete curing.

B. Install joints spaced no more than 24 times the slap thickness (i.e. a 4-inch thick slab shall have a control joint at least every 96-inches = 8-feet). Contraction joints should be placed to produce panels that are as square as possible and never exceeding a length to width ratio of 1 ½ to 1

C. Joint depth shall be at least 25% of slab depth.

D. Tooled joints shall be installed using a grooving tool. Contraction joints may be tooled into the concrete surface at the time of placement. Joints may be tooled into the surface (first pass) prior to the onset of bleeding or immediately with the first pass of the floating operation.

E. Sawcut joints between 6-12 hours after finishing concrete, unless specifically approved otherwise by the engineer. Sawcut as soon as the concrete is hard enough to withstand the energy of sawing without raveling or dislodging aggregate particles, and that the edges abutting the cut do not chip from the saw blade.

3.7 REMOVAL OF FORMS

A. Formwork for columns, walls, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.

3.8 FINISHES

A. Provide formed concrete walls to be left exposed with Sacked Finish.

1. Point and Patch: Patch defects, chip or rub off fins exceeding one-quarter inch (1/4) in height with Patch Mortar. Patch tie holes and defects and remove fins completely. When surface texture is impaired and form joints misaligned by more than one-eighth (1/8) inch, grind or bushhammer.

2. Sacked Finish: Remove forms and perform necessary patching as soon after placement as possible. Finish newly hardened concrete no later than the day following form removal. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced. No cement grout to be used other than cement paste drawn from concrete by rubbing process.

B. Concrete flatwork shall not be trowelled, use screed, float, and broom.

C. Stairs to receive a light broom finish parallel to the nose of the tread. And shall receive nose end treatment as shown in the plans.

D. Sidewalks to receive a light broom finish perpendicular to the direction of travel.

E. Patios to receive light broom finish.

F. Curbs and Gutter to receive light broom finish parallel to flow line of gutter.

G. Pedestrian ramps to receive a light broom finish perpendicular to the direction of travel.

H. Light pole, sign, fence foundations to receive light broom finish.

3.9 CURING AND PROTECTION

A. To preserve moisture in unformed concrete surfaces, apply one of the following immediately after placement and finishing.

1. Continuous mist spray.

2. Waterproof sheet materials, ASTM C 171.

3. Curing compound, ASTM C 309. Apply in accordance with recommendations of manufacturer immediately after water sheen has disappeared. Do not use on any surface against which additional concrete or other material is to be bonded or adhesively applied, unless it is proven that curing compound will not prevent bond, or unless positive measures are taken to remove it completely from areas to receive bonded applications. Provide curing compound compatible with hardener in areas where hardener is to be used.

B. Cure concrete for seven (7) days.

C. When mean daily outdoor temperature is less than 40°F, maintain temperature of concrete between 50°F and 70°F for required curing period.

3.10 SEALER

A. Apply sealer to vertical walls, stairs, and walkways. Apply two coats. Apply in accordance with manufactures recommendations. Conspec Silane 40 sealer should be applied normally about 30 days after pour.

3.11 TESTING

A. The Contractor shall obtain and pay for the services of certified materials testing laboratory to perform all sampling and testing of installed materials to assure that the requirements of this specification are met. The Contractor shall pay all testing costs associated with product submittal prior to use in the Work.

B. Perform the following testing (See Specification 03 30 00):

1. Entrained Air – Test every 40 yards of concrete delivered to the project.

2. Slump – Test every 40 yards of concrete delivered to the project.

3. Strength characteristics – Test every 40 yards of concrete placement with four compressive test cylinders.

4. Temperature: If air temperature is less than 40°F, test every 30 yards of concrete delivered.

C. Test results shall be reported in writing to the Engineer within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

D. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

3.12 ACCEPTANCE

A. The Engineer will base acceptance of the concrete on parameters specified for the given concrete class. The Engineer will base acceptance of strength from the results of 28-day compression strength test results on cylinders made from concrete being placed. The engineer will consider average strength from three companion cylinders as one test.

B. Replace unacceptable concrete at no additional cost to the Owner.

C. The Engineer will use a price adjustment for concrete that does not meet the intended strength, but is allowed to remain in place by the Engineer, in accordance with the following pay factor (PF) reductions:

1. If compression strength is ≥ 100% of required, PF = 1.0.

2. If compression strength is ≥ 95% < 100% of required, PF = 0.90.

3. If compression strength is ≥ 90% < 95% of required, PF = 0.80.

4. If compression strength is < 90% of required, subject to rejection, if allowed to remain in place, the PF will be 0.50.

3.13 SPECIAL WARRANTY

A. Scaled or spalled surfaces exceeding 5% (randomly dispersed or concentrated) per twenty (20) square feet of concrete surfacing area will be considered defective and shall be replaced at the Contractor’s expense. The area requiring replacement will be as directed by the Engineer.

END OF SECTION 32 13 13

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SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide chain link fencing and slider gates and appurtenant Work, complete and operable.

1.2 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop drawings of fences and gates with all dimensions, details, and finishes. Drawings must include post foundations.

C. Product data: Manufacturer’s catalog indicating materials and a letter certifying that all conditions of the specifications have been met.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Chain link fencing and gates shall be products of a single manufacturer which has been successfully engaged in the production of such items for a period of at least 5 years.

B. Installer's Qualifications: Installation of the chain link fence shall be by the manufacturer or by a firm accepted and licensed by the manufacturer.

PART 2 - MATERIALS

2.1 GENERAL

A. All perimeter fencing and gates shall be 6 feet high. All materials and components shall be new, first quality items specifically manufactured for the intended application.

2.2 CHAIN LINK FENCE FABRIC

A. Chain link fence fabric shall be made of steel wire helically wound and interwoven in such a manner as to provide a continuous mesh without knots or ties except in the form of knuckling or twisting the ends of the wire to form the desired selvage of the fabric.

B. Fence fabric shall be No. 11 gauge steel wire, 2-inch mesh, with top selvages knuckled and bottom selvages twisted and barbed. Fabric shall be galvanized in conformance with ASTM A392, Class 1, with not less than 1.2 ounces zinc per square foot of coated surface.

2.3 STEEL FENCE FRAME MEMBERS

A. Steel pipe produced in accordance with commercial standards. Minimum yield strength of 50,000 psi. Cold formed and welded per ASTM F1043 Group IC. Pipe sections to conform to ASTM A120, Schedule 40 standard weights.

B. Pipe Section Size

1. End and Corner Post 2-3/8” OD, 3.65 lb/ft

2. Line 1.9” OD, 2.72 lb/ft

3. Rail and Braces 1.66” OD, 2.27 lb/ft.

4. Gate Post 6-5/8” OD

2.4 FITTINGS

A. Chain link fence fittings per ASTM F 626. All ferrous metal fittings to be galvanized.

B. Post caps: Steel, cast iron or aluminum alloy; must be weatherproof to prevent moisture intrusion into post.

C. Rail ends: Formed steel or iron, designed to provide secure connection of top rails to terminal post and brace or other rails to terminal and intermediate posts.

D. Sleeves: Lengths of top rails to be connected using 6" sleeves with a .055 minimum wall thickness that allow for expansion or contraction of the rail.

E. Tie Wire: 9 gauge galvanized steel or aluminum for attachment of chain link fabric to rails. Hog rings attach fabric to tension wire to be 12-1/2 GA steel.

F. Fabric bands and brace bands to be pressed steel.

G. Tension (stretcher) bars to be made of one continuous piece of steel or aluminum, 3/16" x 3/4", in the same height as the fence. Provide one bar, per end or gate post and two bars per corner or pull post.

H. Tension wire: Galvanized steel wire, 7 gauge core, having a tensile strength of 75,000 psi.

I. Truss rods & tightened. Rod diameter 3/8".

J. Nuts, bolts and screws shall be steel, minimum size 3/8-inch diameter, hot-dip galvanized after fabrication.

K. Galvanized coating damaged during construction of the fencing shall be repaired by application of Galvo-Weld; Galvinox; or equal.

2.5 SLIDE GATE

A. Chain link slide gate and fittings per ASTM F626. All ferrous metal fittings to be galvanized.

B. Chain link slide gates as per ASTM F1184 Specifications for Industrial and Commercial Horizontal Slide Gates.

C. Gate to be equipped with latch with pad-lock hole to be pressed steel.

2.6 POST FOUNDATIONS

A. Concrete Class 3000 in accordance with ISPWC Section 703.2.4 Table 1 and drawings.

PART 3 - EXECUTION

3.1 GENERAL

A. Inspection: Prior to commencing installation, require Installer to inspect all areas and conditions within which Work of this Section will be performed. Dimensions and clearances shall be verified. Final grading shall be completed and all earth, brush, or other obstructions which interfere with the proper alignment and construction of fencing shall be removed.

B. Unless otherwise indicated, all posts shall be set in concrete. Gate and related posts, corner posts, and other critical elements shall be provided with concrete foundations which are designed by an engineer to safely accommodate the loads to which they will be subjected.

3.2 INSTALLATION

A. Excavation: Holes for posts shall be drilled or hand excavated to the diameters and spacing indicated on the plans, in firm, undisturbed or compacted soil. Post foundations shall comply with the following:

B. Holes shall be excavated to a diameter not less than 12-inches or not less than 5 times the largest dimension of the item being anchored, whichever is larger.

C. Depth for holes shall be not less than 40 inches.

D. Setting Posts: Line posts shall be spaced at not more than 10-foot intervals, measured from center to center of the posts, parallel to the ground slope. Posts shall be set plumb and shall be centered in holes, 4-inches above the bottom of the excavation, with posts extending not less than 36-inches below finish grade surface.

E. Corner posts shall be installed where changes in the fence lines equal or exceed 30 degrees, measured horizontally.

F. Each post shall be properly aligned vertically and its top aligned parallel to the ground slope. Posts shall be maintained in proper position during placement and finishing operations.

G. Concrete: Concrete for footings may be placed without forms, providing the ground is firm enough to permit excavation to neat line dimensions. Prior to placing concrete, the earth around the hole shall be thoroughly moistened.

H. Encasement concrete for footings shall be placed immediately after mixing in a manner such that there will be no concentration of the large aggregates. The concrete shall be consolidated by tamping or vibrating.

I. Concrete footings shall have a neat appearance and shall be extended 2-inches above grade and troweled to a crown to shed water.

J. A minimum of 7 days shall elapse after placing the concrete footings before the fence fabric is fastened to the posts.

K. Bracing: Bracing shall be provided at all ends, corners, gates, and intermediate brace posts. Corner posts and intermediate brace posts shall be braced in both directions. Horizontal brace rails shall be set midway between the top rail and the ground, running from the corner, end, intermediate brace or gate post to the first line post. Diagonal tension members shall connect tautly between posts below horizontal braces.

L. Braces shall be so installed that posts remain plumb when diagonal rod is under proper tension.

M. Intermediate Brace Posts: Where straight runs of fencing exceed 500-feet, intermediate brace posts shall be installed, spaced equally between ends or corners; with additional posts provided as required, such that the spacing between intermediate brace posts does not exceed 500-feet. Intermediate brace posts shall be equivalent in size to corner posts and shall be braced with horizontal brace rails and diagonal tension members in both directions.

N. Top Rails: Top rails shall be run continuously through post caps, bending to radius for curved runs. Expansion couplings shall be provided as recommended by the fencing manufacturer.

O. Tension Wire: Continuous bottom tension wire shall be stretched tight with turnbuckles at end, gate, intermediate, and corner posts. Tension wire shall be installed on a straight grade between posts, with approximately 2-inches of space between finish grade and bottom selvage, unless otherwise indicated. Tension wire shall be tied to each post with not less than 6 gauge galvanized wire.

P. Fabric: The chain-link fabric shall be fastened on the secured side of the posts. Fabric shall be stretched and securely fastened to posts. Between posts, top and bottom edges of the fabric shall be fastened to the top rail and bottom tension wire, respectively. Fabric shall be stretched and anchored in such a manner that it remains in tension after the pulling force is released.

Q. Tie Wires: Tie wire shall be bent to conform to the diameter of the pipe to which it is attached, clasping pipe and fabric firmly with ends twisted at least two full turns. Ends of wire shall be bent back to minimize hazard to persons or clothing.

R. Fabric shall be tied to line posts with tie wires spaced at 12-inches on center.

S. Fabric shall be tied to rails and braces with tie wires spaced at 14-inches on center.

T. Fabric shall be tied to tension wires, with hog rings spaced 18-inches on center.

U. Stretcher Bars: Fabric shall be fastened to end, corner, intermediate brace, and gate posts with stretcher bars. Bars shall be threaded through or clamped to fabric at 4-inches on center and secured to posts with stretcher bar bands spaced no more than 14-inches on center.

V. Fasteners: Nuts for tension bands and hardware bolts shall be installed on the side of fence opposite the fabric side. Ends of bolts shall be peened or the threads scored to prevent removal of nuts.

3.3 GROUNDING

A. Fences crossed by power lines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 150-feet on each side of the crossing.

B. Fences, gates and appurtenances enclosing electrical equipment areas, gas yards, or other hazardous areas shall be electrically continuous and grounded.

C. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 3/4-inch by 10-foot long copper-'clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 6-inches below grade.

1. Where driving is impracticable, electrodes shall be buried a minimum of 12-inches deep and radically from the fence. Top of electrode shall be not less than 2-feet or more than 8-feet from the fence.

D. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps so as to create electrical continuity between fence posts, fence fabric, and ground rods. After installation, the total resistance of fence to ground shall not be greater than 25 ohms.

END OF SECTION 32 31 13

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SECTION 32 80 00 - IRRIGATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The CONTRACTOR shall construct an automatic irrigation system, complete, in accordance with the requirements of the Contract Documents.

B. The irrigation system shall include, but not be limited to, all pipes, fittings, valves, automatic control valves, controllers, valve boxes, drain valves, holes bib valves, operating wrenches riser assemblies, direct burial wires, electrical connections, wring and other appurtenances, piping connections testing cleaning up, maintenance and adjustments necessary for a complete operating system, ready for intermediate use upon completion. Provide all minor items necessary for proper construction and functional operation of this system, even though not specifically described in the Contract Documents, shall be included as a part of the work of this Section.

1.2 REFERENCE STANDARDS

A.	ASTM B 3	Specification for Soft or annealed Copper Wire.
B.	ASTM D 2564	Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
C.	AWWA C 500	Gate Valves for Water and Sewerage Systems

1.3 SUBMITTALS

A. ENGINEER approval is required for all submittals. The following shall be submitted in accordance with Section 01 33 00 - Submittal Procedures.

B. Spare Parts: Spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the filed test. The data shall include a complete list of parts and supplies, with current unit prices and source of supply. As a minimum, the CONTRACTOIR shall provide the spare parts listed below:

1. Two drip emitters of each size and type;

2. One valve key for operating manual valves;

3. Two wrenches for removing and installing each type of head; and

4. Four irrigation controller housing keys.

C. Owner's Manuals: Provide OWNER with operating and maintenance manuals from manufacturers per Section 01 78 23 - Operation and Maintenance Data. Operating manuals shall detail the step-by-step procedures required for system startup, operation and shutdown. Operating manuals shall include the manufacturers name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manual shall list routine maintenance procedures, possible breakdowns and repairs and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

D. Product Data: Include pressure ratings, rated capacities, and settings of selected models for the following:

1. Water regulators.

2. Water hammer arresters.

3. General-duty valves.

4. Specialty valves.

5. Control-valve boxes.

6. Irrigation specialties.

7. Controllers. Include wiring diagrams.

8. Control cables. Include splice kits and conduit.

E. Shop Drawings: Show irrigation system piping, including plan layout, and locations, types, sizes, capacities, and flow characteristics of irrigation system piping components. Include water meters, backflow preventers, valves, piping, and devices, accessories, controls, and wiring. Show wire size and number of conductors for each control cable.

F. Coordination Drawings: Show piping and major system components. Indicate interface and spatial relationship between piping, system components, adjacent utilities, and proximate structures.

1.4 QUALITY ASSURANCE

A. Field Tests: All instruments, equipment, facilities and labor required to conduct field tests shall be provided by the CONTRACTOR. The CONTRACTOR shall notify the ENGINEER at least 48 hours prior to performing the tests. All tests shall be performed in the presence of the ENGINEER.

B. The following field tests shall be performed:

1. Hydrostatic Pressure Test: After assembly and installation, all water pipes, fitting, automatic equipment, and appurtenances shall be tested at a hydrostatic pressure of 150 psi at the lowest point of the system for not less than 2 hours.

a. Install all thrust blocks and cap risers for hydrostatic pressure test. Backfill trenches between pipe connections to prevent pipe from moving under pressure. Expose couplings and fittings during testing for visual inspection.

b. The first test shall be made in such a manner that all valves in the new water pipe emitter lines will be tested for watertight closure. Valves may be tested in groups or singly while subjected 150 psi water pressure for a period of not less than 2 hours.

c. The second irrigation system test shall be made by forcing all air from the pipes with water and capping or plugging pipe risers. After the pipe risers shall been plugged or capped, all line valves shall be fully opened and the pipe lines subjected to the full static water pressure a period of not less than 2 hours.

d. Subject mainline pipe to a hydrostatic pressure equal to 150 psi of two hours. Install 200 psi pressure gauge for testing, not more the 5 psi loss will be permitted. Replace defective pipe, fittings, joints, valves or appurtenances. Repeat the test until the pipe passes the test.

1) Operation Test: At conclusion of the Hydrostatic Pressure Test, emitters shall be installed and entire system tested for operation under normal operating pressure. The Operation Test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

1.5 SCHEDULING AND COORDINATION

A. The CONTRACTOR shall be responsible for making arrangements for the coordination of its construction operations with those of all others on the job. The CONTRACTOR shall permit others engaged in work to accomplish their portion of the WORK without undue interference or delay.

B. The CONTRATOR shall be responsible for the scheduling and coordination of the electrical and water connections and the installation of the piping and equipment in a manner that will effect the earliest completion of the WORK in conformance with the construction progress schedule.

PART 2 - PRODUCTS

2.1 GENERAL

A. Brand names specified for materials are supplied for the purpose of describing the type, size, quality, and performance of materials. The CONTRACTOR may propose, as substitutions, other manufacturer's materials of equal quality and performance to the ENGINEER for review in accordance with Section 01 25 13 - Product Substitution Procedures.

B. The CONTRACTOR shall furnish, at no additional charge, all samples necessary for testing as outlined in the Specifications or, when requested, certified evidence of off-site testing.

2.2 PLASTIC PIPE AND FITTINGS

A. Pipe shall be continuously and permanently marked with the following information: Manufacturer's name, nominal pipe size, PVC type, pressure rating, and extrusion date.

B. All plastic pipe for lateral lines shall be PVC (polyvinyl chloride) SDR 21, Class 200, NSF approved.

C. All materials for pressure main lines shall be PVC (polyvinyl chloride) SDR 21, Schedule 40, NSF approved, or galvanized steel pipe.

D. All fittings shall be PVC (polyvinyl chloride) Schedule 40, Type II, NSF, or Schedule 80 as called for in the Contract Documents.

E. Swing joint ells shall be Schedule 80 PVC. Flexible riser shall be 1/2-inch in size as manufactured by Flex-nipple, Model No. UP-90 and UP-180, or equal.

2.3 VALVES

A. Main shut-off valves shall be bronze gate valves with union bonnet, renewable seats, and non-rising stem, Class 150, or better.

B. Isolation valves for main lines shall be bronze gate valves with wedge disc, Class 125, screwed ends, and operating nut, as noted on plans or equal.

C. Remote Control Valves: Remote control valves for the irrigation system shall conform to the following requirements:

1. Control valves shall be bronze valves, for 24-volt electrically controlled solenoids, ac or dc operation. They shall be of heavy cast-bronze construction with cross or slotted type wheel for operation with key, and bleed fitting.

2.4 AUTOMATIC CONTROLLER

A. The automatic controllers shall be electrically-timed devices for automatically opening and closing remote control valves. All controllers and remote control valves supplied under this contract shall be of the same manufacturer and have similar operational and adjustment features.

B. The controller shall be enclosed in a weatherproof metal housing having locking cover or covers to protect all adjustment and breakable equipment from vandalism. Exterior controllers shall be provided with locking covers. Keys for covers shall be interchangeable keys. The controller shall be wall mounted.

C. Automatic controller shall be Rainbird ESP-LXD or approved equal.

2.5 DRIP TUBE

A. Drip tube shall be the model and type indicated on the Drawings.

2.6 CONTROL WIRING

A. Control wiring shall be Standard UF Direct Burial Copper Wire, Type UF Bearing, UL approved for direct underground burial in National Electrical Code Class II circuits, AWG sizes.

B. Conductor of electrical conductivity shall be grade copper meeting requirement of ASTM B 3.

C. All splices shall be made with wire connectors, such as manufactured by Rainbird, Pen Tit, Scotch Lock, or equal.

2.7 PVC SOLVENT CEMENT AND PRIMERS

A. Solvent Cement shall be NSF approved and shall meet requirements of ASTM D 2564.

B. Primer shall be NSF approved and shall be Weld-On, P-70 Industrial Polychemical Service, or equal.

2.8 VALVE AND CONTROLLER BOXES

A. Boxes for valves and controllers shall be heavy duty fiber glass, PVC, or concrete and shall be complete with identification lid. Boxes shall be sized for equipment within box, depth of installation, and operation and maintenance space required.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of the irrigation system shall be performed after the finish grading, but prior to landscaping.

B. All valves, fittings, heads, and piping shall be installed as shown and all connections made to permit the irrigation system to function properly through its entire length.

C. All materials and equipment shall be installed in strict accordance with manufacturer's written instructions and recommendations and all local and state codes, laws, ordinances, and regulations.

D. Before proceeding with the installation of any section or unit of the irrigation system, the CONTRACTOR shall check and verify the correlation between ground measurements and Drawings and shall advise the ENGINEER of any discrepancies.

E. The total number of drip heads and circuits and size of pipes shall be not less than shown unless otherwise approved.

3.2 EXCAVATION

A. Trenches shall be dug as wide and as deep as necessary to properly install the irrigation lines.

B. Pipe trenches shall be straight, or "snaked" slightly allowing for expansion and contraction of PVC pipe.

C. Subsoil shall be kept separate from topsoil, where possible. D. Minimum cover depth shall be as follows:

1. Supply pressure lines from water source to control valves: 18 inches unless otherwise shown.

2. Lateral lines from control valves to emitters; 12 inches unless otherwise shown. Lateral lines under paving, roadways, and driveways shall have 24 inches of cover and be located in Schedule 40 PVC sleeves.

3. Trenches for control wire only shall be 18 inches deep unless otherwise shown. Control wires under concrete walks and slabs, paving, roadways, and driveways shall be installed in Schedule 40 PVC sleeves.

D. A trench of sufficient width shall be provided to allow for proper tamping around pipe.

3.3 PIPING, GENERAL

A. Piping shall be laid out and installed in accordance with manufacturer's printed recommendations and industry standards. Substantial support shall be provided at all points, and pipes shall be snaked slightly allowing for expansion and contraction.

B. Minimum 1-inch vertical clearance shall be between lines crossing at angles greater than 45 degrees.

C. Minimum 3 inches horizontal and vertical clearances shall be maintained between all other lines.

D. All swing or swivel joints shall provide a leak-resistant joint with freedom of movement.

E. Teflon thread sealant 3/4-inch wide (tape or liquid), Rectorseal No. 5, or equal shall be used at all threaded joints.

F. Galvanized steel pipes shall have clean standard threads of standard lengths. Joints shall be made up with pipe compound applied to male threads only and not more than 2 threads shall show at the joints when connected.

G. Pipe sleeves shall be provided under all paving and where necessary for passage under finish surface material, future replacement

3.4 PLASTIC PIPE

A. The pipe shall be guaranteed by the manufacturer to be suitable for operation under the conditions of this installation and shall be guaranteed free from defects in workmanship and quality.

B. The pipe shall be connected by a-ring type or by solvent-weld joints as outlined below. Joints shall be made in strict accordance with the manufacturer's printed recommendation.

C. The plastic pipe sections shall be placed accurately to line and grade in the prepared trenches. The inside of all pipe shall be clean and free from foreign matter and shall be end-reamed to remove burrs and provide full inside diameter of the pipe end.

D. Pipe assembly shall have a firm, uniform bearing for the entire length of each pipeline to prevent uneven settlement. All adjustments to grade shall be made by scraping away or filling in with clean earth backfill material, well compacted under the body of the pipe. Wedging of pipe will not be permitted. The inside of all pipe shall be clean and free from foreign materials before joints are assembled.

E. Sealant tape shall be used on all threaded joints.

F. All pipeline open ends upon which the WORK has been stopped shall be closed at the end of each day's construction work with a suitable temporary plug to prevent entrance of any foreign materials into the assembled pipeline.

G. Pressure pipe shall be defined as all piping lying "upstream" from remote control valves and quick-coupling lines.

H. A ring type flexible coupling pipe shall be used on pressure pipes larger than 3-inch diameter.

I. Three-inch and smaller mainlines and fittings of pressure piping shall be solvent-weld type.

J. Pressure piping 3-inch and larger shall be provided with portland cement concrete thrust blocks. Thrust blocks shall be constructed at the following places:

1. Where pipe changes direction at fittings.

2. Where pipe changes size.

3. Where line terminates.

4. Around gate valves (bottom half of valve in concrete; bolts exposed for change of top half).

3.5 VALVES

A. Piping systems shall be supplied with valves at all points as shown or specified herein so arranged to give complete regulating control throughout. Automatic control valves and gate valves, shall be as detailed in the Contract Documents or as otherwise directed by the ENGINEER. Winter blow out fittings shall be provided.

B. Valves shall be the full size of the line in which they are installed, unless otherwise shown.

C. Gate valves shall be line (pipeline) size, shall be installed where shown, and shall be properly blocked to a cast-iron water works valve box. All gate valves shall be provided with 2-inch square operating nuts. One 5-foot wrench for each 3 gate valves shall be furnished.

D. Quick-coupling valves shall be provided, located, and installed as shown. Quick- coupling valves shall be installed with one-inch swing joint.All quick-coupler lines shall be installed not less than 18 inches below grade.

E. A main stop and drain valve shall be installed near the point of connection to the main line.

F. Drain valves shall be installed at low points along the main. It shall be the CONTRACTOR'S responsibility to see that the main drains properly.

G. Gravel sumps 2-ft by 2-ft by 2-ft in size and filled with 3/4-inch to 1-inch size round gravel shall be provided at each manual drain valve and at low sprinkler head locations for drainage, (spray heads only).

3.6 VALVE BOXES

A. Valve boxes shall be set 1/2-inch above the designated finish grade in lawn areas and 2 inches above finish grade in ground cover areas. Where dimensions permit, up to 3 remote control valves may be installed in each box.

3.7 DRIP SYSTEM

A. Emitters shall be installed in coordination with actual field placement of shrubs and as directed by the ENGINEER.

B. The system shall be thoroughly flushed as so to remove all possible foreign matter prior to installation of the emitters.

C. The CONTRACTOR shall protect against re-entry of contaminated water into risers or piping..

3.8 CONTROLLERS

A. The CONTRACTOR shall install controller as shown complete with required waterproof circuit breaker type disconnect switch, per manufacturer's printed recommendations.

B. Controller location is essentially diagrammatic, and the actual installation shall be as specifically located by the ENGINEER.

C. All local and applicable codes shall be followed in furnishing and/or connecting a 115-volt electrical service to the controller.

D. The controller shall be wall-mounted in buildings as shown, in such a manner that all normal adjustments can be conveniently reached by the operator while in a standing position.

E. Adjustment of the controller shall be such that each control valve in the circuit will remain open for a readily adjustable period of 5 or less minutes to 60 minutes. Readily made field adjustments shall include a provision whereby any number of days in a week can be skipped and whereby one or more positions on the controller may be skipped. When any or all of the above adjustments have been made, the controller shall continue to operate automatically as set until further adjustments are made. Provision shall be made for conveniently resetting the start of the irrigation cycle at any time and also for advancing from one position to any other position at will.

F. The CONTRACTOR shall properly ground the control boxes to copper ground rods driven into the ground.

G. Timing, sequence and period will be supplied to the CONTRACTOR by the ENGINEER. At this time, the CONTRACTOR shall adjust the controller for normal operation.

H. The controller shall be single-phase, 115-volt (approx.) ac operated and shall contain an "On-Off" switch and fuse assembly. The controllers shall be equipped with a transformer to reduce voltage to a 24-volt system. Controller station shall be provided where shown.

3.9 WIRING AND ELECTRICAL WORK

A. All electrical equipment and wiring shall comply with local and state codes and shall be installed by those skilled and licensed in the trade. Unless the governing codes specify otherwise, low voltage control wire may be installed by the CONTRACTOR when code allows.

B. All 115-volt wire shall be installed in conduit and taken from appropriate sources as shown. CONTRACTOR shall coordinate manufacturer and installer.

C. The CONTRACTOR shall provide low voltage, 24-volt direct burial wires. Wire size shall be as shown but shall be not less than No. 14. Where sizes are not shown, they shall be sized per wire manufacturer's sizing charts and specifications.

D. The CONTRACTOR shall provide all wiring, conduits, sleeves, and connection for the low voltage electrical system between controller and valves, and where else shown and necessary for a complete and operable irrigation system.

E. Wires shall be color coded as follows:

1. Control wires shall be red.

2. Ground (neutral) wire shall be white.

F. All splices shall be moisture proof using specified electrical connectors.

G. Wires shall be bundled together and wrapped with electrical tape similar to PVC at 5-ft intervals. They shall be buried in same trench as the pipe where possible.

H. An expansion curl should be provided within 3 feet of each wire connection and at least every 100 feet of wire length on runs more than 100 feet in length. Expansion curls shall be formed by wrapping at least 5 turns of wire around a 1-inch pipe or more in diameter, then withdrawing pipe.

I. All conduits and sleeves necessary for running wires under concrete, walks, and paving shall be furnished and installed before said concrete, walks, and paving work is constructed.

J. Wire shall be continuous without splices except at control valves, and shall be routed in main line trench whenever possible.

K. All wire under paving shall be encased in PVC pipe; changes in direction under paving shall be made with sweep ells.

3.10 PIPE TRENCH BACKFILL

A. After pipe and wires have been installed, the trenches shall be backfilled. The backfill operation must provide a firm continuous support for the pipe.

B. Backfill material shall be free of rocks and other materials that may damage the piping.

C. Bottom of trenches shall be smooth and free of sharp rocks and other objects that may damage pipe.

D. The initial backfill shall be accomplished by carefully tamping selected material (from material excavated from the trench) under the pipe and between the pipe and the trench walls.

E. The pipes shall be filled with water and pressurized during backfilling operations if necessary, to prevent drainage to piping.

F. The backfill shall be carefully installed around and over the pipe to approximately 10 inches of the ground surface, then water shall be allowed to flow in the trench. After this puddling operation has been completed and allowed to stand for 24 hours, the balance of the materials shall be placed in the trench to the sub-grade line (leaving room for topsoil). Rocks and other materials found in the backfill shall be removed. The backfill shall be compacted carefully and thoroughly.

G. Couplings and fittings shall be left exposed until leakage tests have been completed, unless the ENGINEER orders otherwise.

H. Topsoil shall be installed prior to planting.

3.11 TESTING AND ADJUSTMENTS

A. The ENGINEER shall be notified by the CONTRACTOR prior to performing hydrostatic tests on the irrigation system in place. This test shall be done by the CONTRACTOR in the presence of the ENGINEER. The test results will be acceptable to the ENGINEER when no leakage or loss of pressure is evident during the test period. Defects shall be detected and repaired prior to retesting.

END OF SECTION 32 80 00

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SECTION 32 90 00 - LANDSCAPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials, and equipment as required to install plants, landscaping rock, and seed or sod the areas that are to receive lawn or grass, as shown on the plans, including soil preparation, fertilizer, seeding, sodding, and maintenance as required.

1.2 REFERENCE STANDARDS

A. FS O-F-241 - Fertilizers, Mixed, Commercial

B. ASPA (American Sod Producers Association) - Guideline Specifications to Sodding

C. American Association Nurserymen, Inc. - Rules and Grading Provisions

1.3 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

B. The Contractor shall furnish a certificate with each delivery of bulk material delivery, stating source, quantity, and type of material.

C. Samples: Typical samples, two (2) of each variety and size of plants, shall be submitted for approval at the site. These samples, if approved, shall be planted and maintained as standards for comparison with plants furnished.

D. Maintenance Instructions: Recommended procedures to be established for maintenance, by Owner, of exterior plants during a calendar year.

E. Certification of Grass Seed: From seed Vendor for each type of seed.

1.4 QUALITY ASSURANCE

A. All plants furnished by the Contractor shall be true to type or name as shown in the Contract Documents. The Contractor shall transport planting stock either in fully enclosed trailer or trucks.

B. Field Inspections: The Contractor shall request inspection at least 24 hours in advance of the time inspection is required. Inspection will be required on the following stages of the Work:

1. When shrubs are spotted for planting, but before planting holes have been excavated.

2. When all specified work, except the maintenance period, has been completed.

C. Maintenance Guarantee: The Contractor shall be responsible of all plantings until acceptance of all work under the Contract and tree replacements.

1. The Work covered by the maintenance and guarantee portions of these specifications consists of providing all replacements of seeded areas, plants, labor, materials, equipment, and supplies and in performing all operations in connection with maintenance and guarantees.

2. The inspection of the low mow grass areas is independent of the final inspection and maintenance period.

3. Inspection of work and plantings will be made at conclusion of contract period. Written notice requesting inspection shall be submitted to the Engineer at least ten (10) days prior to the anticipated inspection date.

4. Final acceptance of the Work prior to maintenance guarantee period of the contract will be accepted upon written approval by the Engineer, on the satisfactory completion of all work, but exclusive of the replacement of plant material.

5. Plants used for replacement shall be of the same size and variety specified in the plant list. Plants shall be furnished, planted, as specified.

1.5 LANDSCAPING MAINTENANCE

A. The Contractor shall be responsible for protecting, watering, and maintaining all planting until final acceptance of all work under the contract.

B. At time of acceptance of the complete project, all natural grass areas shall be totally established with no bare spots.

C. Watering: Shrubs shall be thoroughly soaked after planting and provided with additional water at intervals as necessary to provide for good health and growth of the planting.

D. Upon completion of natural grass seeding, the entire area shall be soaked to saturation by a fine spray. The new planting shall be kept watered during dry weather or whenever necessary for proper establishment of the natural grass. Care shall be taken to avoid excessive washing or puddling on the surface and any such damage caused thereby shall be repaired by the Contractor at its own expense.

E. Protection: The Contractor shall provide adequate protection to all newly seeded areas including the installation of approved temporary fences to prevent trespassing and damage, as well as erosion control, until acceptance.

F. The Contractor shall replace any materials or equipment it has damaged or which has been damaged by its employees or subcontractors.

G. Partial utilization of the project shall not relieve the Contractor of any of the requirements contained in this specification.

H. Plants shall be maintained in a vigorous, thriving condition by watering, cultivating, weeding, spraying, and other operations necessary.

I. Maintenance shall include, in addition to the foregoing, cleaning, the repair of erosion, and all other necessary work of maintenance.

PART 2 - PRODUCTS

2.1 GENERAL

A. All landscaping materials for planting shall be first-grade, commercial quality and shall have certificates indicating the source of material, quantity, attached to each container or provided with each delivery.

2.2 LANDSCAPE ROCK

A. As show in the plans, landscape rock is to be provided by the Contractor. Prior to placement of landscape rock, an approved weed barrier should be placed in all areas that are scheduled to receive landscape rock. Landscape rock should be a clean rock with a diameter of approximately 2-inches and smaller. Samples of the rock shall be provided to the owner for review prior to ordering and placement. See landscaping rock detail for specifics.

2.3 GROWING MEDIA

A. Topsoil: Natural, fertile, agricultural soil capable of sustaining vigorous plant growth, not in frozen or muddy condition, containing not less than six (6) percent organic matter, and corrected to pH value of 5.9 to 7.0. Free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, crabgrass, coughgrass, noxious weeds, and foreign matter. Not exceeding twelve (12) inches of depth.

B. Fertilizer: Use commercial fertilizer that is a 16-16-8 grade commercial fertilizer, uniform in composition, dry and free flowing, containing by weight: 16 percent nitrogen, 16 percent phosphorous acid, 8 percent potash. (Controlled release fertilizer tablets shall be slow release 12 grams each 20-10-5 “Agriform,”, "Lesslie", Osmocote, or equal.) Deliver fertilizer mixed as specified in standard size bags showing weight, analysis, name of manufacturer, as required by State regulations. Store in a weatherproof storage location in such a manner that it will be kept dry and its effectiveness will not be impaired.

2.4 PLANT MATERIALS

A. General

1. Plants shall be in accordance with the botanical names and applicable standards of quality, size, condition, and type. They shall be true to name, genera, species, and variety in accordance with reference publications. Plant names are defined in “Standardized Plant Names” and “Bailey's Encyclopedia of Horticulture”. When a name is not found in either reference, the accepted name used in the nursery trade shall apply.

2. Nurseries that sell the specified grass seed and trees may be found at www.idahonativeplants.org/guides/sawahbenurserylist.html.

B. Shrubs

1. All shrubs shall be symmetrical and shall conform to the size, age, and condition as specified on the following list. Shrubs shall be of sound health, vigorous, and free from disease and shall be well- branched, shall have full foliage when in leaf, and shall have a healthy well-developed normal root system.

2. Shrub specimens are described in the plans.

PART 3 - EXECUTION

3.1 GENERAL

A. New sod shall be installed where sod is removed as part of the project. Hydroseeding will not be allowed for rehabilitation in areas where there is sod existing prior to beginning construction.

B. The landscape work shall not be performed at any time when it may be subject to damage by climatic conditions.

1. Grass seed shall be hydro seeded between May 15th to June 15th or September 1st to September 15th.

C. Waste materials shall be removed and disposed of off the Owner's property, unless otherwise indicated.

D. The landscape work shall not begin until all other trades have repaired all areas of settlement, erosion, rutting, etc., and the soils have been re-established, recompacted, and refinished to finish grades.

E. The landscape work shall not proceed until after walks, curbs, and pavings are in place. The contract operations shall be completed to a point where the landscape areas will not be disturbed.

3.2 SOIL PREPARATION

A. Remove from site, foreign materials collected during construction.

B. Spread subgrade material evenly; smooth over to remove ridges and depressions so evenly graded.

C. Spread topsoil evenly across subgrade area to receive grass seed.

3.3 DELIVERY, STORAGE, AND HANDLING OF PLANT MATERIALS

A. Plant material shall be planted on the day of delivery if possible. The Contractor shall protect the stock at the project site where it shall be protected from sun and drying winds and shall be shaded. Plants shall be planted within 1 day after delivery.

3.4 PLANT LOCATIONS

A. The Contractor shall have the locations approved by the Engineer before starting excavation of plant pits. The plant locations shall be observed, and their locations shall be adjusted as directed by Engineer before final approval.

3.5 PLANT PITS

A. Plant pits, centered on location stakes, shall be excavated (scalped) circular pits with vertical sides and flat or saucer shape bottom three (3) times the size of the root ball.

END OF SECTION 32 90 00

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SECTION 40 05 00 – PIPING, GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide the piping systems indicated, complete and operable, in accordance with the Contract Documents.

B. The mechanical drawings define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. Where pipe supports and spacings are indicated on the drawings and referenced to a standard detail, the Contractor shall use that detail. Where pipe supports are not indicated on the drawings, it is the Contractor's responsibility to develop the details necessary to design and construct all mechanical piping systems, to accommodate the specified equipment, and to provide all spacers, adapters, and connectors for a complete and functional system.

C. Piping system drawings are diagrammatic and are intended to show approximate location of equipment and piping. Dimensions given on the plans in figures take precedence over scaled dimensions. Verify dimensions, whether in figures or scaled, in the field. The Contractor shall be responsible for the installation of complete and workable systems whether completely detailed on the plans or not.

D. The Contractor shall ascertain locations of apparatus, fixtures, equipment, and piping in the field, and layout work accordingly. The Owner reserves the right to have minor changes in location of piping and equipment made up to the time of installation without additional cost.

E. All piping, fittings and valves that come in contact with potable water shall be NSF 61 compliant.

1.2 REFERENCE STANDARDS

A. All mechanical work shall conform to latest edition of the International Mechanical Code.

B. Commercial Standards

1.	ASTM B 88	Hard Copper Tube
2.	ASME B 16.22	Copper Fittings
3.	ANSI/ASME B 1.20.1	Pipe Threads, General Purpose (inch)
4.	ANSI B 16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys

5.	ANSI/AWWA C 207	Steel Pipe Flanges for Water Works Service; Sizes 4 in through 144 in.
6.	ANSI/AWWA C 606	Grooved and Shouldered Joints
7.	ANS/AWS D1.1	Structural Welding Code
8.	ASTM A 307	Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile
9.	ASTM A 325	Specification for High-Strength Bolts for Structural Steel Joints
10.	ASTM D 792	Test Methods for Specific Gravity and Density of Plastics by Displacement
11.	ASTM D 2000	Classification System for Rubber Products in Automotive Applications

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Submittal Procedures.

B. At a minimum, the following information shall be submitted for review and approval prior to ordering piping materials.

1. Manufacturer specifications for each pipe type, including all references to acceptable standards as referenced in each individual pipe section.

2. Indicate fittings and manufacturer recommended connections.

3. Pressure ratings.

4. Lining and coating type, thickness, and application procedures.

5. Fitting types and manufacturer recommended applications and acceptable installation procedures and tolerances.

C. Fabrication Drawings: The Contractor shall submit piping fabrication drawings show in all fittings, pipe material, supports, and all dimensions for proper installation of piping system as illustrated on mechanical drawings.

1.4 QUALITY CONTROL

A. Certifications: Necessary certificates, test reports, and affidavits of compliance shall be obtained by the Contractor. A certification from the pipe fabricator that each pipe will be manufactured subject to the fabricator's or a recognized quality control program. An outline of the program shall be submitted to the Engineer for review prior to the manufacture of any pipe.

B. Where the assistance of a manufacturer's service representative is advisable, in order to obtain recommended pipe joints, supports, or special connections, the Contractor shall furnish such assistance at no additional cost to the Owner.

C. All pipe, fittings, and gaskets used in potable water systems shall be compliant with NSF/ANSI 61, 14, and 372.

PART 2 - PRODUCTS

2.1 GENERAL

A. Extent of Work: Pipes, fittings, and appurtenances shall be provided in accordance with the requirements of the applicable sections of Divisions 31 and 40 and as indicated. Materials in contact with potable water shall be listed as compliant with NSF Standard 61.

B. Pipe Supports: Pipes shall be adequately supported, restrained, and anchored in accordance with Section 40 05 07 – Hangers and Supports for Process Piping, and as indicated.

C. Lining: Application, thickness, and curing of pipe lining shall be in accordance with the applicable sections of Division 40 unless otherwise indicated. Fittings and couplings shall be lined with the same material required for the pipeline in which the fittings and couplings are installed.

D. Coating: Application, thickness, and curing of pipe coating shall be in accordance with the applicable sections of Division unless otherwise indicated. Pipes above ground or in structures shall be field-coated in accordance with Section 09 90 00 – Painting and Coating.

E. Pressure Rating: Piping systems shall be designed for the maximum expected pressure as indicated on the drawings and individual pipe specifications.

F. Grooved Piping Systems: Piping systems with grooved joints and fittings may be provided in lieu of flanged, joint systems for exposed ductile iron piping. To assure uniform and compatible piping components, all grooved fittings, couplings, and valves shall be from the same manufacturer. The Contractor shall make the coupling manufacturer responsible for the selection of the correct style of coupling and gasket for each individual location.

G. Tests: Except where otherwise indicated, materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. Welds shall be tested as indicated. The Contractor shall be responsible for performing material tests.

H. Welding Requirements: Qualification of welding procedures used to fabricate pipe shall be in accordance with the provisions of ANSI/AWS D1.1 - Structural Welding Code. Welding procedures shall be submitted for the Engineer's review.

I. Welder Qualifications: Welding shall be done by skilled welders and welding operators who have adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 or the ASME Boiler and Pressure Vessel Code, Section 9, by an independent local, approved testing agency not more than

six (6) months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests. Qualification testing of welders and materials used during testing is part of the Work.

J. Joining Dissimilar Materials: Di-electric unions shall be used at the junction of two dissimilar metallic pipes as required by the local adopted plumbing code. It shall be the responsibility of the Contractor to identify any such conditions whether indicated in the Project Drawings or not. Di-electric unions shall be lead free, appropriate for the two dissimilar metals and be stamped with an approved UPC seal.

2.2 PIPE FLANGES

A. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise indicated. Attachment of the flanges to the pipe shall conform to the applicable requirements of AWWA C207. Flange faces shall be perpendicular to the axis of the adjoining pipe. Flanges for miscellaneous small diameter pipes shall be in accordance with the standards indicated for these pipes. Flanges shall have pressure ranges corresponding to the following:

1. 150 PSI or less: Flanges shall conform to either AWWA C207 - Steel Pipe Flanges for Waterworks Service-Sizes 4 In. Through 144 In., Class D, or ASME B16.5 - Pipe Flanges and Flanged Fittings, 150 lb class.

2. 150 to 275 PSI: Flanges shall conform to either AWWA C207 Class E or Class F, or ASME B16.5 150 lb. class.

3. 275 to 700 PSI: Flanges shall conform to ASME B16.5, 300 lb. class.

4. AWWA flanges shall not be exposed to test pressures greater than 125 percent of rated capacity. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected.

B. Blind Flanges: Blind flanges shall be in accordance with AWWA C207, or as indicated for miscellaneous small pipes. Blind flanges for pipe sizes 12-inches and greater shall be provided with lifting eyes in the form of welded or screwed eye bolts.

C. Flange Coating: Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. Flange Bolts: Bolts and nuts shall conform to Section 05 50 00 – Metal Fabrications. All-thread studs shall be used on all valve flange connections, where space restrictions preclude the use of regular bolts.

E. Gaskets for flanged joints shall be full-faced type, with material and thickness in accordance with AWWA C207. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets shall not be permitted, unless otherwise indicated.

F. Gaskets for flanged joints used in chemicals, air, solvents, hydrocarbons, steam, chlorine and other fluids shall be made of materials compatible with the service, pressure, and temperature

G. Flange gaskets for potable water shall be NSF 61 approved.

2.3 INSULATING CONNECTIONS

A. Insulating Flange Sets: Unless otherwise specified, insulating flange sets shall be provided at all locations where dissimilar metals are connected. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers, and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2 inch or smaller and shall be made of acetal resin. For bolt diameters larger than 1-1/2 inch, insulating sleeves and washers shall be two (2) pieces and shall be made of polyethylene or phenolic material. Steel washers shall be in accordance with ASTM A 325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength. Insulating gaskets shall be full-face.

1. Insulating Flange Manufacturers, or equal

a. JM Red Devil, Type E

b. Maloney Pipeline Products Co., Houston

c. PSI Products, Inc., (Frost Engineering Service Co., Costa Mesa, California).

B. Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved. Threaded insulating connections shall be of nylon, teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

C. Insulating Sleeve Couplings: Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a sleeve of an insulating compound material compatible with the fluid service in order to obtain insulation of all coupling metal parts from the pipe

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

A. Cast mechanical-type couplings shall be provided where indicated. The couplings shall conform to the requirements of AWWA C606 - Grooved and Shouldered Joints. Bolts and nuts shall conform to the requirements of Section 05 50 00 – Metal Fabrications. Mechanical-type couplings shall be bonded. The Contractor shall have the coupling manufacturer's service representative verify the correct choice and application of couplings and gaskets, and the workmanship, to assure a correct installation. To assure uniform and compatible piping components, grooved fittings, couplings, and valves shall be furnished by the same manufacturer as the coupling. Grooving tools shall be of the same manufacturer as the grooved components.

B. Gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations.

C. The wall thickness of grooved piping shall conform to the coupling manufacturer's recommendations to suit the highest expected pressure.

D. To avoid stress on equipment; equipment connections with mechanical-type couplings shall have rigid-grooved couplings or flexible type coupling with harness in sizes where rigid couplings are not available, unless thrust restraint is provided by other means.

E. Manufacturers of couplings for steel pipe, or equal

1. Gustin-Bacon (Aeroquip Corp.) (banded or grooved)

2. Victaulic Style 41 or 44 (banded, flexible)

3. Victaulic Style 77 (grooved, flexible)

4. Victaulic Style 07 or HP-70 (grooved, rigid)

F. Manufacturers of ductile iron pipe couplings, or equal

1. Gustin-Bacon, (Aeroquip Corp.)

2. Victaulic Style 31 (flexible or rigid grooving)

Note: Ductile iron pipe couplings shall be furnished with flush seal gaskets.

2.5 SLEEVE-TYPE COUPLINGS

A. Sleeve-type couplings shall be provided where indicated. The Contractor will not be allowed to substitute a sleeve-split coupling for the sleeve coupling unless approved by the Engineer.

B. Construction: Sleeve couplings shall be in accordance with AWWA C219 - Standard for Bolted Sleeve- Type Couplings for Plain-End Pipe. Couplings shall be steel with steel bolts, without pipe stop. Couplings shall be of sizes to fit the pipe and fittings indicated.

1. The middle ring shall be not less than 1/4-inch thick or at least the same wall thickness as the pipe to which the coupling is connected. If the strength of the middle ring material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe. Buried sleeve-type couplings shall be epoxy-coated at the factory as indicated.

2. The coupling shall be either 5- or 7- inches long for sizes up to and including 30-inches and 10-inches long for sizes greater than 30-inches, for standard steel couplings, and 16-inches long for long-sleeve couplings.

3. The followers shall be single-piece contoured mill sections welded and cold-expanded as required for the middle rings, and of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures

without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket.

4. Bolts and nuts shall conform to the requirements of Section 05 50 00 – Metal Fabrications.

C. Pipe Preparation: Where indicated, the ends of the pipe shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12-inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof- test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

2.6 GASKETS

A. Gaskets shall be full-faced type, with material and thickness in accordance with AWWA C207. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets shall not be permitted, unless otherwise indicated. The rubber in the gasket shall meet the following specifications:

Color	Jet Black or Red
Surface	Non-Blooming
Durometer Hardness	74 plus and minus 5
Tensile Strength	1000 psi Minimum
Elongation	175 percent Minimum
Temperature	150 Deg. F
pH	1 - 11

B. The gaskets shall be immune to attack by impurities normally found in potable water . All gaskets shall meet the requirements of ASTM D 2000 - Classification System for Rubber Products in Automotive Applications, AA709Z, meeting Suffix B13 Grade 3, except as noted above. Where sleeve couplings are used in water containing chloramines or other fluids which attack rubber materials, gasket material shall be compatible with the piping service and fluid utilized.

2.7 FLANGE COUPLING ADAPTERS

A. Flange coupling adapters shall only be used where shown on the drawings or accepted by the Engineer. Otherwise, the Contractor shall only use dismantling joints if additional flexibility is required for the pipe installation.

B. Flange coupling adapters shall be designed for a water working pressure not less than the design pressure of the pipe on which they are to be installed, and shall be equipped with suitable rubber gaskets.

C. Couplings shall be Romac RFCA, or equal. Thrust ties shall be provided for all flexible couplings to sustain the force developed by the test pressure. Anchor studs will not be acceptable.

2.8 FLEXIBLE CONNECTORS

A. Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, pumps and other vibrating equipment, and where indicated. Flexible connectors for service temperatures up to 180 degrees F shall be flanged reinforced neoprene or butyl single-arched spools, rated for a working pressure of 40 to 150 psi, or reinforced flanged duck and rubber, as best suited for the application. Flexible connectors for service temperatures above 180 degrees F shall be flanged, braided stainless steel spools with inner, annular, corrugated stainless steel hose, rated for minimum 150 psi working pressure, unless otherwise indicated. The connectors shall be a minimum of 9-inches long, face-to-face flanges, unless otherwise indicated. The final material selection shall be approved by the manufacturer. The Contractor shall submit manufacturer's shop drawings and calculations. Manufacture of flexible joints shall be Proco 231 or equal with restraining rods for use in potable water.

2.9 MISCELLANEOUS

A. Expansion Joints: Piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement without exertion of undue forces to equipment or structures. This may be accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints. Expansion joints shall be flanged end, stainless steel, Monel, rubber, or other materials best suited for each individual service. The Contractor shall submit detailed calculations and manufacturer's Shop Drawings of all proposed expansion joints, piping layouts, and anchors and guides, including information on materials, temperature, and pressure ratings.

B. Piping Connection to Equipment: Where piping connects to mechanical equipment such as pumps, compressors, and blowers, the piping shall be brought to the equipment connection aligned and perpendicular to the axis of the flange or fitting for which the piping is to be connected to the equipment. The piping shall not impose excessive stress to the equipment connection so much to cause misalignment of the equipment. The Contractor shall assign the responsibility to the equipment manufacturer to review the piping connection to the equipment and submit any modifications to the Engineer for review.

C. Restrained Joints: Sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means. Harnesses shall be designed by the pipe manufacturer in accordance with Manual M11, or as indicated. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed. Where harness sets are installed near the suction and discharge of the pump. Harness bolts shall have zero elongation to prevent misalignment of the pump imparted by the thrust within the piping system. Thrust restraints systems shall be manufactured by Victaulic, “Depend-O-Lok”; Dresser, “Style 38”; Ford Meter Box Co., Inc., “Style FC1 or FC3”; and Smith-Blair, “Style 411.”

D. Pipe Threads: Pipe threads shall be in accordance with ANSI/ASME B1.20.1 - Pipe Threads, General Purpose (inch), and be made up with Teflon tape unless otherwise indicated.

E. Air and Gas Traps: Air and gas pipes shall slope to low points and be provided with drip legs, shut-off valves, strainers, and traps. The traps shall be piped to the nearest drain. Air and gas traps shall be not less than 150 lb iron body float type with copper or stainless steel float. Bracket, lever, and pins shall be of stainless steel. Drain traps shall have threaded connections acceptable manufacturers include Armstrong International, Inc. and Spirax Sarco, Inc.

2.10 COUPLINGS

A. Flexible Pipe Couplings – Smith Blair OMNI 441 coupling system, or approved equal. Couplings shall be lined and coated with a minimum thickness of 0.012" fusion-bonded epoxy or approved equal. Coating must comply with ASTM C213 and AWWA C550.

2.11 DISMANTLING JOINTS

A. Dismantling joints shall be Romac Style DJ400, Smith Blair Model 975 or approved equal. Dismantling joints shall be coated with fusion bonded epoxy per AWWA C213. Provide high strength stainless steel bolts, nuts and tie rods. Use anti seize lubricant when assembling all stainless steel hardware.

2.12 TAPPING SADDLES

A. Tapping saddles shall have a ductile iron body meeting ASTM A536, Grade 65-45-12. Gasket shall be Nitrile Butadiene Rubber (NBR) for water and sewer service. Saddles shall have two, 2" straps constructed of Type 304 stainless steel with GMAW and GTAW welds. Stainless steel shall be passivated for corrosion resistance. Casting shall be coated with fusion bonded black nylon, 10 – 12 mils thick, with a dielectric strength of 1,000 v/mil. Threads as required for installation of instrumentation.

B. Bolts, nuts and washers shall be Type 304 (18-8) heavy gauge stainless steel.

C. Saddles shall comply with AWWA C800 and shall have a pressure rating of 350 psi for pipe sizes up to 24 inch.

D. Provide Romac 202 service saddles or equivalent.

2.13 THRUST BLOCKS

A. Concrete to have a minimum compressive strength of 2,500 psi at 7 days. Place in accordance with plan details.

2.14 MECHANICAL RESTRAINT

A. Type: Standard mechanical joint restraint gland, restraint devices for MJ fittings and appurtenances to conform to ANSI/AWWA C111 or ANSI/AWWA C153.

B. Product: EBAA Iron Series 2000 PV (for PVC Pipe) or EBAA Iron Series 1100 Megalug (for DIP) or approved equal, and to meet requirements of ASTM F1674.

C. Application: Approved for above ground installation and below ground where specifically specified on the Plans. Also, mechanical restraint shall be installed in locations where the pipeline must be used immediately as a temporary restraint while thrust blocks cure.

D. Pipe joints shall be restrained 30 ft. or a minimum of two pipe joints (whichever is longer) upstream and downstream of a mechanically restrained fitting.

2.15 BOLTS AND ANCHORS

A. Bolts and anchors for fittings, pipe couplings, valves, piping and accessories shall comply with Section 05 50 00 – Metal Fabrications.

2.16 POLYETHYLENE PIPE WRAP

A. Polyethylene encasement shall comply with ISO 8180, ANSI A21.5, AWWA C105, and ASTM A674. **Utilize Protective Wrap V-Bio or approved equal for buried ductile iron pipe. Polyethylene encasement shall be installed on all buried pipe, valves, and fittings (including all nuts, bolts, and other apparatuses installed below grade) per manufacturers recommendations and shall meet all the requirements of AWWA C105/A21.5 standard for polyethylene encasement.**

PART 3 - EXECUTION

3.1 GENERAL

A. Piping, fittings, and appurtenances shall be installed in accordance with the requirements of applicable sections of Division 31 and Division 40. Proprietary manufactured couplings shall be installed in accordance with the coupling manufacturer's recommendation.

B. Care shall be taken to ensure that piping flanges, mechanical-type couplings, sleeve-type couplings, flexible connectors, and expansion joints are property installed as follows:

1. Gasket surfaces shall be carefully cleaned and inspected prior to making up the connection. Each gasket shall be centered properly on the contact surfaces.

2. Connections shall be installed to prevent inducing stress to the piping system or the equipment to which the piping is connected. Contact surfaces for flanges, couplings, and piping ends shall be aligned parallel, concentric, and square to each axis at the piping connections.

3. Bolts shall be initially hand-tightened with the piping connections properly aligned. Bolts shall be tightened with a torque wrench in a staggered sequence to the AISC recommended torque for the bolt material.

4. Groove ends shall be clean and free from indentations, projections, and roll marks in the area from the pipe end to the groove.

5. After installation, joints shall meet the indicated leakage rate. Flanges shall not be deformed nor cracked.

C. Soldered Pipe Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook", using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS ASB.

E. Lined Piping Systems: The lining manufacturer shall take full responsibility for the complete, final product and its application. Pipe ends and joints of lined pipes at screwed flanges shall be epoxy-coated to assure continuous protection.

F. Core Drilling: Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction to avoid damage to embedded raceways and reinforcing bars.

G. Cleanup: After completion of the Work, cuttings, joining and wrapping materials, and other scattered debris shall be removed from the Site. The entire piping system shall be handed over in a clean and functional condition.

H. Protective Coating: All pipes shall be coated in accordance with Section 09 90 00-Painting and Coating.

3.2 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. Piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact Defective or damaged materials shall be replaced with new materials.

3.3 PIPING INSTALLATION

A. Cut piping accurately for fabrication to measurements established at the construction site and work into place without springing and/or forcing.

B. Remove burrs and cutting slag from pipe by reaming or other approved cleaning methods.

C. Make changes in direction with proper fittings.

D. Arrange piping so as not to interfere with the removal of other equipment, ducts, or devices. Do not block access doors, windows, or access openings. Provide unions in the piping at connections to all equipment. Unions must be accessible.

E. Make connections of dissimilar metals (such as copper and steel) with insulating couplings suitable for at least 175 psi working pressure at 250 degrees F.

F. Cap or plug open ends of pipes and equipment with PVC caps or expanding neoprene plugs to keep dirt and other foreign materials out of the system. Plugs of rags, wool, cotton, waste, or similar materials are not acceptable.

G. Install all piping systems so they can easily be drained. Provide hose bibs at low point of water lines.

H. Slope all soil and waste lines within the building at 1/4 inch fall per foot in the direction of flow unless otherwise noted on drawings.

3.4 YARD PIPING INSTALLATION

A. If excavation enters an area of petroleum or other contamination, stop work and notify the Engineer for verification of piping and gasket material usage.

B. Install pipe per manufacturer's specific instructions. Do not install pipe without continuous support under the barrel or where a dry joint connection cannot be made.

C. Install pipe with a minimum of 5 feet of cover or as indicated on the drawings. Insure that the pipe has adequate cover from sub-grade as listed above and installed below frost depth.

D. Pipe bedding is required; bed pipe in accordance with Section 31 23 33 – Trenching and Backfilling.

E. Mechanical Joint Pipe

1. Gland shall be placed on spigot end of pipe with lip extension toward the joint, and the rubber gasket shall be slipped on the pipe with its thick edge toward the gland.

2. The gasket and joint surfaces shall be thoroughly wetted using a soapy solution made with vegetable soap or similar soap as recommended by the manufacturer.

3. After inserting the spigot end of the pipe to full depth and pressing the gasket firmly into place in the bell, the gland shall be moved into place, the bolts inserted, and the nuts finger tightened. The nuts shall then be tightened gradually with a wrench - a half turn at a time, moving wrench from one nut to another repeating until all nuts are uniformly tight. Final tightness shall be with a torque wrench: 60 - 90 pounds torque for ¾" bolts. Install gland retainer on thrust retainer glands as recommended by the manufacturer.

F. Gravity Pipelines

1. Begin construction at the low point of the pipeline. Install pipe upgrade with the bell end upgrade.

2. Control line and grade of the pipe installation by use of a pipeline laser. Limit variance of installed pipe from design line and grade to less than 0.02 feet, unless a smaller variance is necessary to prevent a level or negative slope.

G. Pressure Pipelines: All buried pipe installations shall be capable of withstanding maximum thrust at test pressure; provide thrust blocks at each angled fitting, tee, cross, reducer, cap, and plug, or mechanically restrained joints where shown. All buried valves shall be mechanically restrained in accordance with this specification section. For thrust blocks, provide bearing area against undisturbed earth. Place such that thrust block may be removed in the future without damage to pipe or fitting. Place V-Bio polyethylene plastic between thrust blocks and fittings.

H. Furnish and install plugs or caps on pipe ends and stub-outs. Insure watertight connection. Provide a bell end or joint suitable for making a gasketed connection when the pipeline is extended. Thrust block all pressure pipe stubs. Protect against displacement during backfilling operations and testing.

I. When pipe installation is suspended at the end of each day, assure that no dirt or other foreign material is allowed in pipe or fittings. Block or plug the open end of the pipe to prevent creep, uplift or floating, entrance of water, dirt, or other materials.

J. Place pipe anchors on all pipes installed on slopes 20% and greater.

K. Do not operate existing or active valves without the authorization of the Engineer.

L. Install pipe end markers to surface. Pipe marker to be 2x4 wood stud, painted green for sewer, purple for reclaimed or utility water or irrigation, or blue for potable water. Attach finder wire attached to stub and 2x4.

M. Assure that continuity is maintained in locating wire, in accordance with Section 31 23 33 – Trenching and Backfilling.

3.5 WORKMANSHIP

A. Care shall be taken at all times to protect floors, stairways, and walls during the make-up, erection of piping, and placing of equipment. The Contractor shall remove all stains and repair all damage before final acceptance of the work.

3.6 TESTING

A. Test all pressure piping according to the requirements of Section 01 74 30 – Site Pressure Pipe Testing and Disinfection.

B. Repair defects which develop under tests promptly and repeat tests. No caulking of screwed joints, cracks, or holes will be permitted. Repair leaks in screwed joints by replacing pipe or fitting or both with new material.

C. Repair leaks in copper tubing by melting out joint, thoroughly cleaning both tubing and fitting, and resoldering.

3.7 CLEANUP

A. After completion of the work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site. The entire piping system shall be handed over in a clean and functional condition.

END OF SECTION 40 05 00

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SECTION 40 05 07- HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials, and equipment as required for the installation of all piping and all related work required for complete pipe installations. Coordinate Work with other trades.

B. Furnish and install all pipe hangers, sleeves, supports, brackets, and other related items required to support the piping systems as required whether shown on the plans or not.

C. Test all piping systems and correct any problems found to exist.

1.2 REFERENCE STANDARDS

A. All mechanical piping systems shall conform to requirements under the latest revision of International Mechanical Code, ASA Code for Pressure Piping and the International Building Code.

1. ASA Codes as sponsored by ASME
2. ASME B31.1 Power Piping (2001)
3. ASME B31.2 Fuel Gas Piping (1968)
4. ASME B31.3 Process Piping (2002)
5. ASTM A 123 Zinc (Hot-Dip Galvanized) Coatings on Iron & Steel Products
6. Piping Handbook Nayyar, Mohinder L. (2000). Piping Handbook (7th Edition). McGraw-Hill.

B. Install Work in accordance with applicable provisions of codes, rules, regulations, statutes, and ordinances of governing bodies having jurisdiction. Such codes, rules, regulations, statutes, and ordinances are hereby incorporated into these specifications. Comply with specification requirements which are in excess of code requirements and not in conflict therewith.

1.3 SUBMITTALS

A. Submit shop drawings shall be in accordance with Section 01 33 00 – Submittal Procedures. Shop Drawings shall include the following information:

1. Plans and Details of pipe supports, hangers, anchors, and guides
2. Calculations for supports and anchors stamped by a Licensed Engineer in the State where work is to be done.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Pipe hangers shall be capable of supporting the pipe in all conditions of operation, allowing free expansion and contraction of the piping, and preventing excessive stress on equipment. All hangers shall have a means of vertical adjustment after erection. Hangers shall be designed to prevent becoming disengaged by any movement of the supported pipe. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves, shall include hydraulic shock suppressors. All hanger rods shall be subject to tensile loading only.

B. Unless shown otherwise, provide vertical piping supports for all pipe except copper:

1. Support vertical piping with wrought steel riser clamps. Make adequate provision for expansion, contraction, and lateral stability.

2. Use steel extension pipe clamps for vertical pipe supports similar to Anvil Figure 261, refer to manufacturer's rated maximum loading for each size pipe. Bolt clamp securely to pipe rest, clamp end extension on building structure.

3. Where pipe sleeves extend above floor, place pipe clamps at ceiling below, support clamp end extension from inserts.

4. Use beam clamps that are of malleable iron, Anvil Figure 86 for 3/8-inch hanger rods; forged steel beam clamp, Anvil Figure 228 for hanger rod up to 1-1/2 inch.

C. Supports for piping with the longitudinal axis in approximately a horizontal position shall be spaced to prevent excessive sag, bending, and shear stresses in the piping, with special consideration given where components such as flanges and valves impose concentrated loads. For temperatures other than ambient temperatures, or those listed, and for other piping materials or wall thicknesses, the pipe support spacing shall be modified in accordance with the pipe manufacturer’s recommendations. Vertical supports shall be provided to prevent the pipe from being overstressed from the combination of all loading effects. Use one of the following means of supporting horizontal piping from a wall.

1. Steel J-Hook for pipe located close to wall, up to three-inch pipe, Fee and Mason Figure 146.

2. For hanger suspension with 750 lbs. maximum loading, use light welded steel bracket with hole for one rod, 3/4-inch diameter, Fee and Mason Figure 153.

3. For pipe-roll stand support use welded-steel bracket, light for 700 lbs. maximum loading, Fee and Mason Figure 150; medium for 1,500 lbs. maximum loading, Figure 151; and heavy for 3,000 lbs. maximum loading, Figure 155.

D. Unless otherwise specified, support spacing for Steel and Copper shall conform to the following:

Nominal Pipe Diameter (inches)	Maximum Span (feet)

1 - 1/4" and smaller	6' - 0" on center
1 - 1/2" thru 3"	8' - 0" on center
4" thru 8”	12' - 0" on center
10” and larger	20’ - 0” on center

E. Unless otherwise specified, support spacing for Ductile-Iron Pipe shall conform to the following:

Nominal Pipe Diameter (inches)	Maximum Span (feet)
All Diameters	Two supports per pipe length or 10 feet (one of the 2 supports located at joint)

F. Unless otherwise specified, support spacing for PVC, CVC, and ABS shall conform to the following:

Nominal Pipe Diameter (inches)	Maximum Span (feet)
1" and smaller	4' - 0" on center
1 - 1/4" thru 2"	5' - 0" on center
2 - /2" thru 4"	6' - 0" on center
5" and larger	7' - 6" on center

G. Thermal Expansion: Wherever expansion and contraction of piping is expected, a sufficient number of expansion loops or expansion joints shall be provided, together with the necessary rolling or sliding supports, anchors, guides, pivots, and restraints permitting the piping to expand and contract freely in directions away from the anchored points. All components shall be structurally suitable to withstand all loads imposed.

H. Heat Transmission: Supports, hangers, anchors, and guides shall be so designed and insulated, that excessive heat will not be transmitted to the structure or to other equipment. Support insulated piping with pipe saddles and hangers that fit on the outside of the insulation. Do not compress or damage pipe insulation with hangers or supports.

I. Point Loads: Any meters, valves, heavy equipment, and other point loads on PVC, FRP, and other plastic pipes, shall be supported on both sides, according to manufacturer's recommendations to avoid undue pipe stresses and failures. To avoid point loads, all supports on PVC, FRP, and other plastic piping shall be equipped with extra wide pipe saddles or galvanized steel shields.

J. Materials of Construction: All pipe support assemblies, including framing, hardware, and anchors, shall be steel construction, galvanized after fabrication, unless otherwise indicated.

1. All submerged piping and top of tank walls, as well as piping, conduits, and equipment in hydraulic structures within 24-inches of the water level, shall be supported with support, assemblies, including framing, hardware, and anchors, constructed of Type 316 stainless steel, unless otherwise indicated.

2. All piping in chemical and corrosive areas shall be supported with support assemblies, including framing, hardware, and anchors, constructed of Type 316 stainless steel or FRP, unless otherwise indicated.

K. Manufactured Supports

1. Stock Parts: Where not specifically indicated, designs which are generally accepted as exemplifying good engineering practice and use stock or production parts, shall be utilized wherever possible. Such parts shall be locally available, new, of best commercial quality, designed and rated for the intended purpose.

2. Manufacturers, or equal:

a. Cooper B-Line;

b. Anvil International, Inc.;

c. Bergen-Paterson Pipesupport Corp.;

d. Fee & Mason Mfg., Co.;

e. Tolco Incorporated.

f. Standon Pipe Supports Inc.

L. Galvanizing: Unless otherwise indicated, all fabricated pipe supports other than stainless steel or non-ferrous supports shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

2.2 INSERTS

A. Furnish and set inserts in concrete forms; provide reinforcing rods for pipe sizes over three inches or equivalent.

B. Furnish concrete inserts as follows: Black, malleable iron, Universal type for threaded connections with lateral adjustment, Anvil Figure 279 for pipe sizes up to 3 - 1/2 inches; Anvil Figure 282 for pipe sizes up to eight inches.

2.3 SHIELDS

A. Provide shields to protect insulation in all areas. Provide approved galvanized form shields to protect insulation at areas of contact with hangers and supports. Size in accordance with shield manufacturer's recommendations.

2.4 SLEEVES

A. Where pipes pass through floors, footings, foundations, walls, or ceilings, furnish and install pipe sleeves. Sleeves for concealed piping shall be of galvanized iron, and I.P.S. black steel pipe for exposed piping installed so as to be completely covered by escutcheons, hereinafter specified. Extend sleeves through floors 1/2 inch above finish floor.

2.5 ESCUTCHEONS

A. Fit pipe passing through walls, floors, or ceilings with escutcheons with set screws as shown on the plans. Use prime painted escutcheons where surface is to receive a paint finish; otherwise, use escutcheons that are nickel or chromium plated. Where piping is insulated, use escutcheon outside the insulation.

2.6 JOINTS

A. For screwed pipe make ends with sharp, clean tapered threads using pipe compound on male thread only. Do not use mill cut threads. Ream cut pipe to full inside diameter.

B. Welding may be done by either the arc or acetylene process conforming to the requirements of the ASME B31.1 – Power Piping.

C. For solder joints use fittings specifically made for soldering. Clean all burrs and roughen pipe to clean; solder complete around joint.

D. For grooved pipe jointing systems use Victaulic couplers or equal.

E. For no-hub cast iron pipe use double screw joint neoprene coupler.

2.7 UNIONS

A. Furnish and install unions necessary for installation and necessary to permit removal of equipment.

B. For unions in steel pipe 1-1/2 inch and smaller use malleable iron ground joint unions with brass to iron seat, galvanized or black as required.

C. For larger unions in steel pipe, use standard weight cast iron flange unions with 1/16 -inch thick gaskets, galvanized or black as required.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to installation of piping, verify that it will not interfere with clearances required for the erection and finish of structural members, architectural members, electrical, or mechanical items.

B. Code Compliance: All piping systems and pipe connections to equipment shall be properly anchored and supported to prevent undue deflection, vibration, dislocation due to seismic events and line pressures, and stresses on piping, equipment, and structures. All supports and parts thereof shall conform to the requirements of ANSI/ASME 831.1 - Power Piping, except as supplemented or modified below. Supports for plumbing piping shall be in accordance with the latest edition of the applicable plumbing code or local administration requirements.

C. Structural Members: Wherever possible, pipes shall be supported from structural members. Where it is necessary to frame structural members between existing members, such supplementary members shall be provided by the Contractor and coordinated with the Engineer. All supplementary members shall be in accordance with the requirements of the building code and the American Institute of Steel Construction and shall be acceptable to the Engineer.

D. Do not cut or modify any structural members for installation of piping.

E. All pipe supports, hangers, brackets, anchors, guides, and inserts shall be fabricated and installed in accordance with the manufacturer's printed instructions and ASME B31.1 - Power Piping. All concrete inserts for pipe hangers and supports shall be coordinated with the formwork.

3.2 INSERTS

A. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

B. Set inserts in position in advance of concrete work. Contractor to coordinate openings with reinforcing supplier prior and Engineer prior to construction. Provide reinforcement rod in concrete for inserts carrying pipe over 12-inches in diameter.

C. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.3 SLEEVES

A. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

B. Extend sleeves through potentially wet floors one inch above finished floor level. Caulk sleeves full depth and provide floor plate.

C. Where piping passes through floor, ceiling, or wall, close-off space between pipe and construction with noncombustible insulation. Provide tight-fitting metal caps on both sides and caulk.

3.4 PIPE HANGERS AND SUPPORTS

A. Appearance: Pipe supports and hangers shall be positioned to produce an orderly, neat piping system. All hanger rods shall be vertical, without offsets. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, without interference with other work.

B. Support all piping and make adequate provisions for expansion, contraction, slope, and anchorage.

C. The use of pipe hooks, chains, or perforated metal for pipe support will not be permitted.

D. Suspend all piping in the building as shown on the plans.

1. Install hangers to provide minimum 1/2-inch clear space between finished covering and adjacent work.

E. Place a hanger within one foot of each horizontal elbow.

F. Use hangers which are vertically adjustable 1-1/2 inch minimum after piping is erected.

G. Support horizontal soil pipe near each hub, with five feet maximum spacing between hangers.

H. Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

I. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

J. Where practical, support riser piping independently of connected horizontal piping.

3.5 FINISHING

A. Paint exposed piping and supports in accordance with Section 09 90 00 – Painting and Coating.

END OF SECTION 40 05 07

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SECTION 40 05 19 - DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials and equipment as required for the installation of all ductile iron pipe, couplings, fittings, and jointing materials where shown on the Plans, including all piping installed under buildings that is connected to PVC yard piping.

B. Coordinate Work with all other trades.

1.2 REFERENCE STANDARDS

A.	AWWA C104	Cement-Mortar Lining for Ductile-Iron and Grey-Iron Pipe and Fittings for Water
B.	AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
C.	AWWA C110	Ductile-Iron and Gray-Fittings, 3 in through 48 in for water
D.	AWWA C111	Rubber Gasket Joints for Ductile-Iron and Grey-Iron Pressure Pipe and Fittings
E.	AWWA C115	Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges
F.	AWWA C151	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds, for Water or Other Liquids
G.	AWWA C153	Grey-Iron and Ductile-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids
H.	AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances

I. State Plumbing Code, as applicable.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures and Section 40 05 00 – Piping, General and include, but not limited to the following information:

1. Pipe Manufacturer information, including pipe class and pressure rating and joint design.

2. Pipe Manufacturer information regarding epoxy, glass, and cement-mortar lining, including lining thickness and descriptions of material properties.

3. Certifications: The Contractor shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section and as specified in the referenced standard and the following supplemental requirements:

   a. Physical and chemical properties.

   b. Hydrostatic test reports.

4. Submit manufacturer's certification that pipe and fittings meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.

   1. The Contractor shall perform said material tests at no additional cost to the Owner. The Engineer shall have the right to witness all testing conducted by the Contractor; provided, that the Contractor's schedule is not delayed for the convenience of the Engineer.

B. Reject any pipe which does not conform to specifications or is cracked, chipped, or otherwise unacceptable.

C. Use the type, size, and strength rating of the pipe as specified in the proposal or as shown on the Plans.

PART 2 - PRODUCTS

2.1 GENERAL

A. All pipe and fittings used in potable water systems shall be compliant with NSF/ANSI 61, 14, and 372.

2.2 MATERIALS

A. Use ductile iron pipe conforming to AWWA C151 pressure class 250 minimum unless otherwise required by the plans. Nominal pipe laying lengths shall be 20 ft. The pipe and associated fittings shall be of the diameter and class indicated. The interior lining shall be as indicated in the Pipe Schedule and as described below. Exterior coatings are described in 2.1.I.

B. Use Class 150 grey-iron or ductile iron fittings conforming to AWWA C153 unless otherwise required by the Plans.

C. Use flanged fittings, spools and flanged couplings for all above grade piping whether shown or not and for buried locations if indicated on the Plans to provide a complete functional pipe system. Fittings shall conform to AWWA C110, C111, and C115. All valve and equipment connections shall be flanged.

D. Use mechanical joint fittings, spools, and couplings for all below grade piping whether shown or not and for above grade locations if mechanically restrained and shown on the Plans to provide a complete functional pipe system. Pipe and fittings shall conform to AWWA C110, C111, and C153. The pipe manufacturer shall provide gasket bolt sets for each pipe and spool provided. All buried valve connections shall be mechanical joint.

E. Joint Design: Ductile iron pipe and fittings shall be furnished with mechanical joints, push-on joints, flanged joints, or restrained joints as required.

1. Mechanical and push-on joint shall conform to AWWA C111. Mechanical joints shall be installed with little or no deflection. Following complete assembly, the joint can be deflected as necessary.

2. Flanged joints shall conform to AWWA C115. Where threaded flanges are provided, the pipe wall thickness under the cut threads shall not be less than the calculated net thickness required for the pressure class of the pipe.

3. Restrained joints shall be "Flex-Ring" restrained joint by American Ductile Iron Pipe, "TR Flex" restrained joint by U.S. Pipe, Griffen BOLT-LOK or MECH-LOK or equal.

4. When ductile iron fittings are called out to be mechanically restrained on the Plans, mechanical restraint shall comply with Section 40 05 00 – Piping, General, 2.15. In addition, the pipe joints shall be restrained 30 ft. or a minimum of two pipe joints (whichever is longer) upstream and downstream of a mechanically restrained fitting.

F. Cement-Mortar Lining: Except as otherwise provided herein, interior surfaces of all ductile iron pipe, fittings, and specials used for potable water and non-potable water service (i.e. tertiary effluent) shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with AWWA C104. During the lining operation and thereafter, the pipe shall be maintained in a round condition by suitable bracing or strutting. The lining machines shall be a type that has been used successfully for similar work. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found fault at the Site, the damaged or unsatisfactory portions shall be replaced with lining conforming to these specifications.

1. Cement: Cement for mortar lining shall conform to the requirements of AWWA C104; provided, that cement for mortar lining shall be Type II or V. Cement shall not originate from kilns that burn metal-rich hazardous waste fuel, nor shall a fly ash or pozzolan be used as a cement replacement.

2. The minimum lining thickness shall be double the thickness defined by AWWA C104.

3. Protection of Pipe Lining/Interior: Shop-applied cement mortar lining shall be given a seal coat of asphaltic material in conformance with AWWA C104.

G. Exterior Coating:

1. The exterior surfaces of the pipe which will be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and then given a shop coat of rust-inhibitive primer and finish coat conforming to the requirements of Section 09 90 00 – Painting and Coating.

2. All buried mechanical joints, piping and fittings shall be wrapped with a polyethylene encasement as specified in Section 40 05 00 – Piping, General and in the plans – V-Bio Polywrap or equal. All buried ductile iron piping shall be provided with a bituminous tar coating on the pipe exterior.

H. Bolts and Nuts: The flange and MJ bolts shall comply with the material specified in Section 05 50 00 – Metal Fabrications.

I. Gaskets shall be as specified in Section 40 05 00 – Piping, General.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect pipe and components against dirt and damage during shipment and storage.

B. The pipe shall be handled according to the manufacturer’s specifications to prevent damage to the pipe coating/exterior. The use of chains, hooks, or other equipment that might damage the pipe coating/exterior is prohibited. Stockpiled pipe shall be supported on padded skids, sand or earth berms free of rock exceeding 3 inches in diameter, sand bags, or suitable means so the coating will not be damaged. The pipe shall not be rolled and shall be secured to prevent accidental rolling.

C. Keep jointing material sealed when not in use.

D. Unload and string out pipe in accordance with manufacturer's recommendations and in a manner approved by the Engineer.

3.2 INSTALLATION

A. The pipe shall be installed in accordance with AWWA C600 and per manufacturer's specific instructions. Do not install pipe without continuous support under the barrel or where a dry joint connection cannot be made.

B. Coat all mechanical joints with low density polyethylene film sleeve as per AWWA C105, except where concrete encased as shown.

C. Where necessary to raise or lower the pipe due to unforeseen obstruction or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed 75 percent of the maximum deflection recommended by the pipe manufacturer. No joint shall be misfit any amount that will be detrimental to the strength and water tightness of the finished joint.

3.3 RUBBER GASKETED JOINTS

A. Rubber Gasketed Joints.

1. For bell end pipe, the bell end of the pipe shall be thoroughly cleaned immediately before joining the pipe, and a clean rubber gasket shall be placed in the bell groove. The spigot end of the pipe and the inside surface of the gasket shall be carefully cleaned and lubricated. The lubricant shall be suitable for lubricating the parts of the joint for assembly.

    a. For potable water pipe the lubricant shall be a compound listed as in compliance with NSF Standard 61. The lubricant shall be nontoxic, shall not support the growth of bacteria, and shall have no deleterious effects on the gasket material. The lubricant shall not impart taste or odor of water in the pipe. Tilting of the pipe to insert the spigot into the bell will not be permitted.

2. For mechanical joint pipe, once the gasket is placed over the plain end of the pipe and prior to assembly, the gasket shall be thoroughly lubricated so the gasket will "flow" into the wedge-shaped gasket seat during tightening of the bolts.

3.4 INSTALLATION OF PIPE APPURTENANCES

A. Protection of Appurtenances: When the joining pipe is dielectric-coated, buried appurtenances shall be coated in kind. Where pipe is encased in polyethylene sleeves, buried appurtenances shall also be encased in polyethylene.

B. Installation of Valves: Valves shall be handled in a manner to prevent any injury or damage to any part of the valve. Joints shall be thoroughly cleaned and prepared prior to installation. The Contractor shall adjust all stem packing and operate each valve prior to installation to insure proper operation.

C. Valves shall be installed so that the valve stems are plumb in the location indicated.

3.5 PIPELINE TESTING

A. All pipes shall be tested in accordance with Section 01 74 30– Pressure Pipe Testing, as shown on the pipe test ID on the drawings. The Contractor shall furnish all test equipment, labor, material, and devices at no extra cost to the Owner. Leaks shall be repaired to the satisfaction of the Engineer, and the system shall be re-tested until no leaks are found at no extra cost to the Owner.

END OF SECTION 40 05 19

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SECTION 40 05 23 - STAINLESS STEEL PIPE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide stainless steel pipe and appurtenances, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE STANDARDS

A.	ASTM A 312	Seamless and Welded Austenitic Stainless Steel Pipe
B.	ASTM A 409	Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service
C.	ASTM A 778	Welded, Unannealed Austenitic Stainless Steel Tubular Products
D.	ANSI/ASME B 31.1	Power Piping, and ANSI/AWWA C606.
E.	ASTM A 967	Passivation of Stainless Steel Pipe.

1.3 SUBMITTALS

A. Submit to the Engineer shop drawings in accordance with Section 40 05 00 – Piping, General.

PART 2 - PRODUCTS

2.1 GENERAL

A. All pipe fittings used in potable water systems shall be compliant with NSF/ANSI 61,14, and 372.

2.2 PIPE MATERIAL

A. Unless otherwise indicated, stainless steel pipe shall be in accordance with ASTM A 312, Type 304 or 316, seamless, of the schedules indicated, with screwed fittings for sizes up to and including 2-1/2 inches as indicated on Drawings. Stainless steel pipe 3 inches in diameter and larger shall be in accordance with ASTM A 409, Type 304 or 316 as indicated on Drawings of the schedules indicated, with welded or flanged fittings.

B. All fittings shall conform to the following schedule:

Fitting Type	Material	Standard
Threaded	Forged stainless steel per ANSI/ASME B 16.11	Type 304 & 316
Socket Welded	Forged stainless steel, ANSI/ASME B 16.11	Type 304 & 316
Butt-Welded	Wrought stainless steel, ASTM A 403, and ANSI/ASME B 16.9	Type 304 &316
Flanged	Forged Stainless Steel, ANSI/ASME B 16.5	Type 304 & 316

C. Flanged Joints

1. Bolts shall be ASTM A320, B8M Class 1 Stainless Steel.

2. Nuts shall be ASTM A194 Grade 8M Stainless Steel.

3. Washers shall be 316 Stainless Steel.

4. Gaskets shall be Viton.

D. Surface Treatment

1. All Stainless Steel pipe shall be surface treated and tested to meet ASTM A 967 Passivation Standard.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Stainless steel pipe shall be installed in a neat and workmanlike manner, properly aligned and cut from measurements taken at the Site to avoid interferences with structural members, architectural features, openings, and equipment. Exposed pipe shall afford maximum headroom and access to equipment, and where necessary all piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points. Installation shall be acceptable to the Engineer.

B. Supports and Anchors: Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 40 05 07 – Hangers and Supports for Process Piping. Where necessary to avoid stress on equipment or structural members, the pipe shall be anchored or harnessed. Expansion joints and guides shall compensate for pipe expansion due to temperature differences.

C. Valves and Unions: Unless otherwise indicated, connections to fixtures, groups of fixtures, and equipment shall be provided with a shutoff valve and union, unless the valve has flanged ends. Unions shall be provided at threaded valves, equipment, and other devices requiring occasional removal or disconnection.

D. Preparation. Prior to installation, each pipe length shall be carefully inspected, be flushed clean of any debris or dust, and be straightened if not true. Ends of threaded pipes shall be reamed and filed smooth. Pipe fittings shall be equally cleaned before assembly.

3.2 PIPE JOINTS

A. Threaded Joints: Pipe threads shall conform to ANSI/ASME B 1.20.1 - Pipe Threads, General Purpose (inch), and shall be full and cleanly cut with sharp dies. Not more than three threads shall remain exposed after installation.

B. Welded Joints: Welded joints shall conform to the specifications and recommendations of ANSI/ASME B 31.1 - Power Piping. Welding shall be done by skilled and qualified welders per Section 40 05 00 – Piping, General.

1. Field welding shall be minimized to the greatest extent possible by use of couplings and prefabrication of pipe systems at the factory. Pipe butt welds may be performed at the Site, providing the butt welds are performed only with an inert gas shielded process and that other indicated welding requirements are followed rigidly.

2. Residue, oxide, and heat stain shall be removed from any type of field weld and the affected areas adjacent by the use of stainless steel wire brushes, followed by cleaning with an agent such as Eutectic Company's "Euclean" or equal, followed by complete removal of the agent.

3.3 INSPECTION AND FIELD TESTING

A. Inspection: The finished installation shall be carefully inspected for proper supports, anchoring, interferences, and damage to pipe, fittings, and coating. Damage shall be repaired to the satisfaction of the Engineer.

B. Field Testing: Prior to enclosure or burying, piping systems shall be pressure tested as required in the Piping Schedule, for a period of not less than one hour, without exceeding the tolerances listed in the Piping Schedule. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. The Contractor shall furnish all test equipment, labor, materials, and devices at no extra cost to the Owner. For additional testing requirements refer to Section 01 74 30 – Site Pressure Pipe Testing and Disinfection.

END OF SECTION 40 05 23

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SECTION 40 05 51 - VALVES, GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide valves, actuators, and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to all valves and valve actuators pertaining to this Work as outlined in Contract Documents. Valves and actuators in particular locations may require a combination of units, sensors, and controls indicated in other sections of the Specifications.

C. Where a valve is to be supported by means other than the piping to which it is attached, the Contractor shall obtain from the valve manufacturer a design for support and foundation that satisfies the criteria in Section 43 05 01 – Equipment General Provisions. The design, including drawings and calculations sealed by an engineer, shall be submitted with the Shop Drawings. When the design is approved, the support shall be provided.

D. Unit Responsibility: A single manufacturer shall be made responsible for coordination of design, assembly, testing, and furnishing of each valve; however, the Contractor shall be responsible to the Owner for compliance with the requirements of each valve section. Unless indicated otherwise, the responsible manufacturer shall be the manufacturer of the valve.

E. Single Manufacturer: Where two or more valves of the same type and size are required, the valves shall be furnished by the same manufacturer.

1.2 REFERENCE STANDARDS

A.	ANSI B1.20.1	Pipe Threads, General Purpose
B.	ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
C.	ANSI B16.5	Pipe Flanges and Flanged Fittings
D.	ANSI B16.18	Cast Copper Alloy Solder Joint Pressure Fittings Class 25, 125, 250 and 800
E.	AWWA C111	Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
F.	AWWA C207	Steel Pipe Flanges for Waterworks Service - Sizes 4 through 144 IN
G.	NEMA	Motors and Generators

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Shop Drawings shall contain the following information:

1. Valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number.

2. Complete information on valve actuator, including size, manufacturer, number, limit switches, and mounting.

3. Cavitation limits for control valves.

4. Assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, handwheels, position indicators, limit switches, integral control systems, needle valves, and control systems.

5. Data in accordance with Section 40 05 93 – Common Motor Requirements for Process Equipment for electric motor-actuated valves.

6. Complete wiring diagrams and control system schematics.

7. Valve Labeling: A schedule of valves to be furnished with stainless steel tags, indicating in each case the valve location and the proposed wording for the label.

8. Certification that products being used under meet requirements of standards referenced.

C. Operation and Maintenance Data: Provide in accordance with Section 01 78 23 – Operation Maintenance Data.

D. Spare Parts List: A Spare Parts List shall contain the required information for each valve assembly, where indicated.

E. Factory Test Data: Where indicated, signed, dated, and certified factory test data for each valve requiring certification shall be submitted before shipment of the valve. The data shall also include certification of quality and test results for factory-applied coatings.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Valve manufacturers shall have a successful record of not less than five (5) years in the manufacture of the valves indicated.

B. Valve Testing: As a minimum, unless otherwise indicated or recommended by the reference Standards, valves 3-inches in diameter and smaller shall be tested in accordance with manufacturer's standard, larger valves shall be factory tested as follows:

1. Hydrostatic Testing: Valve bodies shall be subjected to internal hydrostatic pressure equivalent to twice the water rated pressure of the valve. Metallic valves rating pressures shall be at 100 degrees F and plastic valves shall be at 73-degrees, higher temperature according to type of material. During the hydrostatic test, there shall be no leakage through the valve body, end joints, or shaft seals, nor shall any part of the valve be permanently deformed. The duration shall be sufficient time to allow visual examination for leakage. Test duration shall be at least 10 minutes.

2. Seat Testing: Valves shall be tested for leaks in the closed position with the pressure differential across the seat equal to the water rated pressure of the valve. The duration of test shall be sufficient time to allow visual examination for leakage. Test duration shall be at least 10 minutes. Leakage past the closed valve shall not exceed 1 fluid ounce per hour per inch diameter for metal seated valves and drop-tight for resilient seated valves.

3. Performance Testing: Valves shall be shop operated from fully closed to fully open position and reverse under no-flow conditions in order to demonstrate the valve assembly operates properly.

C. Certification: Prior to shipment, the Contractor shall submit for valves over 12- inches in size, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, or ASTM.

PART 2 - PRODUCTS

2.1 GENERAL

A. All valves used in potable water systems shall be NSF/ANSI 61 certified and compliant with 14 and 372.

2.2 PRODUCTS

A. Valves and gates shall be new and of current manufacture. Shut-off valves 6-inches and larger shall have actuators with position indicators. Gate valves 18-inches and larger or where chain wheel is required, shall be furnished with spur gear and hand wheel. Buried valves shall be provided with valve boxes and covers containing position indicators and valve extensions. Manual shut-off valves mounted higher than 7-feet above working level shall be provided with chain actuators.

B. Valve Actuators: Unless otherwise indicated, valve actuators shall be in accordance with Section 40 05 57 – Actuators for Process Valves and Gates.

C. Protective Coating: The exterior surfaces of all valves and the wet interior surfaces of ferrous valves of sizes 4-inches and larger shall be coated in accordance with manufacturer’s written instructions. The valve manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior to shipment. Flange faces of valves shall not be epoxy coated.

D. Valve Labeling: Except when such requirement is waived by the Engineer in writing, a label shall be provided on shut-off valves and control valves except for hose bibbs. The label shall be of 1/16-inch plastic or stainless steel, minimum 2-inches by 4-inches in size and shall be permanently attached to the valve or on the wall adjacent to the valve as directed by the Engineer.

2.3 MATERIALS

A. Materials shall be suitable for the intended application. Materials in contact with potable water shall be listed as compliant with NSF Standard 61. Materials not indicated shall be high-grade standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended. Unless otherwise indicated, valve and actuator bodies shall conform to the following requirements:

1. Cast Iron: Close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. Ductile Iron: ASTM A 536 - Ductile Iron Castings, or to ASTM A 395 - Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

3. Steel: ASTM A 216 - Steel Castings, Carbon Suitable for Fusion Welding for High- Temperature Service, or to ASTM A 515 - Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service.

4. Bronze: ASTM B 62 - Composition Bronze or Ounce Metal Castings, and valve stems not subject to dezincification shall conform to ASTM B 584 - Copper Alloy Sand Castings for General Applications.

5. Stainless Steel: Stainless steel valve and operator bodies and trim shall conform to ASTM A 351 - Steel Castings, Austenitic, for High-Temperature Service, Grade CF8M, or shall be Type 316 stainless steel.

6. PVC: Poly Vinyl Chloride materials for valve body, flanges, and cover shall conform to Cell Classification 12454.

7. CPVC: Chlorinated Poly Vinyl Chloride materials for valve body, flanges, and cover shall conform to Cell Classification 23447.

2.4 VALVE CONSTRUCTION

A. Bodies: Valve bodies shall be cast, molded (in the case of plastic valves), forged, or welded of the materials indicated, with smooth interior passages. Wall thicknesses shall be uniform in agreement with the applicable standards for each type of valve, without casting defects, pinholes, or other defects that could weaken the body. Welds on welded bodies shall be done by certified welders and shall be ground smooth. Valve ends shall be as indicated, and be rated for the maximum temperature and pressure to which the valve will be subjected.

B. Valve End Connections: Unless otherwise indicated, valves 2-1/2 inches diameter and smaller may be provided with threaded end connections. Valves 3-inches and larger shall have flanged end connections.

C. Bonnets: Valve bonnets shall be clamped, screwed, or flanged to the body and shall be of the same material, temperature, and pressure rating as the body. The bonnets shall have provision for the stem seal with the necessary glands, packing nuts, or yokes.

D. Stems: Valve stems shall be of the materials indicated, or, if not indicated, of the best commercial material for the specific service, with adjustable stem packing, O-rings, Chevron V-type packing, or other suitable seal. Where subject to dezincification, bronze valve stems shall conform to ASTM B 62, containing not more than 5 percent of zinc or more than 2 percent of aluminum, with a minimum tensile strength of 30,000 psi, a minimum yield strength of 14,000 psi, and an elongation of at least 10 percent in 2 inches.

E. Stem Guides: Stem guides shall be provided per the manufacturer's recommendations. Submerged stem guides shall be 304 stainless steel.

F. Internal Parts: Internal parts and valve trim shall be as indicated for each individual valve. Where not indicated, valve trim shall be of Type 316 stainless steel or other best suited material.

G. Nuts and Bolts: Nuts and bolts on valve flanges and supports shall be in accordance with Section 43 05 50 – Equipment Mounting.

2.5 VALVE ACCESSORIES

A. Valves shall be furnished complete with the accessories required to provide a functional system.

2.6 SPARE PARTS

A. The Contractor shall furnish the required spare parts suitably packaged and labeled with the valve name, location, and identification number. The Contractor shall also furnish the name, address, and telephone number of the nearest distributor for the spare parts of each valve. Spare parts are intended for use by the Owner, after expiration of the correction of defects period.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation, inspect interconnecting piping and end connections to ensure compatibility.

B. Prior to installation, inspect and verify condition of valve and appurtenances. Installation constitutes installer's acceptance of product condition for satisfactory installation.

C. Ensure exposed piping is sufficiently supported to bear weight of valve when it is installed.

3.2 PREPARATION

A. Correct defects or conditions, which may interfere with or prevent a satisfactory installation.

3.3 VALVE INSTALLATION

A. Valves, actuating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as indicated. Gates shall be adequately braced to prevent warpage and bending under the intended use. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. All buried valves shall be mechanically restrained as per Section 40 05 00 – Piping, General.

C. Access: Valves shall be installed with easy access for actuation, removal, and maintenance and to avoid interference between valve actuators and structural members, handrails, or other equipment.

D. Valve Accessories: Where combinations of valves, sensors, switches, and controls are indicated, the Contractor shall properly assemble and install such items so that systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on Shop Drawing submittals.

END OF SECTION 40 05 51

SECTION 40 05 57 – ACTUATORS FOR PROCESS VALVES AND GATES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide all valve actuators and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to all valves and gates, except where otherwise indicated in the Contract Documents. This Section includes manual operators and motorized valve operators, and mechanical, gear type limit switches.

C. Unit Responsibility: A single manufacturer shall be responsible for furnishing and coordinating design, assembly, testing, and installation of each type of valve and gate; however, the Contractor shall be responsible to the Owner for compliance with the requirements of each valve and gate section.

D. Single Manufacturer: Where two or more valve or gate actuators of the same type or size are required, the actuators shall all be produced by the same Manufacturer.

1.2 REFERENCE STANDARDS

A. Unless otherwise indicated and where applicable, all actuators shall be in accordance with ANSI/AWWA C540 - AWWA Standard for Power-Actuating Devices for Valves and Sluice Gates.

B. National Electrical Manufacturer’s Association (NEMA).

1.3 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01 33 00 – Submittal Procedures and Section 40 05 51 - Valves, General.

B. Shop Drawings: Shop Drawings of all actuators shall be submitted together with the valve and gate submittals as a complete package.

C. Motorized valve submittals shall include the following:

1. Installation list of similar municipal applications with contacts and phone numbers to verify experience.

2. Shop drawings and product data.

3. Motor, gear type and design information.

4. Design Data shall include:

a. Operating calculations for max break and max dynamic torques and minimum safety factor at which degree of valve opening and at break.

b. Submit data and calculations to substantiate operating time.

c. Submit proposed operator configuration and dimensions for each valve.

5. Wiring Schematics.

6. Manufacturer's published installation instructions.

7. Submit Operation and Maintenance Manuals in accordance with Section 01 78 23 – Operation and Maintenance Data.

8. Warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. The motorized operators offered for this project shall have a minimum of 5 years of commercial use in municipal wastewater installations of a similar scope and use. New and prototype hardware/software will not be accepted.

2. Submit evidence of satisfactory operation of the proposed product in at least five separate facilities in accordance with the following requirements. Include contact names and phone numbers.

PART 2 - PRODUCTS

2.1 GENERAL

A. All valve and gate actuators shall comply with the requirements of Section 40 05 51 – Valves, General.

B. Unless otherwise indicated, all shut-off and throttling valves, and externally actuated valves and gates, shall be provided with manual or power actuators. The Contractor shall furnish all actuators complete and operable with mounting hardware, motors, gears, controls, wiring, solenoids, handwheels, levers, chains, and extensions, as applicable. All actuators shall be capable of holding the valve in any intermediate position between fully-open and fully-closed without creeping or fluttering. All wires of motor-driven actuators shall be identified by unique numbers.

C. Where indicated, certain valves and gates may be provided with actuators manufactured by the valve or gate Manufacturer. Where actuators are furnished by different manufacturers, the Contractor shall coordinate selection to have the fewest number of manufacturers possible.

D. Materials: All actuators shall be current models of the best commercial quality materials and liberally-sized for the maximum expected torque. All materials shall be suitable for the environment in which the valve or gate is to be installed.

E. Mounting: All actuators shall be securely mounted by means of brackets or hardware specially designed and sized for this purpose and of ample strength. The word "open" shall be cast on each valve or actuator with an arrow indicating the direction to open in the counter-clockwise direction. All gear and power actuators shall be equipped with position

indicators. Where possible, manual actuators shall be located between 48 and 60 inches above the floor or the permanent working platform.

F. Functionality: Electric and pneumatic actuators shall be coordinated with power and instrumentation equipment indicated elsewhere in the Contract Documents.

2.2 MANUAL ACTUATORS

A. Unless otherwise indicated, all valves and gates shall be furnished with manual actuators as specified below:

1. Valves up to and including 4 inches in diameter shall have direct acting lever or handwheel actuators of the manufacturer's best standard design.

2. Larger valves and gates shall have gear-assisted manual actuators, with a maximum operating pull of 60 pounds on the rim of the handwheel.

a. Above ground valves 6-inches to 24-inches in diameter may have traveling nut actuators, worm-gear actuators, spur- or bevel-gear actuators, as appropriate for each valve.

b. Buried and submerged valves, gates, and other valves as indicated shall have totally enclosed worm-gear actuators, hermetically-sealed water-tight and grease-packed.

B. Buried Valves: Unless otherwise indicated, buried valves shall have extension stems to grade, with square nuts or floor stands, position indicators, and cast-iron or steel pipe extensions with valve boxes, covers, and operating keys. Where so indicated, buried valves shall be in cast-iron, concrete, or similar valve boxes with covers of ample size to allow operation of the valve actuators. Covers of valve boxes shall be permanently labeled as required by the local Utility Company or the Engineer. Wrench-nuts shall comply with AWWA C500 – Metal-Seated Gate Valves for Water Supply Service.

C. Floor Boxes: Hot-dip galvanized cast-iron or steel floor boxes and covers to fit the slab thickness shall be provided for all operating nuts in or below concrete slabs. For operating nuts in the concrete slab, the cover shall be bronze-bushed.

D. Manual Worm-Gear Actuator: The actuator shall consist of a single or double reduction gear unit contained in a weather-proof cast-iron or steel body with cover and minimum 12-inch diameter handwheel. The actuator shall be capable of 90-degree rotation and shall be equipped with travel stops capable of limiting the valve opening and closing. The actuator shall consist of spur or helical gears and worm-gearing. The spur or helical gears shall be of hardened alloy steel and the worm-gear shall be alloy bronze. The worm-gear shaft and the handwheel shaft shall be of stainless steel. All gearing shall be accurately cut with hobbing machines. Ball or roller bearings shall be used throughout. Actuator output gear changes shall be mechanically possible by simply changing the exposed or helical gear set ratio without further disassembly of the actuator. All gearing shall be designed for a 100 percent overload.

PART 3 - EXECUTION

3.1 GENERAL

A. All valve and gate actuators and accessories shall be installed in accordance with Section 40 05 51 - Valves, General. Actuators shall be located to be readily accessible for operation and maintenance, without obstructing walkways. Actuators shall not be mounted where shock or vibrations will impair their operation, nor shall the support systems be attached to handrails, process piping, or mechanical equipment.

3.2 SOURCE QUALITY CONTROL

A. Factory test each motorized operator assembly in accordance with AWWA C540, except as modified herein.

B. Demonstrate that the stroke time is within the specified range.

C. Verify limit switch and torque switch functions in both directions.

D. Provide individual factory test certificates for each motorized actuator at no additional cost. Record the following parameters as a minimum.

1. No load current.
2. Current at maximum torque setting.
3. Stall current.
4. Torque at maximum torque setting.
5. Stall torque.
6. Test voltage and frequency.
7. Flash test voltage.
8. Actuator output speed.

E. Record details of specification, such as gear ratios for both manual and automatic drive, closing direction, wiring diagram, and serial number on the test certificates.

F. Require the motorized actuator manufacturer to submit certified statements that proof-of-design tests were carried out per the “Valve Actuator” section of AWWA C540 and that all requirements were successfully met.

3.3 INSTALLATION

A. Install operators in accordance with manufacturer's instructions.

3.4 MANUFACTURER'S FIELD SERVICES

A. Coordinate field service work with Owner and Engineer prior to initiating such work.

B. Contractor shall furnish a qualified Manufacturer’s Representative to provide manufacturer’s field services for inspection, testing, equipment startup, and operator training.

C. Require manufacturer’s representative to perform the following services as described below and as specified in Section 01 75 00 - Equipment Testing and Startup Procedures.

1. Installation Assistance:

a. Advise/observe the Contractor on the installation of motorized operators.

b. Check and verify that installation of the motorized operators is in accordance with the Drawings and manufacturer’s installation instructions.

c. Provide additional assistance as required.

2. Provide a 2 year warranty from date of substantial completion for the project.

3.5 COMMISSIONING KIT

A. Each actuator shall be supplied with a start-up kit comprising installation instruction manual and cover seals to make good any site losses during the commissioning period. In addition, sufficient actuator commissioning tools shall be supplied to enable actuator set up and adjustment during valve/actuator testing and site installation commissioning.

END OF SECTION 40 05 57

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SECTION 40 05 61 - GATE VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide gate valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.2 SUBMITTALS

A. Provide shop drawings per Section 01 33 00 – Submittal Procedures and Section 40 05 51 – Valves, General.

PART 2 - PRODUCTS

2.1 GENERAL

A. All buried valves shall be of the inside screw, non-rising stem type. The valve actuators shall be as indicated, with counter-clockwise opening stems, in accordance with Section 40 05 57 – Actuators for Process Valves and Gates.

2.2 RESILIENT-SEATED GATE VALVES (2-INCH AND LARGER)

A. Construction: Resilient-seated gate valves for water service shall conform to ANSI/AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service. The valve bodies shall be of ductile iron conforming to ASTM A 126 - Specifications for Gray Iron Castings for Valves, Flanges, and Pipe Fittings, or ductile iron conforming either to ASTM A 395 - Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures, or to ASTM A 536 - Specification for Ductile Iron Castings, with flanged, bell and spigot, or mechanical joint-ends as indicated.

1. The wedge shall be ductile iron or bronze encapsulated with EDPM rubber.

B. Body and bonnett wall thickness shall be equal to or greater than the minimum wall thickness as listed in Table 2 of ANSI/AWWA C500. The design working water pressure shall be 250 psig. For sewage or fluids containing solids, an outside thread shall be used.

C. The gate valve stem and wedge nut shall be copper alloy in accordance with Section 4.4.5.1 of the AWWA C515 Standard. The stem shall have an integral thrust collar.

D. Valves shall be certified NSF to Standard 61.

E. The operating nut shall be constructed of ductile iron and shall have four flats at stem connection.

F. Stem shall be sealed by three O-Rings.

G. All internal and external surfaces of the valve body and bonnet shall have a fusion-bonded epoxy coating, complying with ANSI/AWWA C550, applied electrostatically prior to assembly.

H. See City of Pocatello Material Standards in Summary of Work 01 11 00.

2.3 VALVE SCHEDULE

A. Refer to the valve schedules in the mechanical drawings and the buried valves called out in the site civil utility drawings.

2.4 ACTUATORS

A. Unless otherwise indicated, all gate valves shall have manual actuators in accordance with Section 40 05 57 – Actuators for Process Valves and Gates.

2.5 MANUFACTURERS, OR EQUAL

A. Kennedy Valve Company;

B. Clow Valve Company;

C. Mueller Valve Company;

2.6 GATE VALVES (SMALLER THAN 2-INCH)

A. Construction: Gate valves, smaller than 2-inch, for general purpose use, shall be non- rising stem, heavy-duty type for industrial service, with screwed or soldered ends to match the piping. The bodies shall have union bonnets of bronze conforming to ASTM B 62 - Specification for Composition Bronze or Ounce Metal Castings. The stems shall be of bronze conforming to ASTM B 62, or ASTM B 371 - Specification for Copper-Zinc-Silicon Alloy Rod. The solid wedges shall be of bronze conforming to ASTM B 62. The valves shall have malleable iron handwheels, unless otherwise indicated, and stem seals shall be of Teflon-impregnated or other acceptable non-asbestos packing. All valves shall have a pressure rating of minimum 125 psi steam, and 200 psi coldwater, unless otherwise indicated.

B. Manufacturers, or Equal:

1. Kennedy Valve Company;

2. Clow Valve Company;

3. Mueller Valve Company;

PART 3 - EXECUTION

3.1 GENERAL

A. All gate valves shall be installed in accordance with the provisions of Section 40 05 51 – Valves, General. Care shall be taken that all valves in plastic lines are well supported at each end of the valve.

END OF SECTION 40 05 61

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SECTION 40 05 63 - BALL VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide ball valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. The Contractor shall furnish submittals in accordance with Section 40 05 51 – Valves, General.

PART 2 - PRODUCTS

2.1 METAL BALL VALVES (4-INCH AND SMALLER)

A. Unless otherwise indicated, general purpose metal ball valves in sizes up to 4-inch shall have actuators in accordance with Section 40 05 57 – Actuators for Process Valves and Gates.

B. Body: Ball valves up to 1-1/2-inch (incl.) in size shall have bronze or carbon steel 2-or 3-piece bodies with screwed ends for a pressure rating of not less than 600 psi WOG. Valves 2-inch to 4-inch in size shall have bronze or carbon steel 2-or 3-piece bodies with flanged ends for a pressure rating of ANSI 125 psi or 250 psi unless otherwise indicated.

C. Balls: The balls shall be solid chrome plated brass or bronze, or stainless steel, with standard port (single reduction) or full port openings.

D. Stems: The valve stems shall be of the blow-out proof design, of bronze, stainless steel, or other acceptable construction, with reinforced Teflon seal.

E. Seats: The valve seats shall be of Teflon or Buna-N, for bi-directional service and easy replacement.

F. Manufacturers, or equal

1. Conbraco Industries, Inc. (Apollo)

2. ITT Engineered Valves

3. Neles-Jamesbury, Inc.

4. Watts Regulator

5. Worcester Controls

2.2 PLASTIC BALL VALVES

A. Plastic ball valves for corrosive fluids shall be made of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polypropylene (PP), or polyvinylidene fluoride (PVDF), as recommended by the Manufacturer for the specific application. Valves shall have manual actuators in accordance with Section 40 05 57 – Actuators for Process Valves and Gates, unless otherwise indicated.

B. Construction: Plastic ball valves shall have union ends or flanged ends to mate with ANSI B 16.5, class 150 flanges, for easy removal. The balls shall have full size ports and Teflon seats. Body seals, union o-ring seals, and stem seals shall be in accordance with the corrosion resistance requirements of respective valve manufacturer. External (without entering into the wetted area) seat packing adjustment is preferred. Metal reinforced stems to prevent accidental breakage are preferred. The valves shall be suitable for a maximum Working non-shock pressure of 150 psi at 73 degrees F for PVC and CPVC, with decreasing ratings for higher temperatures and other plastics.

C. Manufacturers, or equal

1. ASAHI-America
2. George Fischer, Inc.
3. Plast-O-Matic Valves, Inc.
4. Spears Mfg. Co.

PART 3 - EXECUTION

3.1 GENERAL

A. Valves shall be installed in accordance with Section 40 05 51 – Valves, General. Care shall be taken that valves in plastic lines are well supported at each end of the valve.

END OF SECTION 40 05 63

SECTION 40 05 65.23 – SWING CHECK VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide swing check valves and appurtenances, complete and operable, in accordance with the Contract Documents where required.

1.2 REFERENCE STANDARDS

A.	ANSI/AWWA C 508	Swing-Check Valves for Waterworks Service, 2 in. through 24 in.
B.	ASTM A 126	Gray Iron Casting for Valves, Flanges, and Pipe Fittings;
C.	ANSI/ASME B 16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 300;
D.	ASTM B 584	Copper Alloy Sand Castings for General Applications
E.	ASTM B 584 or B 148	Aluminum-Bronze Castings, or of Buna-N;
F.	ASTM B 763	Copper Alloy Sand Castings for Valve Application, or
G.	ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch);
H.	ASTM B 16	Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines.

1.3 SUBMITTALS

A. The Contractor shall furnish submittals in accordance with Section 40 05 51 – Valves, General.

PART 2 - PRODUCTS

2.1 SWING CHECK VALVES (4-INCH AND LARGER)

A. Valves shall be certified to NSF Standard 61.

B. General: If not specified otherwise, swing check valves for water, sewage, sludge, and general service shall be of the outside lever and spring or weight type, in accordance with ANSI/AWWA C 508 - Swing-Check Valves for Waterworks Service, 2 in. through 24 in. NPS. Valves shall have full-opening passages, designed for a water-working pressure of 250 psi. They shall have a flanged cover piece to provide access to the disc.

C. Body: The valve body and cover shall be of ductile iron conforming to ASTM A 536 – Ductile Iron Castings for Valves, Flanges, and Pipe Fittings, with flanged ends conforming to ANSI/ASME B 16.1 - Ductile Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800, or mechanical joint ends, as indicated.

D. Disc: The valve disc shall be of ductile iron, or bronze conforming to ASTM B 584 - Copper Alloy Sand Castings for General Applications.

E. Seat and Rings: The valve seat and rings shall be of stainless steel T304 or T316 Type.

F. Lining & Coating: The valve shall be lined and coated with NSF 61 Fusion Bonded Epoxy.

G. Hinge Pin: The hinge pin shall be of bronze or stainless steel.

H. Manufacturers, or equal

1. Val-Matic, 7800LW Series

2. American Flow Control (Darling)

3. APCO (Valve and Primer Corp.)

4. Kennedy Valve

5. Mueller Company

6. Crane Valves and Fittings

2.2 SWING CHECK VALVES (2-1/2-INCH AND SMALLER)

A. Swing check valves for steam, water, oil, or gas in sizes 2-1/2 inch and smaller shall be suitable for a steam pressure of 150 psi and a cold-water pressure of 300 psi. They shall have screwed ends unless otherwise indicated, and screwed caps.

B. Body: The valve body and cap shall be of bronze conforming to ASTM B 763 - Copper Alloy Sand Castings for Valve Application, or ASTM B 584 with threaded ends conforming to ANSI/ASME B1.20.1 - Pipe Threads, General Purpose (inch).

C. Disc: Valves for steam service shall have bronze or brass discs conforming to ASTM B 16 - Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines, and for cold water, oil, and gas service replaceable composition discs.

D. Hinge Pin: The hinge pins shall be of bronze or stainless steel.

E. Manufacturers, or equal

1. Crane Company

2. Milwaukee Valve Company

3. Stockham Valves and Fittings

4. Wm. Powell Company

PART 3 - EXECUTION

3.1 GENERAL

A. Valves shall be installed in accordance with provisions of Section 40 05 51 – Valves, General.

END OF SECTION 40 05 65.23

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SECTION 40 05 67 –DEEP WELL PUMP CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Combination deep well pump control and pressure relief valve for water service.

B. Combination deep well pump control and pressure relief valves shall meet the applicable requirements of Section 40 05 51 – Valves, General.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 536 Specification for Ductile Iron Castings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Description: This valve will minimize the surge in the system caused by the well pump starting and stopping. This valve will also allow well to flush the initial column water and sand from the well casing before pumping into the system.

B. Valves shall be certified to NSF Standard 61.

C. Contractor shall be responsible for providing a ½" pressure supply line to the valve from the downstream side of the swing check valve in accordance with valve manufacturer requirements.

D. Combination Deep Well Pump Control and Pressure Relief Valve:

1. Manufacturers:

a. Cla-Val Model 61-02

2. Design:

a. Size: 8-inch

b. Pattern: Globe

c. Pressure rating: 250 psi (150 Class)

d. End Types: Flanged (150 lb.)

e. Installation: Horizontal

f. Valve Body & Cover: Ductile Iron ASTM A536

g. Trim: Stainless Steel

h. Solenoid Voltage: 24 volts

i. Disk: Buna-N Rubber

j. Diaphragm: Nylon Reinforced Buna-N Rubber

k. Stem, Nut, & Spring: Stainless Steel

l. Orientation: Horizontal

3. Solenoid Control:

a. Hosing Body: Aluminum

b. Enclosure: NEMA 3

c. Trim: Stainless Steel

d. Limit Switches: one limit switch shall be provided to relay fully open valve positions to PLC and SCADA.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All valves shall be installed in accordance with the manufacturer's recommendations with the provisions of Section 40 05 51 – Valves, General.

END OF SECTION 40 05 67

SECTION 40 05 82 – SOLENOID VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide miscellaneous valves, and appurtenances, complete and operable in accordance with the Contract Documents.

1.2 REFERENCE STANDARDS

A. Commercial Standards:

1.	AWWA C511	Reduced-Pressure Principle Backflow Prevention Assembly
2.	ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
3.	C-510-97	Double Check Valve Backflow Prevention Assembly
4.	C-511-97	Reduced Pressure Principle Backflow Prevention Assembly
5.	NPFA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 40 05 51 – Valves, General.

B. Technical Manual: Furnish operation and maintenance information in accordance with Section 01 78 23 – Operation and Maintenance Data.

1.4 QUALITY ASSURANCE

A. Comply with quality assurance requirements listed in Section 40 05 51 – Valves, General.

PART 2 - PRODUCTS

2.1 GENERAL

A. All valves specified in this Section shall meet the applicable requirements of Section 40 05 51 – Valves, General.

B. All components that are in contact with potable water shall be certified to NSF Standard 61.

2.2 SOLENOID VALVES

A. All coil ratings shall be for continuous duty. For electrical characteristics see electrical drawings or specifications.

B. Solenoid valves shall be of the size, type, and class indicated and shall be designed for not less than 150 psi water-working pressure. Valves for water, air, or gas service shall have stainless steel body with screwed ends, stainless steel trim and spring, Teflon or other resilient seals with material best suited for the temperature and fluid handled. Unless otherwise indicated, for chemicals and all corrosive fluids, solenoid valves with PVC, CPVC, polypropylene (PP), polyvinylidene fluoride (PVDF), or Teflon materials of construction, suitable for the specific application shall be provided. Enclosures shall be NEMA rated in accordance with the area designations.

C. Solenoid valves shall be pilot controlled and shall be water hammer free.

D. Solenoid valves shall fail in the closed position unless otherwise indicated on the project drawings.

E. Where solenoid valves are apart of a packaged equipment system, those solenoids valves shall be specified and provided by the equipment manufacturer.

F. Solenoid valves to NSF-61 compliant valves for potable water service.

G. Manufacturers, or Equal:

1. For general duty

a. Automatic Switch Co. (ASCO), Model "RED HAT"

b. Skinner Valve (Parker Hannifin Corporation)

c. Magnatrol Valve Corporation

d. J. D. Gould Co.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Valves shall be installed in accordance with the manufacturer's printed recommendations, and with provisions of Section 40 05 51 – Valves, General.

B. After installation is complete, the solenoid valve shall be tested for proper operation.

END OF SECTION 40 05 82

SECTION 40 05 93 – COMMON MOTOR REQUIREMENTS FOR PROCESS EQUIPMENT

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. The Pump Supplier shall provide electrical motors, accessories, and appurtenances complete and operable, in conformance with the individual driven equipment specifications and the Contract Documents.

B. The provision in this Section apply to all low voltage AC squirrel cage induction motors except as indicated otherwise.

C. All motors shown on the Drawings or specified in other divisions of the specifications shall in general, be furnished with the driven equipment and connected under Division 26 of the Specification.

D. If motors are specified in other divisions of the Specification, then in the event of conflicts, the more restrictive specification shall apply.

E. The equipment supplier is responsible to select suitable electric motors for the equipment. The choice of motor manufacturer shall be subject to review by the Engineer. Such review will consider future availability of replacement parts and compatibility with driven equipment.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Motors shall be designed, built, and tested in accordance with the latest revision of the following standard documents. In the case of conflict between the requirements of this Section and those of the standard documents, the requirements of this Section shall prevail.

1.	NEMA MG 1	Motors and Generators
2.	ANSI/IEEE 112	Test Procedures for Polyphase Induction Motors and Generators
3.	UL l004	Motors, Electric

1.3 PUMP SUPPLIER SUBMITTALS

A. Refer to Section 01 33 00 – Submittal Procedures and individual equipment specification requirements.

B. Submit the motor manufacturer's certification of bearing life on motors where application conditions suggest significant belt drive or thrust loads.

C. A Motor Data form (sample Form follows section) shall be submitted for each and every motor furnished under this Contract.

D. Motor outline, dimensions, and weight.

E. Manufacturer's descriptive information relative to specified features.

F. Motor Performance Characteristics:

1. Guaranteed minimum efficiency at rated load at rated voltage.

2. Guaranteed minimum power factor at rated load at rated voltage.

3. Expected efficiency at 1/2, 3/4, and full load at rated voltage.

4. Expected power factor at 1/2, 3/4, and full load at rated voltage.

5. Motor no-load current at rated voltage.

6. Full load current at rated voltage.

7. Full load current at 110 percent voltage.

8. Starting current at rated voltage.

9. Full load speed.

10. Certified copy of test report for identical motor tested in accordance with NEMA MG 1-12.53a and IEEE Standard 112, Test Method B, showing full load efficiency and power factor not less than specified value. Motors not as specified will be rejected.

G. Vertical Motor Data:

1. Thrust bearing life

2. Type of thrust bearing lubrication.

3. Type of guide bearing lubrication.

H. Operation and Maintenance Manuals (provided before or during training of treatment plant staff), including:

1. Complete information for storage and installation.

2. Complete operating and maintenance instructions.

3. Bill of Materials.

1.4 EQUIPMENT GUARANTEE

A. Guarantees shall cover:

1. Faulty or inadequate design.

2. Improper assembly or erection.

3. Breakage, or other failure.

4. Defective workmanship or materials

1.5 FACTORY TESTS

A. Provide factory test and test reports as listed below for all polyphase motors. For motors 7 1/2 hp and above, provide test reports for the actual motor being supplied. For motors under 7 1/2 hp, test reports of an identical motor may be provided. Perform all tests in accordance with the Procedures for Polyphase Induction Motors and Generators No. 112A and NEMA MG 1.

B. Measurements of no-load current and speed at nominal voltage and frequency

1. Measurement of locked rotor current at rated frequency.

2. Results of high-potential test.

3. Determination of efficiency and power factor at 1/2 load, 3/4 load, full-load, and service factor load.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide squirrel-cage induction motors unless otherwise noted.

B. Electric motors driving identical machines shall be identical.

C. Coordination: Provide motors especially suitable both electrically and mechanically to drive the loads specified. The speed, horsepower, torque base, bearing, shaft, insulation and enclosure shall be closely coordinated with this specification so as to provide a satisfactory, efficient drive without overloading, overheating, abnormal noise or vibration. The BHP required of the driven equipment under the most severe operating conditions for the equipment served shall not exceed the rated nameplate horsepower of the motor when operating at its rated service factor, nor shall it exceed the rated nameplate horsepower of the motor when operated at specified conditions at a service factor of 1.0. The "most severe operating conditions" shall include the full possible range of normal operating conditions but shall not include unusual conditions such as equipment failure.

D. Standards: All motors shall be in accordance with NEMA-MG 1 "T" Line, IEEE and ANSI latest revision insofar as they are applicable.

E. Service Conditions: Provide motors designed and built for long, trouble-free life in industrial service capable of operating successfully under the following application conditions:

1. 40°C maximum ambient temperature to -20 degrees Celsius minimum ambient temperature.

2. Altitude at the facility site shall be verified.

3. Voltage variations to + 10 percent of nameplate rating.

4. Frequency variations to + 5 percent of nameplate rating.

5. Multiple speed motors suitable for use with multiple speed starter furnished.

6. Inverter duty motors suitable for use with variable frequency drives, if furnished.

F. Operating Characteristics: All motors shall be rated for full-voltage starting, NEMA Design B, normal torque, normal starting current, unless otherwise required by the driven equipment or specified.

G. Installation Environment: Provide motors suitable for the environment in which they are to be installed. Where the installation environment is specified, provide motors suitable for the environment indicated and in conformance with the specification.

H. Exempt Motors: Motors for valve operators, submersible pumps, or motors which are integral part of standard manufactured equipment, i.e., non-NEMA mounting, common shaft with driven element, or part of domestic or commercial uses apparatus may be exempted from these specifications to the extent that such variation reflects a necessary condition of motor service or a requirement of the driven equipment.

2.2 ENCLOSURES

A. Horizontal: Dripproof NEMA Standard MG 1, unless otherwise specified. Provide screen over all air openings.

B. Vertical: Motors shall be weather protected Type 1 (WP-l) NEMA Standard MG 1, with inlet and outlet openings screened unless otherwise specified.

C. TEFC and TENV: Totally enclosed fan cooled (TEFC) where specified. Provide horizontal TEFC motors with condensate drain holes. Totally enclosed non- ventilated (TENV) may be substituted for TEFC at Contractor's option.

D. Cast iron or extruded aluminum or die cast aluminum stator frames and end shields, rigid construction.

E. Heavy fabricated steel, cast iron or aluminum frames for single phase motors.

2.3 ACCESSORY REQUIREMENTS

A. Motor Assembly: Provide NEMA conduit entrance box. Provide conduit entrance box size and drilling to conform to the conduit or wiring requirements indicated on the electrical drawings. Include motor leads and all accessory leads in a common conduit entrance box.

B. Motor Leads: Provide motor leads compatible with motor insulation systems, permanently identified.

C. Eyebolts: Provide drilling and tapping for eyebolts on all motors weighing more than 83 pounds.

D. Nameplates: Provide one or more engraved stainless steel stamped metal nameplates with the information required by NEMA-MGI-IO.38 and the following additional information:

1. Maximum ambient temperature for which motor is rated.

2. Class of insulation.

3. Service factor.

4. Bearing number.

5. Motor connection diagram if more than three leads.

6. Power rating in KW if driven equipment ratings are given in metric units.

E. Oil Lubricated Polyphase Motors: Provide lubricating oil reservoirs and sight gauges.

F. Painting: As specified in Section 43 05 01 – Equipment General Provisions.

G. Provide motor grounding lug suitable to terminate ground wire, sized as indicated.

2.4 INSULATION CLASS

A. Provide NEMA Class B insulation for all polyphase squirrel-cage induction motors, unless otherwise specified.

1. Provide additional anti-abrasion protection for non-enclosed motors, per NEMA MGl-l.27.

2. Provide additional moisture protection for enclosed motors, per NEMA MGl-20.48a.

B. Class F insulation with additional nonhygroscopic moisture protection as specified in paragraph 2.03A above may be utilized at the Contractor's option, however, the temperature rise as measured by resistance when operating at rated service factor and load shall conform to the limiting observable temperatures in NEMA-MGl, for class of insulation used.

C. Class A insulating materials shall not be utilized except in single-phase fractional horsepower motors or used in dry locations, with a standard reduction in rated temperature rise.

D. Encapsulation: Where specified. Provide insulating resin encapsulation by a molded or equivalent process in which the resin completely surrounds the conductors in the slots and end turns, leaving no voids between the conductors or adjacent stator steel. Allowable temperature rise shall not exceed the limits of NEMA-MGl.

E. Motors to be operated from adjustable frequency drives shall be provided with insulation systems to withstand 1600 volt spikes, with dV/dt as defined in NEMA MG 1-31 and shall be labeled as “Inverter Duty”.

2.5 SERVICE FACTOR

A. Provide the service factor indicated, or NEMA standard for the specified insulation and enclosure, whichever is greater. Minimum service factor shall be 1.15.

2.6 NEMA TYPE

A. Provide motors in accordance with standard NEMA type classifications as specified. The use of industry standard subclassifications such as "mill and Chemical" motors and similar" standard" heavy-duty designs are encouraged where they meet or exceed the specified minimum requirements.

2.7 POWER RATINGS

A. Motor horsepower or kw ratings, if indicated in the detailed equipment specifications, are minimum size acceptable.

B. Ratings indicated on the electrical drawings are for guidance only and do not limit the equipment size.

C. Frame/hp relationships shall conform to the latest NEMA standards for "T" or "U" frames and all dimensions shall meet NEMA standards.

2.8 STANDARD RATED VOLTAGE PHASE AND FREQUENCY

A. Provide motors nameplate-rated for 60 Hertz power supply as follows unless otherwise specified or shown on the drawings:

1. Motor less than 1/6 hp, single-phase, 115 volts.

2. Motors 1/6 hp through 1 hp, single phase, 115/230 volts.

3. Motors 1 hp and greater, three phase, 460 volts.

4. Multi-speed motors may have single voltage rating if manufacturer's standard.

B. Conform to the specified service conditions and the equipment specifications without reduction in the service factor.

2.9 BEARINGS AND SHAFTS

A. Motors greater than 2 HP shall have bearings designed for 17,500 hours (belted) or 100,000 hours (coupled) L-10 life.

B. Fractional Horsepower: Motors with fractional horsepower through 2 HP shall be provided with Lubricated-for-Life ball bearings.

C. Horizontal Motors Over 2 HP: Motors larger than 2 HP shall be provided with relubricatable ball bearings. Lubrication shall be per manufacturer's recommendation for smooth operation and long life of the bearings.

D. Vertical Motors Over 2 HP: Vertical motors larger than 2 HP shall be provided with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall be per manufacturer's recommendation for smooth operation and long life of the bearings.

E. Shafts: Shafts shall be in accordance with NEMA "T" or "TS" dimensions. Long shafts shall be suitable for belt, chain or gear drive within limits established by good industrial practice and documented by NEMA. Short shafts shall be used for direct connection. Vertical motors shall be the solid-shaft type except where application requires a hollow-shaft design.

F. Inverter Duty Motors: Motors to be used in VFD applications must have bearing protection from shaft currents. Provide AEGIS shaft grounding ring, ceramic bearings or equivalent means to prevent premature bearing failure due to shaft current discharge.

2.10 DUTY CYCLE

A. Provide motors rated for continuous duty unless otherwise specified. Short time rated motors may be provided where the application is well documented by NEMA, is usual industrial practice and the driven equipment and motor is a tested combination under the specified performance conditions.

2.11 LUBRICATION

A. Horizontal polyphase motors shall be grease lubricated. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent relubrication, but facilities shall be provided for adding new grease and draining out old grease without major motor disassembly. Motors 180T frame and smaller may utilize grease release fitting in lieu of grease drain plug. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings or leakage of grease out of the bearing cavity.

B. Vertical polyphase motor lubrication shall conform to the motor manufacturer's recommendations. Except as otherwise recommended, guide bearings shall be ball bearings, grease lubricated; thrust bearings shall be grease lubricated through frame 28OT, oil lubricated in larger frame sizes.

2.12 MOTOR THERMAL PROTECTION

A. Provide one heat-sensing detector per phase, embedded in the windings to provide even temperature protection on motors 75 hp or larger. Coordinate over-temperature protection system with motor starter overload relays.

B. Single Phase Motor: Single phase 120, 208, or 230 volt motor shall have integral thermal overload protection or shall be inherently current limited.

C. Thermostats: Winding thermostats shall be snap action, bi-metallic, temperature-actuated switch, and shall be factory mounted integral to the motors. Thermostats shall be provided

with one normally closed contact. The thermostat switch point shall be precalibrated by the manufacturer.

2.13 HIGH EFFICIENCY MOTORS

A. All motors provided shall be high efficiency as specified below.

B. High efficiency motors shall have minimum and nominal efficiencies which meet or exceed the efficiencies specified below when tested in accordance with the latest version of IEEE Test Procedure 112A. Method B. using accuracy improvement by segregated loss determination including stray load loss improvement as specified in NEMA Standard MGl-12.S3A. latest revision. Minimum efficiencies shall be guaranteed in writing.

C. Single speed induction high efficiency motors, three-phase, NEMA Design B, 460V, continuous duty, 40°C ambient shall meet or exceed the efficiencies specified in the following table.

Energy Efficiency Horizontal					
		Percent Guaranteed Minimum Rated Load Efficiencies		Percent Guaranteed Minimum Rated Load Power Factor	
HP	Nominal Speed RPM	DP	TEFC	DP	TEFC
1	1,800	80.0	81.5	85.0	85.0
	1,200	78.5	79.3	74.0	74.0
1.5	3,600	79.3	81.5	86.0	86.0
	1,800	79.3	82.0	88.0	88.0
	1,200	82.5	84.0	69.5	69.5
2	3,600	82.0	84.0	88.0	88.0
	1,800	81.5	83.7	84.0	84.0
	1,200	85.5	85.5	69.0	69.0
	900	82.9	82.5	54.0	54.0
3	3,600	82.0	84.0	91.0	88.0
	1,800	84.8	86.5	79.0	79.5
	1,200	87.5	88.1	71.0	71.5
	900	84.1	82.9	62.0	62.5
5	3,600	84.8	86.5	87.0	91.5
	1,800	86.5	86.5	81.0	81.0
	1,200	87.5	88.1	75.5	75.5
	900	87.5	86.5	70.0	70.5
7.5	3,600	86.5	88.1	90.0	90.0
	1,800	89.3	89.5	86.5	86.5
	1,200	88.5	88.5	80.0	80.0
	900	87.5	86.5	72.0	72.0
10	3,600	89.3	89.5	90.0	90.0
	1,800	89.3	89.5	86.0	86.0
	1,200	89.5	89.5	80.5	81.0
	900	89.3	88.5	77.5	78.0

2.14 ACCEPTABLE MANUFACTURER

A. General Electric

B. Or Preapproved Equal

PART 3 - EXECUTION

3.1 ERECTION

A. Motors shall be factory installed on common bases, stands, etc., with the driven equipment. Provide suitable couplings and guards between motor and driven equipment.

B. Align and connect to driven equipment.

C. Connect motors to power supply and controllers and verify correct rotation of equipment.

3.2 INSTALLATION CHECK

A. Provide services of an experienced, competent, and authorized representative of the manufacturer to visit site of work and inspect, check, adjust if necessary, and approve equipment installation for motors 25 hp and larger.

B. Assure that equipment manufacturer's representative is present when equipment is placed in operation.

C. Verify that equipment representative revisits jobsite as often as necessary until all trouble is corrected and equipment installation and operation are satisfactory, in the opinion of the Owner.

D. The Installing Contractor shall perform the following field checks:

1. Inspect each motor installation for any deviation from rated voltage, phase, or frequency and improper installation.

2. Visually check for proper phase and ground connections. Verify that multi-voltage motors are connected for proper voltage.

3. Check winding and bearing temperature detectors and space heaters for functional operation.

4. Test for proper rotation prior to connection to the driven equipment.

5. Test insulation (megger test) of all new and re-used motors in accordance with NEMA MG-1. Test voltage shall be 1000 VAC plus twice the rated voltage of the motor.

END OF SECTION 40 05 93

MOTOR DATA FORM

Equipment Name: _____ Equipment Number(s): _____

Site Location: _____

Nameplate Markings

Mfr: _____ Mfr Model: _____ Frame: _____ HP: _____

Volts: _____ Phase: _____ RPM: _____ Service Factor: _____

FLA: _____ LRA: _____ Freq: _____ Ambient Temp Rating: _____°C

Time Rating: _____ (NEMA MG-10.35) Design Letter _____ (NEMA MG-1.16)

KVA Code Letter: _____ Insulation Class: _____

The following information is required for high efficiency motors only:

A. Guaranteed minimum efficiency at full load at NEMA efficiency index:

_____
(NEMA MG1-12.53B)

B. Nameplate or nominal efficiency: _____

Data Not Necessarily Marked on Name Plate

Type of enclosure: _____ Enclosure Material: _____

Temp rise: _____ °C (NEMA MG1-12.41, 42)

Space heater included: _____ Yes _____ No;

If yes, _____ Watts _____ Volts

Type of Rotor winding over-temperature protection, if specified:

Use the space below to provide additional information on other motor modifications, if specified:

_____

_____

SECTION 40 05 97 - PIPING IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide identification for exposed piping and valves, complete and in place, in accordance with the Contract Documents.

B. All mechanical pipe systems shall have protective coatings applied in accordance with Section 09 99 00 – Painting and Coating.

1.2 REFERENCE STANDARDS

A. Commercial Standards:

1. ANSI A13.1 Scheme for the Identification of Piping Systems

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: A list of suggested labels for each valve tag and pipe system prior to fabrication.

C. The Contractor shall submit one sample of all types of identification devices to be used in the work.

PART 2 - PRODUCTS

2.1 IDENTIFICATION OF PIPING

A. Except as indicated below for very short pipe lengths, identify exposed piping larger than 2-inches nominal size (except that all chemical pipes shall be identified) for the pipe contents and direction of flow. Pipe identification shall be as manufactured by Brady, Seton, or equal.

B. Marker Type: Adhesive – Vinyl or polyester sheet with UV–resistant ink, shaped similar to pipe curvature and coated with pressure sensitive adhesive.

C. Marker Area: Sized per pipe size according to ANSI A13.1; color from the table below.

D. Lettering: Sized per pipe size according to ANSI A13.1; color from the table below.

E. Arrows: At least 2 arrows at each marker area, showing direction of flow.

F. Pipe 2-inches and smaller shall be identified by plastic plates made from laminated 3-layer plastic with engraved black letters on white background.

G. Standard Piping Colors: Paint piping to be in accordance with Table 1 - Color Schedule and in accordance with the requirements of the Specifications for type and quality of paint as hereafter specified. This schedule is to be used only for color and identification purposes.

H. In installations where existing piping identification systems have been established, the Contractor shall follow the existing system. Where existing identification systems are incomplete, utilize the existing system as far as practical and supplement with the indicated system.

Mechanical Piping Color Schedule Piping Color Code			
ANSI Classification	Typical Project Piping	Pipe Color	Letter Color
Liquid or Liquid Mixture	Utility Water Pipe	Beige	Black
	Utility Water Valves	Dark Gray	Black
	Drains	Gray	Black
	Vents	Gray	Black

2.2 IDENTIFICATION OF VALVES AND SHORT PIPE LENGTHS

A. Identifying devices for valves and the sections of pipe that are too short to be identified with markers and arrows shall be identified with metal or plastic tags.

B. Metal tags shall be stainless steel with embossed lettering. Plastic tags shall be solid black plastic laminate with white embossed letters. Tags shall be designed to be firmly attached to the valves or short pipes or to the structure immediately adjacent to such valves or short pipes.

PART 3 - EXECUTION

3.1 GENERAL

A. All markers and identification tags shall be installed in accordance with the manufacturer's printed instructions, and shall be neat and uniform in appearance. Tags and markers shall be readily visible from all normal working locations.

3.2 VALVE TAGS

A. Valve tags shall be permanently attached to the valve or structure by means of two (2) stainless steel bolts or screws.

B. Wording on the valve tags shall describe the exact function of each valve, e.g., “HWR-BALANCING,” “CLS THROTTLING”, “PUMP SHUT-OFF,” etc.

3.3 MARKER LOCATIONS

A. Each pipe shall be marked at:

1. Intervals of 20-feet in straight runs.

2. At least one in every room.

3. Within 2-feet of turns, elbows, and valves.

4. On the upstream side of tees, branches, and other distribution points.

5. On both sides of walls and floors through which the piping passes.

END OF SECTION 40 05 97

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SECTION 40 61 96 – CONTROL STRATEGIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor, through the use of the Instrumentation Supplier, shall provide all instrumentation and programming required to implement the control strategies described in this Section, the functions shown on the drawings complete and operable in accordance with the Contract Documents.

1.2 DEFINITIONS

A. The following terms are used in the descriptions of PLC functions:

1. Operator Settings: Operator set or entered values shall be constants that are adjustable or set from operator displays. Examples of operator set or entered values are controller set points, batch set points, etc. Specific values that are required to be operator set are noted in the process control strategy descriptions.

2. Tunable Values: Tunable values are constants that are adjustable at engineer level displays without requiring any software reconfiguration. These values are not adjustable from operator level displays.

B. The following abbreviations are used throughout this Section:

1.	SS	Selector Switch
2.	F/R	Forward or Reverse
3.	HOR	Hand/Off/Remote
4.	RVS	Reduced Voltage Starter
5.	VFD	Variable Frequency Drive
6.	LR	Local Remote
7.	HOA	Hand/Off/Auto
8.	MOV	Motor Operated Valve
9.	LOS	Lock-Out Stop
10.	LCS	Local Control Station
11.	LCP	Local Control Panel

1.3 SUBMITTALS

A. Provide submittals describing SCADA system screen development in accordance with Section 01 33 00 – Submittal Procedures and Section 40 70 00 – Instrumentation and Control, General.

B. Develop detailed loop descriptions based on the information in the Contract Documents, including the Process and Instrumentation drawings (P&ID) and Division 40 specifications.

1. For each control loop, provide a detailed functional description of the operation of the equipment, signals, and controls shown on the P&IDs:

a. Include all functions depicted or described in the Contract Documents.

b. Include the following within each loop description:

1) All requirements specific to that loop.

2) Common control requirements applicable to that loop.

3) List of all ranges, setpoints, timers, values, counters, etc.

2. Where there are similar loops with identical control, such as multiple loops for individual pumps, only 1 loop description need be developed and the remaining loops may reference that loop description.

C. Loop description format:

1. Loop number and title.

2. References:

a. List P&IDs that are specifically referenced.

3. Abstract:

a. General description of how the loop works, what devices are involved, and how the process shall be controlled.

b. Process values, setpoints, and limits, including units and ranges:

1) Show span and range values for analog inputs and outputs, and operating point and dead band for discrete inputs.

4. Hardwired control:

a. Detailed description of the control functions at the local level.

b. Function of local operator interfaces.

c. Operation of hardwired field pilot controls:

1) Pushbuttons.

2) Selector switches.

3) Potentiometers.

4) Pilot lights, indicators, and other displays.

5. Hardwired interlocks:

a. Explanation of the operation of system interlocks and hardwired permissive conditions.

6. PLC control:

a. Detailed description of the control functions that are under control of the PLC.

b. Operator controls and automatic controls.

c. Setpoints, alarms, etc.:

1) Include units and ranges for analog values.

2) Include span and range for analog inputs and outputs.

3) Include operating point and dead band for discrete inputs, and identify conditions where contacts are open, and when they close.

d. Control sequences.

7. Software interlocks:

a. Operation of system software interlocks.

8. HMI control:

a. Detailed description of the operator controls.

9. SCADA control:

a. Detailed description of the operator controls.

b. Setpoints, alarms, etc.

10. Indicators and alarms:

a. List any indicators and alarms specific to the loop that are not covered in the common control strategies.

11. Failure modes:

a. List any failure modes specific to the loop that are not covered in the common control strategies.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 COMMON FUNCTIONS

A. Common functions that are generally applicable to all loops or to many similar loops are described under the heading "General Control Loop Functions." These functions are not repeated in the descriptions for each individual control strategy.

B. General Control Loop Functions: The following general control system functions shall be provided:

1. All analog and discrete inputs to the dialers shall be displayed. Both RUNNING and OFF input states shall be displayed.

2. All analog inputs shall have instrument failure alarms when the input is below 0 percent or above 100 percent for a tunable time initially set at 10 seconds.

3. All discrete FAIL inputs shall be alarmed for a tunable time initially set at 10 seconds. Other discrete inputs shall be alarmed as noted in the control strategy descriptions.

4. Operational Readiness Testing (ORT) should include all discrete and analog alarms as well as status alarms. This should also include all operations (e.g. lift station pump controls for lead, lag alarms, etc.). All alarm should be tested through voice or text notification as needed.

5. Where alarms are specified in the control strategy descriptions, alarms shall be initiated from the applicable inputs. If discrete inputs are not available, the specified alarms shall be initiated from the applicable analog input; alarm setpoints shall be operator adjustable.

6. All flow inputs and equipment run times shall be totalized and recorded. All totalized values shall be displayed. Runtime shall be displayed in tenths of an hour and be based on real-time accumulation.

7. When a level is less than 10 (e.g. ft, psi, mg/L, etc.) the precision shall be recorded in hundredths.

8. Displays shall be grouped functionally for ease of operation. Both analog and discrete functions associated with an item of equipment or a group of equipment shall be provided on the same display.

9. All PID control functions shall be provided with standard analog controller functions and operator interfaces including, but not limited to, the following:

a. AUTO/MANUAL mode selection: In AUTO, the output of controller shall be based on the PID control calculation. In MANUAL, the output of the

controller shall be operator adjustable. Transfer between operational modes shall be bump less.

b. LOCAL/REMOTE set point selection: In LOCAL, the set point shall be operator adjustable from the equipment, if applicable. In REMOTE, the set point shall be adjustable from a REMOTE set point input.

c. Set point, process variable, and controller output shall be displayed.

d. Provisions shall be included to prevent reset windup.

10. When equipment is tagged OUT OF SERVICE, by the operator all associated equipment shall have their alarms inhibited until the tagged equipment is re-tagged IN SERVICE.

11. Speed indications and speed control setpoints shall be displayed in Hz.

12. Wherever two or more pieces of equipment are provided for the same functions, for example submersible lift station pumps, the MCC shall alternate the equipment after each use.

3.2 WELL HOUSE #2R & WELL HOUSE #22R

A. Both Well Houses will have similar controls.

B. Reference Drawing: EI-701-A, EI-701-B

C. Description:

1. Well house mechanical room is comprised of a well pump, that has level, pressure, flow, chlorine injection, and well pre-lube control.

2. The chlorine room comprises of a chlorine tank on a weighted scale with weight indicator mounted on the wall, a chlorine analyzer sensor, and exhaust fan.

D. Local Controls: located in the mechanical room shall have an HOA switch designating if the system will be in automatic or manual.

1. Automatic mode: Selector switch in automatic mode, the operator shall be able to control the pressure setpoint on the local HMI (start pressure and shutoff pressure with associated time delays). The VFD running the pump will run on a PID loop, ramping up and down to meet the pressure setpoint. Prior to well pump startup, the pre-lube solenoid valve shall open for an operator-designated time and then close at pump startup. At pump startup, a signal will be sent to the deep well pump control valve to begin closing. Upon startup of the well pump the VFD shall ramp up to the operator-designated setpoint pressure (with a minimum and maximum flow setpoints) and run until the Operator sets the local control to off or until any of the interlocks are triggered include the shutoff pressure. When the pump is running and after the flow meter reaches an operator setpoint flow, the solenoid valve for the chlorination system shall open and the small booster pump begin running to allow chlorination to begin. The well pump VFD shall run at a variable

speed. When the pump is signaled to shutdown, a signal will need to be sent to the deep well control valve to open. As the pump is shutting down, a signal shall be sent to the chlorination solenoid valve and small booster pump to close/shutdown. Once the deep well control valve is open, the well pump can finish the shutdown process. A minimum time delay between off/on of the well pump should be able to be set in the PLC by the operator.

2. Manual mode: Selector switch in manual mode, the operator shall be able to control the speed of the pump on the local HMI. When in manual mode the pump and chlorine injection shall run continuously.

3. Both modes: In either automatic or manual mode the pre-lube solenoid valve shall open for a preset time before the vfd will ramp up. When the VFD is running the pre-lube solenoid valve shall be closed.

E. SCADA control

1. Same as automatic mode. Setpoints shall be able to be set via SCADA center.

F. Interlocks: All pumps that are running shall be interlocked to stop on any of the following conditions:

1. A discharge pressure HIGH switch circuit trip (latched). Local Reset required.

2. VFD fault

3. Level is lower than low level shutdown setpoint.

4. Failure of the safety shutdown functions of the pumps.

G. LCP Indicators (See P&ID's):

1. Pump running.

2. Pump stopped.

3. Pump fail.

4. Low level alarm.

5. Well house temperature.

6. Chlorine room temperature.

7. Intrusion alarm.

8. Well Level.

9. VFD current.

10. VFD speed feedback.

11. Pump auto/manual indication.

12. Deep well valve open.

13. Well discharge total flow.

14. Well discharge flow.

15. Well discharge flow setpoint.

16. Well discharge pressure.

17. Well discharge high pressure alarm.

18. Well discharge pressure setpoint.

19. CL2 level.

20. CL2 high level alarm.

21. Chlorine gas weight.

22. ATS/Generator indications and alarms.

H. SCADA Indicators: As a minimum, the following indicators shall be provided in the SCADA system

1. Run status for each pump.

2. VFD fault.

3. Well discharge pressure.

4. Well discharge flow.

5. CL2 high alarm.

6. Chlorine gas weight.

7. ATS and Generator status and alarms - See P&ID's.

END OF SECTION 40 61 96

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DEVICE	TAG	I/O TAGNAME	P&ID	CONTROLLER	TYPE	DESCRIPTION	ANALOG SIGNAL LEVEL	DISCRETE SIGNAL LEVEL	OFF/4 mA	ON/20 mA	POWER	NOTES
AIT-A102	AI	AIT_A102_AI	EI-701-A	PLC-A100	AI	CL2 LEVEL	4-20mA		0 PMM	10 PMM	120V	PLC ONLY
AIT-A102	AAH	AIT_A102_AAH	EI-701-A	PLC-A100	DI	CL2 HIGH ALARM		24V	NO ALARM	ALARM	N/A	
TT-A103	TI	TT_A103_TI	EI-701-A	PLC-A100	AI	WELL HOUSE TEMPERATURE	4-20mA		32°F	122°F	LOOP	PLC ONLY
TT-A104	TI	TT_A104_TI	EI-701-A	PLC-A100	AI	CHLORINE ROOM TEMPERATURE	4-20mA		32°F	122°F	LOOP	PLC ONLY
YS-A105	YA	YS_A105_YA	EI-701-A	PLC-A100	DI	CHLORINE ROOM INTRUSION		24V	NO ALARM	ALARM	N/A	PLC ONLY
YS-A106	YA	YS_A106_YA	EI-701-A	PLC-A100	DI	WELL ROOM INTRUSION		24V	NO ALARM	ALARM	N/A	PLC ONLY
SV-A107	ZCO	SV_A107_ZCO	EI-701-A	PLC-A100	DO	PRE-LUBE SOLENOID VALVE COMMAND OPEN		24V	STANDBY	COMMAND OPEN	120V	PLC ONLY
LT-A109	LI	LT_A109_LI	EI-701-A	PLC-A100	AI	WELL LEVEL	4-20mA		0FT	119FT	LOOP	PLC ONLY
VFD-A110	II	VFD_A110_II	EI-701-A	PLC-A100	AI	PMP-A001 CURRENT	4-20mA		0AMP	450 AMPS	EXTERNAL	PLC ONLY
VFD-A110	SI	VFD_A110_SI	EI-701-A	PLC-A100	AI	PMP-A001 SPEED FEEDBACK	4-20mA		0HZ	60HZ	EXTERNAL	PLC ONLY
VFD-A110	YC	VFD_A110_YC	EI-701-A	PLC-A100	DO	PMP-A001 START/RUN		24V	STANDBY	RUN COMMAND	EXTERNAL	PLC ONLY
VFD-A110	YI.AM	VFD_A110_YI.AM	EI-701-A	PLC-A100	DI	PMP-A001 AUTO/MANUAL		24V	MANUAL	AUTO	EXTERNAL	PLC ONLY
VFD-A110	YI	VFD_A110_YI	EI-701-A	PLC-A100	DI	PMP-A001 RUNNING		24V	NOT RUNNING	RUNNING	EXTERNAL	
VFD-A110	YA	VFD_A110_YA	EI-701-A	PLC-A100	DI	PMP-A001 FAULT		24V	NO ALARM	ALARM	EXTERNAL	
VFD-A110	SC	VFD_A110_SC	EI-701-A	PLC-A100	AO	PMP-A001 SPEED COMMAND	4-20mA		0HZ	60HZ	EXTERNAL	PLC ONLY
PT-A111	PI	PT_A111_PI	EI-701-A	PLC-A100	AI	WELL DISCHARGE PRESSURE	4-20mA		0 PSI	200PSI	LOOP	
FIT-A112	FI	FIT_A112_FI	EI-701-A	PLC-A100	AI	WELL DISCHARGE FLOW	4-20mA		0 GPM	2500 GPM	120V	
FIT-A112	FQI	FIT_A112_FQI	EI-701-A	PLC-A100	DI	WELL DISCHARGE TOTAL FLOW		24V	STANDBY	MEASURE	N/A	PLC ONLY
CR-A113	YC	CR_A113_YC	EI-701-A	PLC-A100	DO	PUMP RUN/ VALVE OPEN		24V	STANDBY	RUN COMMAND	120V	PLC ONLY
WIT-A114	WI	WIT_A114_WI	EI-701-A	PLC-A100	AI	CHLORINE GAS WEIGHT	4-20mA	24V	0 LBS	150 LBS	120V	
SV-A115	ZCO	SV_A115_ZCO	EI-701-A	PLC-A100	DO	DEEP WELL VALVE COMMAND OPEN		24V	STANDBY	COMMAND OPEN	120V	PLC ONLY
ZSO-A115	ZIO	ZSO_A115_ZIO	EI-701-A	PLC-A100	DI	VALVE OPENED		24V	STANDBY	OPEN	N/A	PLC ONLY
ATS-A100	ZI.UP	ATS_A100_ZI.UP	EI-701-A	PLC-A100	DI	UTILITY POWER/NORMAL		24V	NOT UTILITY	UTILITY POWER	EXTERNAL	
ATS-A100	ZI.EP		EI-701-A	PLC-A100	DI	GENERATOR POWER/EMERGENCY		24V	NOT EMERGENCY	EMERGENCY POWER	EXTERNAL	
ATS-A100	YA	ATS_A100_YA	EI-701-A	PLC-A100	DI	ATS FAULT		24V	NO ALARM	ALARM	EXTERNAL	
GEN-A100	II	GEN_A100_II	EI-701-A	PLC-A100	AI	GENERATOR CURRENT	4-20mA		0AMP		EXTERNAL	PLC ONLY
GEN-A100	YI.OK	GEN_A100_YI.OK	EI-701-A	PLC-A100	DI	STATUS/READY		24V	NOT READY	READY	EXTERNAL	
GEN-A100	YI	GEN_A100_YI	EI-701-A	PLC-A100	DI	RUNNING		24V	NOT RUNNING	RUNNING	EXTERNAL	
GEN-A100	YA	GEN_A100_YA	EI-701-A	PLC-A100	DI	FAULT		24V	NO ALARM	ALARM	EXTERNAL	
GEN-A100	YI.AM	GEN_A100_YI.AM	EI-701-A	PLC-A100	DI	AUTO/MANUAL		24V	MANUAL	AUTO	EXTERNAL	
AIT-B102	AI	AIT_B102_AI	EI-701-B	PLC-B100	AI	CL2 LEVEL	4-20mA		0 PMM	10 PMM	LOOP	PLC ONLY
AIT-B102	YAH	AIT_B102_YAH	EI-701-B	PLC-B100	DI	CL2 HIGH ALARM		24V	NO ALARM	ALARM	N/A	
TT-B103	TI	TT_B103_TI	EI-701-B	PLC-B100	AI	WELL HOUSE TEMPERATURE	4-20mA		32°F	122°F	LOOP	PLC ONLY
TT-B104	TI	TT_B104_TI	EI-701-B	PLC-B100	DI	CHLORINE ROOM TEMPERATURE	4-20mA		32°F	122°F	LOOP	PLC ONLY
YS-B105	YA	YS_B105_YA	EI-701-B	PLC-B100	DI	CHLORINE ROOM INTRUSION		24V	NO ALARM	ALARM	N/A	PLC ONLY
YS-B106	YA	YS_B106_YA	EI-701-B	PLC-B100	DI	WELL ROOM INTRUSION		24V	NO ALARM	ALARM	N/A	PLC ONLY
SV-B107	ZCO	SV_B107_ZCO	EI-701-B	PLC-B100	DO	PRE-LUBE SOLENOID VALVE		24V	STANDBY	COMMAND OPEN	120V	PLC ONLY
LT-B109	LI	LT_B109_LI	EI-701-B	PLC-B100	AI	WELL LEVEL	4-20mA		0 FT	140FT	LOOP	PLC ONLY
VFD-B110	II	VFD_B110_II	EI-701-B	PLC-B100	AI	PMP-B001 CURRENT	4-20mA		0 AMP	800 AMPS	EXTERNAL	PLC ONLY
VFD-B110	SI	VFD_B110_SI	EI-701-B	PLC-B100	AI	PMP-B001 SPEED FEEDBACK	4-20mA		0HZ	60HZ	EXTERNAL	PLC ONLY
VFD-B110	YC	VFD_B110_YC	EI-701-B	PLC-B100	DO	PMP-B001 START/RUN		24V	STANDBY	RUN COMMAND	EXTERNAL	PLC ONLY
VFD-B110	YI.AM	VFD_B110_YI.AM	EI-701-B	PLC-B100	DI	PMP-B001 AUTO/MANUAL		24V	MANUAL	AUTO	EXTERNAL	PLC ONLY

VFD-B110	YI	VFD_B110_YI	EI-701-B	PLC-B100	DI	PMP-B001 RUNNING		24V	NOT RUNNING	RUNNING	EXTERNAL	
VFD-B110	YA	VFD_B110_YA	EI-701-B	PLC-B100	DI	PMP-B001 FAULT		24V	NO ALARM	ALARM	EXTERNAL	
VFD-B110	SC	VFD_B110_SC	EI-701-B	PLC-B100	AO	PMP-B001 SPEED COMMAND	4-20mA		0HZ	60HZ	EXTERNAL	PLC ONLY
CR-B113	YC	CR_B113_YC	EI-701-B	PLC-B100	DO	PUMP RUN/ VALVE OPEN		24V	STANDBY	RUN COMMAND	EXTERNAL	PLC ONLY
PT-B111	PI	PT_B111_PI	EI-701-B	PLC-B100	AI	WELL DISCHARGE PRESSURE	4-20mA		0PSI	200 PSI	LOOP	
FIT-B112	FI	FIT_B112_FI	EI-701-B	PLC-B100	AI	WELL DISCHARGE FLOW	4-20mA		0GPM	2500 GPM	120V	
FIT-B112	FQI	FIT_B112_FQI	EI-701-B	PLC-B100	DI	WELL DISCHARGE TOTAL FLOW		24V	STANDBY	MEASURE	N/A	PLC ONLY
WIT-B114	WI	WIT_B114_WI	EI-701-B	PLC-B100	AI	CHLORINE GAS WEIGHT	4-20mA		0 LBS	150 LBS	120V	
SV-B115	ZCO	SV_B115_ZCO	EI-701-B	PLC-B100	DO	DEEP WELL VALVE COMMAND OPEN		24V	STANDBY	COMMAND OPEN	120V	PLC ONLY
ZSO-B115	ZIO	ZSO_B115_ZIO	EI-701-B	PLC-B100	DI	VALVE OPENED		24V	STANDBY	OPEN	N/A	PLC ONLY

SECTION 40 67 00 - CONTROL PANELS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide control panels, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section apply to local panels provided in equipment systems specified in other sections unless indicated otherwise in those sections.

1.2 REFERENCE STANDARDS

A. ASTM A 283 Low and Intermediate Tensile Strength Carbon Steel Plates

B. UL 508A Industrial Control Panels

1.3 SUBMITTALS

A. Submittals shall be furnished in accordance with Sections 01 33 00 – Submittal Procedures and Section 40 70 00 – Instrumentation and Controls, General.

B. Shop Drawings: The Contractor shall submit shop drawings for each panel and enclosure provided under Division 40. The shop drawings shall completely define and document the construction, finish, layout, power circuits, signal and safety grounding circuits, fuses, circuit breakers, signal circuits, internally mounted instrumentation, face plate mounted instrumentation components, internal panel arrangements, and external panel arrangements. The submittal shall include the following:

1. A complete index shall appear in the front of each bound volume. Drawings and data sheets associated with a panel shall be grouped together with the panels being indexed by systems or process areas. Panel tagging and nameplate nomenclature shall be consistent with the requirements of the Contract Documents.

2. Scaled physical arrangement drawings drawn to scale that define and quantify the physical groupings comprising control panel sections, auxiliary panels, subpanels, and racks. Cutout locations with nameplate identifications shall be shown.

3. Front of panel layouts for all control panels.

4. Schematic/elementary diagrams shall depict all control devices and circuits and their functions.

5. Interconnection diagrams shall locate and identify all external connections between the control panel/control panel devices and associated equipment. These diagrams shall show interconnecting wiring by lines, designate terminal assignments, and show the physical location of all panel ingress and egress points.

6. A bill of material that enumerates all devices associated with the control panel.

PART 2 - PRODUCTS

2.1 GENERAL

A. Environmental Suitability: Indoor and outdoor control panels and instrument enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Contract Documents. Heating, cooling, and dehumidifying devices shall be provided, as indicated, in order to maintain all instrumentation devices within 20 percent of the minimums and maximums of their rated environmental operating ranges. The Contractor shall provide all power wiring for these devices. Instrumentation in hazardous areas shall be suitable for use in the particular hazardous or classified location in which it is to be installed.

B. The control panel shall be the source of power for any 120 VAC solenoid valves interconnected with the control panel. Equipment associated with the control panel shall be ready for service after connection of conductors to equipment, controls, and control panel.

C. Instrument power circuits shall be fed from the associated PLC panel.

D. Control panels shall not contain any voltages greater than 120VAC.

E. Unless indicated otherwise, control panels shall be housed in NEMA rated enclosures in accordance with Section 26 05 00 – Electrical, General. Panels shall be either freestanding, pedestal-mounted or equipment skid-mounted, as indicated. Internal control components shall be mounted on an internal back-panel or side-panel as required.

F. Each source of foreign voltage shall be isolated by providing disconnecting or pull-apart terminal blocks. Each control panel shall be provided with identified terminal strips for the connection of all external conductors. The Contractor shall provide sufficient terminal blocks to connect 25 percent additional conductors for future use.

G. Motor starters, where required, shall be in accordance with Section 26 29 00 – Motor Controllers and Section 26 29 23 – Variable-Frequency Motor Controllers. Each motor starter shall be provided with contact closures for motor overload, local indication, and remote alarm. Discrete outputs from the control panel shall be provided by electrically isolated interposing relay contacts. Analog inputs and outputs leaving the envelope of the building shall be isolated 4-20 mA, 2-wire signals with power supply. All analog inputs and outputs shall be individually fused.

H. Control panel mounted devices shall be mounted a minimum of 3 feet above finished floor elevation.

2.2 CONTROL PANELS

A. Each PLC and remote I/O system and corresponding housing, including I/O modules, power supply modules, communication interface devices, and peripheral equipment shall be mounted inside a NEMA enclosure in accordance with Section 26 05 00 – Electrical, General. I/O wiring from the field to the remote I/O system shall be terminated on terminal blocks in the lower portion of the enclosure.

B. Materials: Panels shall be made of Grade 304 stainless steel. Panel section faces shall be No. 10 gauge minimum thickness for free standing panels and No. 14 gauge minimum thickness for wall mounted or pedestal mounted panels. Materials shall be selected for levelness and smoothness.

1. Relay rack high density type panels shall utilize standard relay racks with No. 14 gauge steel frame and supports.

2. Structural shapes and strap steel shall comply with ASTM A 283 - Low and Intermediate Tensile Strength Carbon Steel Plates, Grade C.

3. Bolting Material: Commercial quality carbon steel bolts, nuts, and washers shall be 1/2-inch diameter with UNC threads. Carriage bolts shall be used for attaching end plates. All other bolts shall be hex end machine bolts. Nuts shall be hot pressed hex, American Standard, heavy. Standard wrought washers shall be used for foundation bolts and attachments to building structures. Other bolted joints shall have SAE standard lock washers.

C. Construction: Dimensions shall be in accordance with vendor's requirements. Elevations and horizontal spacing shall be subject to Engineer's approval.

D. Fabrication: End plates, top plates, and top closure panels (to hung ceiling) shall be provided when required by the material requisition. End plates, top plates, and top closure panels shall be removable with countersunk bolts to match panels. Top closure panels shall be furnished in lengths which match the widths of standard panels, except that one top closure panel may extend across two 4-foot 6-inch wide or five 2-foot wide standard panels. The vertical joints of these panels shall align with the vertical joints of the standard panels.

1. End closure or rear closure doors shall be provided where required. Such doors shall be flush fitting, gasketed, and be of the hinged lift-off type with lockable door handles. A common key shall be provided for all doors on one panel assembly. Removable access panels shall be provided with dished handle fasteners. Screw driver 1/4 turn or Dzus type fasteners are not acceptable.

2. The flanged edges of all panels shall be straight and smooth. Corners shall be welded and ground smooth.

3. The face of the panel shall be true and level after angling.

4. All panel cutouts and holes may be cut or drilled by any standard method that does not cause deformation. Burrs shall be ground smooth.

5. Adjacent panels shall assemble with races flush. Gaps or cracks shall not be visible from the front of the assembled instrument board.

6. Stiffeners shall be welded to the back of panels, as required to prevent panel deformation due to the weight of face mounted instruments.

7. Panels shall be self-supporting as defined below.

E. Framework and Supports: The rear of each panel section shall have a steel framework assembled to it for supporting conduit, wireways, switches, piping, and instrument accessory Items such as relay or terminal enclosures, transducers, pressure switches, valves, and air relays.

1. The main frame work shall be constructed of standard structural shapes. Special shapes such as "Unistrut" may be used for secondary supports. Framework must neither interfere with instrument connections nor interfere with access needed for maintenance or adjustments.

2. Steel framework shall extend 2-feet 4-inches back from the panel face or as indicated in the material requisition. Where indicated, individual adjustable leg supports shall be provided at the back of the framework so that the entire panel is self-supporting.

F. Preparation of Panel Surface: The following requirements apply to the front and rear face of the panel, both sides and the edges of all flanges, and the periphery of all holes or cutouts.

1. High spots, burrs, and rough spots shall be ground smooth.

2. The surfaces shall be sanded or sandblasted to a smooth, clean, bright finish.

3. All traces of oil shall be removed with a solvent.

4. The first coat of primer shall be applied immediately.

G. Instrument Finishing: The final coats applied to painted surface of instrument cases, doors, or bezels which are visible from the front of panels shall be manufacturer's standard unless otherwise indicated. Black Japan or "crinkle" finishes on instrument cases are not acceptable.

H. Mounting of Instruments: The panel vendor shall provide cutouts, and shall mount all instrument items indicated to be panel mounted, including any instruments indicated to be furnished by other vendors but installed in the panel.

1. The panel vendor shall also mount behind the panels other instrument accessory items as required for functionality as indicated.

2. Equipment mounted at the rear of panel shall be installed to allow for commissioning adjustments, servicing requirements, and cover removal.

3. Spare space shall be kept clear of wiring, etc., to give maximum space for future additions.

I. Panel Components:

1. Terminal Blocks.

a. Terminal blocks for power distribution and digital signals shall comply with the following requirements

1) Terminal blocks shall be UL rated for 600V, 30A minimum.

2) Terminal blocks shall have a compression-style screw clamp connection.

3) Terminal blocks shall be capable of accepting #12 AWG wire.

4) Terminal blocks directly associated with digital I/O signals shall be two-tier with pre-manufactured jumper bars for distribution of common signals.

b. Terminal blocks for analog signals shall comply with the following requirements:

1) Terminal blocks shall be UL rated for 300V, 20A minimum.

2) Terminal blocks shall have a compression-style screw clamp connection.

3) Terminal blocks shall be capable of accepting #16 AWG wire.

4) Terminal blocks shall be three-tier sensor blocks for termination of signal positive, negative, and shield with pre-manufactured jumper bars for distribution of common signals.

c. Fuse blocks shall comply with the following requirements:

1) Fuse blocks shall be UL rated for 600V, 10A minimum.

2) Fuse blocks shall incorporate a hinged lever that accepts 5x20 mm fuses.

3) Fuse blocks shall have a compression-style screw clamp connection.

4) Fuse blocks shall be capable of accepting #12 AWG wire.

5) Fuse blocks shall contain blown-fuse indication through the use of a neon lamp or an LED.

d. All terminal blocks and fuse blocks shall be designed for DIN rail mounting. Extra deep 15 mm DIN rail shall be used.

e. Contractor shall provide terminal block end sections and end stops as necessary for a complete installation.

f. Terminal blocks and fuse blocks shall be provided with pre-printed snap-on label strips. Stick-on labeling is not acceptable. Labeling shall be consistent with Contractor’s control panel drawings. Contractor shall clearly label all terminal blocks in every control panel; unlabeled terminal blocks are not acceptable.

g. Terminal blocks and fuse blocks shall be ABB, Allen-Bradley, or approved equal.

2. Instrument Power: All instruments requiring power that are wired to a PLC shall also have power supplied from the same PLC control panel. All instrument power sources shall be individually fused.

3. Signal surge suppressors. Signal surge suppressors shall be provided for all analog signals leaving the envelope of the building.

   a. Signal surge suppressors shall be Phoenix Contact TT-2-PE-24DC or equal.

4. Control Relays. Control relays shall comply with the following requirements:

   a. Relays shall be plug-in style with a DIN-rail mountable base.

   b. Relays shall have on/off indication.

   c. General purpose control relays shall have 24VDC or 120VAC coil as required for application. Relay contacts shall be rated 10 Amp at 120VAC or 125VDC. Contractor shall be responsible for quantity of contacts as required for application. New general purpose control relays shall be Allen Bradley 700-HA series or equal.

   d. Digital output interposing relays shall be terminal block style. Allen Bradley 700-HL series or equal.

5. Intrinsically Safe Barriers. Relays shall be solid-state electronic type in which the energy level of the sensing or actuation circuit is low enough to allow safe use in hazardous areas. Relays shall be located in non-hazardous areas. Relays shall be manufactured by GEMS, MTL, R.Stahl, Inc., or Turck.

6. Circuit Breakers. Circuit breakers for use in control panels shall be rated for 600V service.

   a. Control panel circuit breakers shall be DIN-rail mounted.

   b. Control panel circuit breakers shall be Allen-Bradley, Square D, or approved equal.

7. Surge Suppression. PLC control panels shall incorporate a transient-voltage surge suppressor on the incoming line. Surge suppressors shall be properly sized by the Contractor based upon the maximum current draw of the control panel.

   a. Surge suppressors shall be Innovative Technology, Leviton, or equal.

8. DC Power Supplies. PLC control panels shall be provided with a redundant DC power supply system containing two identical 24VDC power supplies and a redundancy module to regulate loading.

a. DC Power Supplies shall be redundant. A redundancy module shall be used to regulate loading.

b. Size DC power supplies based upon the actual 24V load. Power supplies shall not be loaded more than 50% of rated capacity.

c. DC power supply systems shall be Sola HD SDN Series, ABB CP Series, or equal.

9. Digital Panel Indicators. Digital indicators shall be designed for semi-flush mounting in a panel. The indicator shall be a 3 1/2 digit LED, LCD, or gas discharge type display, with digits at least 0.5 inch high. The indicator shall be easily read at a distance of 10 feet in varying control room lighting environments. Operating temperature range shall be 32°F to 140°F. Accuracy shall be ±0.1 percent. The indicator shall be scaled in engineering units, with the units engraved on the display face or on the associated nameplate. The indicator shall have a selectable decimal point and shall provide over-range indication. Digital indicators shall be manufactured by Invensys/Eurotherm/Action Instruments, Newport Electronics, Precision Digital Corporation, or Red Lion Controls.

10. Selector Switches. Selector switches shall be 30.5-mm, heavy-duty, oil-tight type with gloved-hand or wing lever operators. Position legends shall be engraved on the switch faceplate. Switches for electric circuits shall have silver butting or sliding contacts, rated 10 amperes continuous at 120 V ac. Contact configuration shall be as indicated on the Drawings or for the application. Switches used in electronic signal circuits shall have contacts suitable for that duty. Switches shall be Eaton/Cutler-Hammer "10250T", General Electric "CR104P", or Allen Bradley “800T”.

11. Indicating Lights. Indicating lights shall be 30.5-mm, heavy-duty, oil-tight type, with full voltage LED lamps. Legends shall be engraved on the lens or on a legend faceplate. Lights shall be push-to-test type. Indicating lights shall be Eaton/Cutler Hammer "10250T", General Electric "CR104P", or Allen Bradley “800T”.

12. Pushbuttons. Push buttons shall be 30.5-mm, heavy-duty, oil-tight type. Legends shall be engraved on the push-button faceplate. Contacts shall be rated 10 amperes continuous at 120 V ac. Push buttons shall be Eaton/Cutler-Hammer "10250T", General Electric "CR104P", or Allen Bradley “800T”.

13. Alarm Horns. Horns shall be high-decibel, panel-mount, vibrating type designed for heavy-duty use. Horn volume shall be field-adjustable from 78 to 103 dB at 10 feet. Horns shall operate at 120 volts ac. Horns shall be weatherproof NEMA Type 4X. Horns shall be panel front mounted and shall be supplied with gasket. Horns shall be Edwards Signals “870P Series.”Horns shall be supplied with a field mounted enclosure. Horns shall be Edwards Signals “876 series.”

J. Electrical Requirements:

1. All conduit, wireways, switches, wire, and electrical fittings for 120 volt circuits to instruments and other electrical devices as required for a complete and operable installation.

2. Conduit, wireways, junction boxes and fittings shall be provided for signal wire, thermocouple, or resistance thermometer lead wire. Conduit or wireway runs shall include those required between temperature sensors and temperature transmitters and between the thermocouple wireway or junction box and instruments.

3. Each terminal connection shall have a plastic plate with a terminal and instrument tag number. Wiring shall be identified with stamped tubular wire end markers.

4. PLC control panels shall be provided with a 15 amp, 120 volt, service outlet circuit within the back-of-panel area.

5. PLC control panels shall be provided with fluorescent light and door activated switch.

6. Wall mounted or pedestal mounted panels shall be so sized as to adequately - dissipate heat generated by equipment mounted in or on the panel.

7. Control panels mounted outside shall be provided with thermostatically controlled heaters that maintain inside temperature above 40 degrees F.

8. Wiring Methods: Wiring methods and materials for all panels shall be in accordance with the NEC requirements for General Purpose (no open wiring) unless otherwise indicated. Control Panels shall be UL508A listed Control Panels.

9. Signal and Control Circuit Wiring: Wire type and sizes: Conductor shall be flexible stranded copper machine tool wire, UL listed Type MTW, and shall be rated 600 volts. Wires, including shielded cables, shall be No. 16 AWG minimum.

    a. Wire Insulation Colors: Ungrounded control circuit conductors operating at the supply voltage shall have a black insulation. Grounded circuit conductors shall have white insulation. Insulation for ungrounded AC control circuit conductors operating at less than the supply voltage shall be red. Wires energized by a voltage source external to the control panel shall have yellow insulation. Insulation for ungrounded DC conductors shall be blue. Insulation for grounded DC conductors shall be white with blue stripe. Twisted pair wiring shall be positive(+) black and negative(-) white/clear.

    b. Wire Marking: Wire numbers shall be marked using white numbered wire markers made from plastic-coated cloth, Brady Type B 500 or equal, or shall be heat shrink plastic.

    c. Flexible conduit is not acceptable except when specifically approved by the Engineer in writing. Conduit fittings shall be Crouse Hinds cast fittings or equal.

    d. Splicing of wires will only be allowed in junction boxes. Splices shall be either soldered or pressure crimped type.

    e. For case grounding, panels shall be provided with a 1/4-inch by 1-inch copper ground bus complete with soderless connector for one No.4 AWG

bare stranded copper cable. The copper cable shall be provided by the Contractor and be connected to a system ground loop.

10. Power Supply: Unless otherwise indicated control panel primary power supplies shall be 120 volt, 60 Hz circuits. 24VDC subsystems shall be provided for PLC control panels and as indicated on the drawings.

K. Labor and Workmanship: Panels shall be fabricated, piped, and wired by fully qualified workmen who are properly trained, experienced, and supervised.

L. At a minimum, control panels shall be constructed in a UL shop and contain UL labels prior to shipment.

2.3 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Provide and install UPS(s) to power all PLC hardware furnished under this Specification.

B. The UPS shall receive a 120 VAC, 60 HZ power input, and generate a 120 VAC, 60 HZ output signal which is protected from incoming spikes, sags, noise, brownouts, and power outages.

1. The UPS shall incorporate a transformer, a battery pack, a battery charger, an inverter, and a microprocessor based controller to provide continuous, on-line, computer grade uninterruptible power. Lighting and surge protection shall meet ANSI/IEEE c62.41 categories A and B. The UPS shall be U.L. listed. Spike attenuation shall be 2000 to 1. The output neutral shall be bonded to ground. Noise isolation shall be 120 Db common-mode, 60 Db normal mode. Output voltage regulation shall be + 3% with less than 5% total harmonic distortion. UPS efficiency shall be at least 85%. The UPS shall be rated for ambient temperatures from 32 degrees F to 104 degrees F and relative humidity from 0 to 95%

2. Each UPS shall maintain power to all of its connected loads, including non-constant loads such as alarms and printers, for a minimum of 15 minutes with a 50% growth factor over the connected load. The equipment submittal shall include sizing calculations which support the model and size selected. The UPS shall be supplied with a low output voltage cutoff to prevent damage to loads when the battery power is exhausted.

C. The equipment shall include sizing calculation which support the unit selected being able to power all its connected loads for the indicated time period with a 50% growth factor.

D. The uninterruptible power supply shall be Eaton Ferrups UPS series, Liebert, IPM or equal.

2.4 SPARE PARTS AND SPECIAL TOOLS

A. Control panel spare parts selected by the Engineer and special tools shall be furnished in accordance with Section 40 70 00 – Instrumentation and Control, General.

PART 3 - EXECUTION

3.1 LISTING AND INSTALLATION

A. Control panels shall be installed in accordance with Section 40 70 00 – Instrumentation and Control, General.

B. Control Panels shall be fabricated in accordance with UL 508A, and shall be UL Listed Industrial Control Panels.

3.2 EQUIPMENT DELIVERY

A. Panels shall be crated for shipment using a heavy framework and skids. Panel sections shall be cushioned to protect the finish of the instruments and panel during shipment. Instruments which are shipped with the panel shall further have suitable shipping stops and cushioning material installed to protect parts which could be damaged due to mechanical shock. Each separate panel unit shall be provided with removable lifting lugs to facilitate handling.

B. Shipments by air ride van unless otherwise indicated. Control panel testing and inspection, if required, shall be performed prior to shipping.

3.3 CONTROL PANEL SIGNAL AND CONTROL CIRCUIT WIRING

A. Wiring Installation: Wires shall be run in plastic wireways except (1) field wiring, (2) wiring between mating blocks in adjacent sections, (3) wiring from components on a swing out panel to components on a part of the fixed structure, and (4) wiring to panel mounted components. Wiring run from components on a swing out panel to other components on a fixed panel shall be made up in tied bundles. These bundles shall be tied with nylon wire ties and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at the terminals.

B. Wiring run to control devices on the front panels shall be tied together at short intervals with nylon wire ties and be secured to the inside face of the panel using adhesive mounts.

C. Wiring to rear terminals on panel-mount instruments shall be in plastic wireways secured to horizontal brackets above or below the instruments in about the same plane as the rear of the instruments.

D. Shop Drawings shall show conformance to the above wiring installation requirements.

E. Wire Marking: Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on Shop Drawings. These numbers shall be marked on conductors at every terminal.

3.4 CALIBRATION, TESTING, AND INSTRUCTION

A. Calibration, testing, and instruction shall be performed in accordance with Section 40 79 23 – Testing, Calibration, and Commissioning.

B. Inspection and Approval: Panel fabricator shall conduct the following tests before shipment.

1. Alarm circuits rung out to determine their operability.

2. Electrical circuits checked for continuity and where applicable, operability.

3. Any other test required to place the panel in an operating condition.

C. It shall be the responsibility of the Contractor to furnish all necessary testing devices and sufficient manpower to perform the tests required by the Engineer.

D. Factory Acceptance Testing: PLC control panels shall be factory tested as required by Division 40 specifications.

E. Field Testing: Each control panel shall be tested again for functional operation in the field after the connection of external conductors and prior to equipment startup.

END OF SECTION 40 67 00

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DEVICE DESCRIPTION	LOCATION	POWER	CLASSIFICATION	DIMENSIONS	MOUNTING	RATING	P&ID	SPECIFICATION	FURNISHED BY	NEW/EXISTING/ RELOCATED
LCP-A100	WELL #2R	120V	UNCLASSIFIED	60"H X 48"W X	WALL	NEMA 1	EI-701-A	40 67 00	CONTRACTOR	NEW
LCP-B100	WELL #22R	120V	UNCLASSIFIED	60"H X 48"W X	WALL	NEMA 1	EI-701-B	40 67 00	CONTRACTOR	NEW

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SECTION 40 70 00 – INSTRUMENTATION AND CONTROL, GENERAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. General requirements applicable to all Process Control and Instrumentation Work.

2. General requirements for process control and instrumentation submittals.

3. See Section 40 70 00.2 – Instrumentation and Control, System Description for a complete description of the system.

4. Final Control Panel Drawings will be provided to the Contractor during construction.

5. As specified in this Section the Contractor shall provide the following services including, but not limited to:

   a. PLC panels and panel submittals

   b. Instrumentation required for the successful completion of the project that is not explicitly provided by others. Refer to Sections 40 67 00 A and 40 70 00 A for description of equipment which is provided by the Contractor

   c. Termination of all control wiring of instrumentation in the field and in control panels.

   d. Loop testing and documentation of all instrumentation loops.

   e. System Integrator (Contractor) shall be responsible for:

      1) HMI software and configuration

      2) PLC software and programming

      3) SCADA system programming

      4) SCADA computer(s) hardware and installation

      5) Assist electrical contractor in performing loop tests.

      6) Control system startup, documentation, and training.

6. It is the intent of these Specifications that the entire instrumentation and control system be complete and operable. Provide all necessary material and labor for the complete system from source of power to final utilization equipment, including all connections, testing, calibration of all equipment furnished by others, as well as equipment furnished by the Contractor.

B. Related sections:

1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

a. Items involving electrical, control, and instrumentation construction may be indicated on the Drawings or specified in the Specifications that do not apply specifically to electrical, control and instrumentation systems.

3. It is the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.

C. Interfaces to equipment, instruments, and other components:

1. The Drawings, Specifications, and overall design are based on preliminary information furnished by various equipment manufacturers, which identify a minimum scope of supply from the manufacturers. This information pertains to, but is not limited to, instruments, control devices, electrical equipment, packaged mechanical systems, and control equipment provided with mechanical systems.

2. Provide all material and labor needed to install the actual equipment furnished, include all costs to add any additional instruments, wiring, control system inputs/outputs, controls, interlocks, electrical hardware etc., which may be necessary to make a complete, functional installation based on the actual equipment furnished:

a. Make all changes necessary to meet the manufacturer's wiring requirements.

3. Submit all such changes and additions to the Engineer for acceptance as specified in Section 00 72 13 – General Conditions.

4. Review the complete set of Drawings and Specifications in order to ensure that all items related to the instrumentation and control systems are completely accounted for. Include any items indicated on the Drawings or in Specifications from another discipline in the scope of Work:

a. If a conflict between Drawings and Specifications is discovered, refer conflict to the Engineer as soon as possible for resolution.

D. All instrumentation, and control equipment and systems for the entire project to comply with the requirements specified in the Instrumentation and Control Specifications, whether referenced in the individual Equipment Specifications or not:

1. The requirements of the Instrumentation and Control Specifications apply to all Instrumentation and Control Work specified in other Specifications, including HVAC controls, packaged mechanical systems, LCPs, VCPs, etc.

2. Inform all vendors supplying instrumentation, control systems, panels, and/or equipment of the requirements of the Instrumentation and Control Specifications.

3. The Owner is not responsible for any additional costs due to the failure of the Contractor to notify all subcontractors and suppliers of the Instrumentation and Control Specifications' requirements.

E. Contract Documents:

1. General:

a. The Drawings and Specifications are complementary and are to be used together in order to fully describe the Work.

2. Specifications:

a. Section 00 72 13 – General Conditions and Section 00 73 00 – Supplementary Conditions of the Contract Documents govern the Work.

b. These requirements are in addition to all General Requirements.

3. Contract Drawings:

a. The Instrumentation and Control Drawings show in a diagrammatic manner, the desired locations, and arrangements of the components of the Instrumentation Work. Follow the Drawings as closely as possible, use professional judgment and coordinate with the other trades to secure the best possible installation, use the entire Drawing set for construction purposes.

b. Locations of equipment, control devices, instruments, boxes, panels, etc. are approximate only, exercise professional judgment in executing the Work to ensure the best possible installation:

1) The equipment locations and dimensions indicated on the Drawings and elevations are approximate. Use the shop drawings to determine the proper layout, foundation, and pad requirements, etc. for final installation. Coordinate with all subcontractors to ensure that all instrumentation and control equipment is compatible with other equipment and space requirements. Make changes required to accommodate differences in equipment dimensions.

2) The Contractor has the freedom to select any of the named manufacturers as identified in the individual Specifications; however, the Engineer has designed the spatial equipment layout based upon a single manufacturer and has not confirmed that every named manufacturer's equipment fits in the allotted space. It is the Contractor's responsibility to ensure that the equipment being furnished fits within the defined space.

c. Installation details:

1) The Contract Drawings include installation details showing means and methods for installing instrumentation and control equipment. For cases where typical details are not provided or compatible with an installed location, develop installation details that are necessary for completing the Work, and submit these details for review by the Engineer.

d. Schematic diagrams:

1) Schematic diagrams show control function only. Incorporate other necessary functions for proper operation and protection of the system.

2) Add slave relays, where required, to provide all necessary contacts for the control system or where needed to function as interposing relays for control voltage coordination, equipment coordination, or control system voltage drop considerations.

3) Mount all devices shown on motor controller schematic diagrams in the controller compartment enclosure, unless otherwise noted or indicated.

4) Control schematics are to be used as a guide in conjunction with the descriptive operating sequences in the Specifications. Combine all information and furnish a coordinated and fully functional control system.

F. Alternates/Alternatives:

1. Substitute item provisions as specified in Section 00 72 13 – General Conditions.

G. Changes and change orders:

1. As specified in Section 00 72 13 - General Conditions.

1.2 REFERENCES

A. See Section 40 70 00.1 – Instrumentation and Control, References and Definitions

1.3 DEFINITIONS

A. See Section 40 70 00.1 – Instrumentation and Control, References and Definitions

1.4 SYSTEM DESCRIPTION

A. See Section 40 70 00.2 – Instrumentation and Control, System Description

1.5 SUBMITTALS

A. Furnish submittals as specified in Section 01 33 00 – Submittals and this Section.

1. Furnish the submittals required by each section in the Electrical Specifications.

2. Adhere to the wiring numbering scheme specified in Section 26 05 53 – Electrical Identification throughout the Project:

a. Uniquely number each wire.

b. Wire numbers must appear on all Equipment Drawings.

3. Use equipment and instrument tags, as indicated on the Drawings, for all submittals.

B. Submittal organization as specified in Section 01 33 00 – Submittal Procedures and this Section

C. Submittal requirements as specified in Section 01 33 00 – Submittal Procedures and this Section:

1. Furnish submittals including:

a. Project Shop Drawing submittals.

b. The Process Control and SCADA Software Submittal including control system software, programming, and screens.

c. Testing, Calibration and Start-up procedures.

d. O&M Manual as specified in Section 01 78 23 – Operation and Maintenance Data.

e. Training Submittals.

f. Record Documents.

g. Testing Documents

D. Submittal preparation as specified in Section 01 33 00 – Submittal Procedures and this Section:

E. Specific submittal requirements:

1. Control panel hardware submittal in 1 package

a. Project Shop Drawing submittals.

1) Control panel hardware submittal in 1 package with complete and detailed bills of materials:

a) Including quantity, description, manufacturer, and part number for each assembly or component for each control panel.

b) Include all items within an enclosure.

2) Furnish sufficient information to evaluate the suitability of the proposed material or equipment for the intended use, and for compliance with these Specifications.

3) Use equipment and instrument tags as depicted on the P&IDs for all submittals.

4) Adhere to wiring identification scheme outlined in Specification 26 05 00 – Electrical, General throughout the Project.

5) Wire numbers must appear on all equipment drawings.

b. Requirements for physical separation between control system components and 120 VAC, 480 VAC, and medium voltage power cables.

c. UPS and battery load calculations to show that the backup capacity and time meet the specified requirements.

d. Provide a data sheet for each control system component together with a technical product brochure or bulletin.

2. O&M Manual

a. Spare parts list:

b. Control and SCADA System Software Record Documents:

1) Include electronic copies of all software and applications.

2) Navigation tree and screen shots of all SCADA screens with basic narrative.

3) Navigation tree and screen shots of all OIT screens with basic narrative

c. Instrument data sheets and cut sheets:

d. Training Submittals.

e. Record Documents.

3. Training submittals:

a. Develop and submit for review a general training plan. Include complete descriptions of all planned training classes, a preliminary training schedule, a list of all proposed instructors along with resumes, examples of proposed training manuals, and a description of any special training tools to be used (simulators, self-paced modules, personal computer-based training, etc.).

b. The Engineer will review the general training plan. Special emphasis will be placed on review of the qualifications of the proposed instructors and the timing of the individual courses to maximize their effectiveness. If, in the opinion of the Engineer, the proposed instructors are not sufficiently qualified to conduct the specified training courses, or lack experience, where required, on the specific configuration of the system, provide more qualified instructors.

4. Record documents:

a. Furnish as specified in Section 01 77 00 – Closeout Procedures.

b. Provide record documents of all Instrumentation Drawings.

c. Shop drawings:

d. Review and corrections:

1) Correct any record documents or other documents found to be incomplete, not accurate, of poor quality, or containing errors.

e. Control Panel Drawings

f. Control System Diagram:

1) Submit a complete set of control system diagrams including the following information:

a) All PLCs, workstations, printers, communication devices, and communication links:

2) All cables required for communication requirements.

5. Testing, Calibration, and Start-up Submittal:

a. General testing submittal requirements are specified in this Section and other Sections.

b. Test Procedure Submittals:

1) Submit the proposed procedures to be followed during tests of the PCIS and its components in two parts:

a) Preliminary Submittal: Outline of the specific proposed tests and examples of proposed forms and checklists.

b) Detailed Submittal: After successful review of the Preliminary Submittal, submit the proposed detailed test procedures, forms, and checklists. Include a statement of test objectives with the test procedures.

c. Provide certified and witnessed test and calibration checklists for any of the following tests:

1) Calibration, adjustment, and test details for all components and systems.

2) Factory Acceptance Tests (FAT).

3) Site Acceptance Test (SAT)

4) Operational Readiness Test (ORT).

d. Test reports:

1) As specified in Section 01 33 00 – Submittal Procedures.

1.2 QUALITY ASSURANCE

A. Manufacture instruments at facilities certified to the quality standards of ISO 9001.

B. Furnish all equipment listed by and bearing the label of UL or of an independent testing laboratory acceptable to the Engineer and the Authority Having Jurisdiction.

C. The panel provider must have their own operating UL listed panel fabrication facility. All panels must be fabricated at this facility and meet all UL 508/508A requirements.

D. System Integration:

1. The Contractor, through the use of a pre-qualified SI, is responsible for the implementation of the PCIS and the integration of the PCIS with other required instrumentation and control devices.

2. The contractor assumes full responsibility, working with the SI where applicable, to perform all work to select, furnish, install, test, calibrate, and place into operation all instrumentation, controls, telemetry equipment, control panels, and SCADA system including application software, for a complete, integrated and functional PCIS system.

3. Due to the complexities associated with the interfacing of numerous control system devices, it is the intent of these Specifications that the SI be responsible for the integration of the PCIS with existing devices and devices provided under the Contract Documents with the objective of providing a completely integrated control system.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store all equipment and materials delivered to the job site in a location that will not interfere with the construction or the Owner's operations.

B. Shipping precautions:

1. After completion of shop assembly, successful FAT, pack all equipment, cabinets, panels, and consoles in protective crates and enclose in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture.

2. Place dehumidifiers when required, inside the polyethylene coverings.

3. Skid-mount the equipment for final transport.

4. Provide lifting rings for moving without removing protective covering.

5. Display boxed weight on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.

C. Tagging:

1. Tag each component and/or instrument to identify its location, instrument tag number, and function in the system.

2. Firmly attach a permanent tag indelibly machine marked with the instrument tag number, as given in the tabulation, on each piece of equipment constituting the PCIS.

3. Tag instruments immediately upon receipt in the field.

4. Prominently display identification on the outside of the package.

5. Utilize the Tag and Loop Number identifications shown on the P&IDs.

D. Delivery and inspection:

1. Deliver products in undamaged condition, in manufacturer's original container or packaging with identifying labels intact and legible. Include date of manufacture on label.

1.4 PROJECT OR SITE CONDITIONS

A. Site conditions:

1. Provide a PCIS, including all equipment, raceways and any other components required for a complete installation that meets the environmental conditions for the Site as specified in the General Requirements and below.

1.5 SEQUENCING

A. General:

1. As specified in Section 01 31 19 – Project Meetings and 01 35 13 – Special Project Procedures.

2. Testing requirements are specified in Section 40 70 00 – Instrument Calibration, and other sections.

3. General scheduling requirements are specified in Section 01 32 16 – Construction Progress Schedule.

4. Other scheduling activities to be determined between the Owner, contractor, engineer and SI

B. Training:

1. As specified in this Section.

2. Complete all training as agreed upon with the Owner, contractor, engineer and SI.

3. Within 10 days after the completion of training, submit the following:

a. A list of all Owner personnel that attended the session.

b. A copy of the training materials utilized during the lesson with all notes, diagrams, and comments.

C. Site Acceptance Test (SAT) or Pre-commissioning test:

1. Commence after acceptance of all training, wire test, calibration tests, and loop validation tests, and all inspections have demonstrated that the PCIS complies with all Contract requirements.

2. The Programmer will assist with SAT testing for PLCs programmed by the Programmer.

3. The Programmer shall not be required to be on site, nor shall the Programmer be required to supply application software, until the loop validation tests are complete for a PLC and all prerequisites for the pre-commissioning test are completed.

4. Complete SAT test before the ORT.

D. Operational Readiness Test (ORT)

1. Complete all with the Owner, contractor, engineer and SI.

2. Confirmation by the Owner, contractor and engineer that the PCIS functions correctly and as designed.

E. Substantial completion testing: The following conditions be fulfilled before the PCIS is considered complete:

1. All submittals have been completed and approved.

2. The Owner training has been performed.

3. All required spare parts, expendable supplies, and test equipment have been delivered to the Owner.

4. The PCIS has been calibrated, loop tested and pre-commissioned.

5. The ORT has been successfully completed.

6. All debris associated with installation of instrumentation has been removed.

7. All probes, elements, sample lines, transmitters, tubing, and enclosures have been cleaned and are in like-new condition.

1.6 WARRANTY

A. Warrant the PCIS as specified in Section 00 72 00 – Standard General Conditions of the Construction Contract:

1. Provide additional warranty as specified in the individual Instrumentation and Control Specifications.

1.7 SYSTEM START-UP

A. Replace or modify equipment, software, and materials that do not achieve design requirements after installation in order to attain compliance with the design requirements:

1. Following replacement or modification, retest the system and perform additional testing to place the complete system in satisfactory operation and obtain compliance acceptance from the Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide similar items from a single manufacturer throughout the PCIS portion of the Project.

B. Allowable manufacturers are specified in individual instrument and equipment specifications in other sections of the Instrumentation and Control Specifications.

2.2 MATERIALS

A. Furnish all materials under this Contract that are new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these devices and that bear all approvals and labels as required by the Specifications.

B. Provide materials complying with the applicable industrial standard as specified in the Contract Documents.

2.3 SOURCE QUALITY CONTROL

A. Provide all equipment that is new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these products that bear all approvals and labels as required by the Specifications.

B. Arrange with all manufacturers of the equipment and fabricators of panels and cabinets, to allow the Owner and Engineer to inspect and witness the testing of the equipment at the site of fabrication:

1. Equipment includes the cabinets, special control systems, flow measuring devices, and other pertinent systems and devices.

C. Factory testing is specified in Division 26 and other sections of the Electrical, and the Instrumentation and Control Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The SI is encouraged to attend a pre-bid conference and examine the premises completely before bidding. It is the SI's responsibility to be fully familiar with the existing conditions and local requirements and regulations.

B. Review the existing Site conditions and examine all shop drawings for the various items of equipment in order to determine exact routing and final terminations for all wiring and cables.

C. Provide a complete instrumentation and control system:

1. Install all extra conduits, cables, and interfaces as may be necessary to provide a complete and operating electrical, and process control and instrumentation system.

3.2 FIELD QUALITY CONTROL

A. Inspection:

1. Allow for inspection of PCIS installation.

2. Provide any assistance necessary to support inspection activities.

3. Engineer inspections may include, but are not limited to, the following:

a. Inspect equipment and materials for physical damage.

b. Inspect installation for compliance with Drawings and Specifications.

c. Inspect installation for obstructions and adequate clearances around equipment.

d. Inspect equipment installation for proper leveling, alignment, anchorage, and assembly.

e. Inspect equipment nameplate data to verify compliance with design requirements.

f. Inspect cable terminations.

g. Inspect/witness instrument calibrations/verifications.

4. Inspection activities conducted during construction do not satisfy inspection requirements specified in Division 26.

B. Instrument Installation Inspection:

1. Provide any assistance necessary to support inspection activities.

2. Inspections may include, but are not limited to, the following:

a. Inspect equipment and materials for physical damage.

b. Inspect the installed arrangement, lay lengths, orientation, piping obstructions etc. that could affect the instruments accuracy or repeatability.

c. Inspect installation for compliance with Drawings and Specifications.

d. Inspect installation for obstructions and adequate clearances around equipment.

e. Inspect equipment installation for proper leveling, alignment, anchorage, and assembly.

f. Inspect equipment nameplate data to verify compliance with design requirements.

g. Inspect cable terminations.

h. Inspect/witness instrument calibrations/verifications.

3. Inspection activities conducted during construction do not satisfy inspection requirements specified in Division 26.

C. Field testing is specified in Division 26 and Section 01 75 16.

D. Installation supervision:

1. Ensure that the entire PCIS is installed in a proper and satisfactory manner. At a minimum, the contractor with assistance of the SI where applicable, shall provide the following services:

    a. Installation resources:

        1) Coordinate with the Contractor regarding installation requirements of the Contract Documents.

    b. Provide technical assistance to installation personnel by telephone:

        1) Furnish installation personnel with at least one copy of the approved submittals, including all installation details.

    c. Periodic inspections during the construction period.

    d. A complete check of the completed installation to ensure that it is in conformance with the requirements of the equipment manufacturer and the Contract Documents.

    e. Field-verify accuracy and calibration of all instruments.

3.3 CLEANING

A. As specified in Section 01 77 00 – Project Closeout.

3.4 PROTECTION

A. Protect all Work from damage or degradation until date of Substantial Completion.

END OF SECTION 40 70 00

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LOCATION	INSTRUMENT TAG NO.	SERVICE DESCRIPTION	P&ID	SETPOINT/RANGE	POWER	CLASSIFICATION	SPECIFICATION	SCOPE	FURNISHED BY	INSTALLED BY	NOTES
WELL HOUSE #2R	YL-A101	CHLORINE ALARM BEACON INTERIOR	EI-701-A	N/A	EXTERIOR	UNCLASSIFIED	40 76 23	NEW	CONTRACTOR	CONTRACTOR	POWERED THROUGH CONTACT ON AIT-A102
WELL HOUSE #2R	YL-A102	CHLORINE ALARM BEACON EXTERIOR	EI-701-A	N/A	EXTERIOR	UNCLASSIFIED	40 76 23	NEW	CONTRACTOR	CONTRACTOR	POWERED THROUGH CONTACT ON AIT-A102
CHLORINE ROOM #2R	AE-A102	CL2 ANALYZER SENSOR	EI-701-A	0-10PPM	LOOP	UNCLASSIFIED	40 75 21	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	AIT-A102	CL2 ANALYZER	EI-701-A	0-10PPM	120V	UNCLASSIFIED	40 75 21	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	TT-A103	WELLHOUSE TEMPERATURE	EI-701-A	32-122°F	LOOP	UNCLASSIFIED	40 74 00	NEW	CONTRACTOR	CONTRACTOR	
CHLORINE ROOM #2R	TT-A104	CHLORINE ROOM TEMPERATURE	EI-701-A	32-122°F	LOOP	UNCLASSIFIED	40 74 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	YS-A105	INTRUSION WELL HOUSE DOOR 1	EI-701-A	N/A	N/A	UNCLASSIFIED	40 70 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	YS-A106	INTRUSION WELL HOUSE DOOR 2	EI-701-A	N/A	N/A	UNCLASSIFIED	40 70 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	SV-A107	PRE-LUBE SOLENOID VALVE	EI-701-A	FC	N/A	UNCLASSIFIED	40 05 82	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	PI-A108	WELL DISCHARGE PRESSURE GAUGE	EI-701-A	0-200PSI	N/A	UNCLASSIFIED	40 73 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	LE-A109	SUBMERSIBLE LEVEL PRESSURE ELEMENT	EI-701-A	0-119FT	LOOP	UNCLASSIFIED	40 72 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	LT-A109	WELL LEVEL TRANSMITTER	EI-701-A	0-119FT	LOOP	UNCLASSIFIED	40 72 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	PT-A111	WELL DISCHARGE PRESSURE TRANSMITTER	EI-701-A	0-200PSI	LOOP	UNCLASSIFIED	40 73 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	PI-A111	WELL DISCHARGE PRESSURE GAUGE	EI-701-A	0-200PSI	N/A	UNCLASSIFIED	40 73 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	FE-A112	10" WELL DISCHARGE MAGNETIC FLOW METER	EI-701-A	0-2500GPM	LOOP	UNCLASSIFIED	40 70 13	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	FIT-A112	WELL DISCHARGE FLOW INDICATING TRANSMITTER	EI-701-A	0-2500GPM	120V	UNCLASSIFIED	40 70 13	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	SV-A113	CHLORINE INJECTION SOLENOID VALVE	EI-701-A	FC	120V	UNCLASSIFIED	40 05 82	NEW	CONTRACTOR	CONTRACTOR	
CHLORINE ROOM #2R	WE-A114	CHLORINE GAS SCALE	EI-701-A	0-150LBS	N/A	UNCLASSIFIED	46 30 00	NEW	CONTRACTOR	CONTRACTOR	
CHLORINE ROOM #2R	WIT-A114	WEIGHT INDICATING TRANSMITTER	EI-701-A	0-150LBS	120V	UNCLASSIFIED	46 30 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	SV-A115	DEEP WELL SOLENOID CONTROL VALVE	EI-701-A	FC	120V	UNCLASSIFIED	40 05 67	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #2R	ZSO-A115	DEEP WELL CONTROL VALVE OPEN LIMIT SWITCH	EI-701-A	N/A	N/A	UNCLASSIFIED	40 05 67	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	YL-B101	CHLORINE ALARM BEACON INTERIOR	EI-701-B	N/A	EXTERIOR	UNCLASSIFIED	40 76 23	NEW	CONTRACTOR	CONTRACTOR	POWERED THROUGH CONTACT ON AIT-B102
WELL HOUSE #22R	YL-B102	CHLORINE ALARM BEACON EXTERIOR	EI-701-B	N/A	EXTERIOR	UNCLASSIFIED	40 76 23	NEW	CONTRACTOR	CONTRACTOR	POWERED THROUGH CONTACT ON AIT-B102
CHLORINE ROOM #22R	AE-B102	CL2 ANALYZER SENSOR	EI-701-B	0-10PPM	LOOP	UNCLASSIFIED	40 75 21	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	AIT-B102	CL2 ANALYZER	EI-701-B	0-10PPM	120V	UNCLASSIFIED	40 75 21	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	TT-B103	WELLHOUSE TEMPERATURE	EI-701-B	32-122°F	LOOP	UNCLASSIFIED	40 74 00	NEW	CONTRACTOR	CONTRACTOR	
CHLORINE ROOM #22R	TT-B104	CHLORINE ROOM TEMPERATURE	EI-701-B	32-122°F	LOOP	UNCLASSIFIED	40 74 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	YS-B105	INTRUSION WELL HOUSE DOOR 1	EI-701-B	N/A	LOOP	UNCLASSIFIED	40 70 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	YS-B106	INTRUSION WELL HOUSE DOOR 2	EI-701-B	N/A	LOOP	UNCLASSIFIED	40 70 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	SV-B107	PRE-LUBE SOLENOID VALVE	EI-701-B	FC	120V	UNCLASSIFIED	40 05 82	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	PI-B108	WELL DISCHARGE PRESSURE GAUGE	EI-701-B	0-200PSI	N/A	UNCLASSIFIED	40 73 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	LE-B109	SUBMERSIBLE LEVEL PRESSURE ELEMENT	EI-701-B	0-140FT	LOOP	UNCLASSIFIED	40 72 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	LIT-B109	WELL LEVEL TRANSMITTER	EI-701-B	0-140FT	LOOP	UNCLASSIFIED	40 72 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	PI-B111	WELL DISCHARGE PRESSURE GAUGE	EI-701-B	0-200PSI	N/A	UNCLASSIFIED	40 73 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	PIT-B111	WELL DISCHARGE PRESSURE INDICATING TRANSMITTER	EI-701-B	0-200PSI	LOOP	UNCLASSIFIED	40 73 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	FE-B112	12"WELL DISCHARGE MAGNETIC FLOW METER	EI-701-B	0-2500GPM	LOOP	UNCLASSIFIED	40 70 13	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	FIT-B112	WELL DISCHARGE FLOW INDICATING TRANSMITTER	EI-701-B	0-2500GPM	120V	UNCLASSIFIED	40 70 13	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	SV-B113	CHLORINE INJECTION SOLENOID VALVE	EI-701-B	FC	120V	UNCLASSIFIED	40 05 82	NEW	CONTRACTOR	CONTRACTOR	
CHLORINE ROOM #22R	WE-B114	CHLORINE GAS SCALE	EI-701-B	0-150LBS	N/A	UNCLASSIFIED	46 30 00	NEW	CONTRACTOR	CONTRACTOR	
CHLORINE ROOM #22R	WIT-B114	WEIGHT INDICATING TRANSMITTER	EI-701-B	0-150LBS	120V	UNCLASSIFIED	46 30 00	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	SV-B115	DEEP WELL SOLENOID CONTROL VALVE	EI-701-B	FC	120V	UNCLASSIFIED	40 05 67	NEW	CONTRACTOR	CONTRACTOR	
WELL HOUSE #22R	ZSO-B115	DEEP WELL CONTROL VALVE OPEN LIMIT SWITCH	EI-701-B	N/A	N/A	UNCLASSIFIED	40 05 67	NEW	CONTRACTOR	CONTRACTOR	

SECTION 40 70 00.1 – INSTRUMENTATION AND CONTROL, REFERENCES AND DEFINITIONS

1.1 REFERENCES

A. Code compliance:

1. The following codes and standards are hereby incorporated into this Section:

a. American National Standards Institute (ANSI).

b. International Organization for Standardization (ISO):

1) 9001 - Quality Management Systems - Requirements.

c. International Society of Automation (ISA):

1) 5.1 - Instrumentation Symbols and Identification.

2) 5.4 - Instrument Loop Diagrams.

3) 20 - Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves.

d. National Electrical Manufacturers Association (NEMA):

1) 250 - Enclosures for Electrical Equipment (1000 V Maximum).

e. National Fire Protection Association (NFPA).

f. National Institute of Standards and Technology (NIST).

g. Underwriters Laboratories, Inc. (UL):

1) 508 - Standard of Safety for Industrial Control Equipment.

2) 508A - Standard of Safety for Industrial Control Panels.

B. Compliance with Laws and Regulations:

1. As specified in Section C-700 – General Conditions.

1.2 DEFINITIONS

A. Definitions of terms and other electrical and instrumentation considerations in accordance with:

1. Factory Mutual (FM).

2. International Electrotechnical Commission (IEC).

3. Institute of Electrical and Electronics Engineers (IEEE).

4. International Society of Automation (ISA).

5. International Organization for Standardization (ISO).

6. National Electrical Code (NEC).

7. National Electrical Manufacturers Association (NEMA).

8. InterNational Electrical Testing Association (NETA).

9. National Fire Protection Association (NFPA).

10. National Institute of Standards and Technology (NIST).

11. Underwriters Laboratories (UL).

B. Specific definitions:

1. Control circuit: Any circuit operating at 120 volts alternating current (VAC) or direct current (VDC) or less, whose principal purpose is the conveyance of information (including performing logic) and not the conveyance of energy for the operation of an electrically powered device.

2. Panel: An instrument support system that may be a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems. Unless otherwise specified or clearly indicated by the context, the term "panel" in these Contract Documents is interpreted as a general term, which includes flat surfaces, enclosures, cabinets and consoles.

3. Power circuit: Any circuit operating at 90 volts (AC or DC) or more, whose principal purpose is the conveyance of energy for the operation of an electrically powered device.

4. Signal circuit: Any circuit operating at less than 50 VAC or VDC, which conveys analog information or digital communications information.

5. Digital bus: A communication network, such as PROFIBUS, Foundation Fieldbus, or DeviceNet, allowing instruments and devices to transmit data, control functions and diagnostic information.

6. 2-Wire transmitter (loop powered): A transmitter that derives its operating power supply from the signal transmission circuit and requires no separate power supply connections. As used in this Section, two-wire transmitter refers to a transmitter that provides 4 to 20 milliamperes current regulation of a signal in a series circuit with an external 24 VDC driving potential.

7. Powered transmitters: A transmitter that requires a separate power source (120 VAC, 240 VAC, etc.) in order for the transmitter to develop its signal. As used in this Section, the produced signal may be a 4 to 20 milliampere current signal, a digital bus communications signal or both.

8. System supplier - As specified in SI Qualifications in the Quality Assurance article of this Section.

9. Modifications: Changing, extending, interfacing to, removing or altering an existing circuit.

C. NEMA:

1. Type 1 enclosure in accordance with NEMA 250.

2. Type 2 enclosure in accordance with NEMA 250.

3. Type 3 enclosure in accordance with NEMA 250.

4. Type 3R enclosure in accordance with NEMA 250.

5. Type 3S enclosure in accordance with NEMA 250.

6. Type 3X enclosure in accordance with NEMA 250.

7. Type 3RX enclosure in accordance with NEMA 250.

8. Type 3SX enclosure in accordance with NEMA 250.

9. Type 4 enclosure in accordance with NEMA 250.

10. Type 4X enclosure in accordance with NEMA 250.

11. Type 5 enclosure in accordance with NEMA 250.

12. Type 6 enclosure in accordance with NEMA 250.

13. Type 6P enclosure in accordance with NEMA 250.

14. Type 12 enclosure in accordance with NEMA 250.

15. Type 12K enclosure in accordance with NEMA 250.

16. Type 13 enclosure in accordance with NEMA 250.

D. Acronym definitions:

1. CCS: The SCADA central computer system (CCS) consisting of personal computers and software. The personal computer-based hardware and software system that includes the operator interface, data storage, data retrieval, archiving, alarming, historian, reports, trending, and other higher level control system software and functions.

2. DPDT: Double-pole, double-throw.

3. ES: Enterprise system: Computer based communications or data sharing system utilized for non-process control functions such as E-mail, sharing files, creating documents, etc.

4. FAT: Factory acceptance test.

5. HART: Highway addressable remote transducer.

6. HOA: Hand-Off-Auto control function that is totally PLC based. In the Hand mode, equipment is started or stopped, valves are opened or closed through operator direction under the control of the PLC software. In the Auto mode, equipment is started or stopped and valves are opened or closed through a control algorithm within the PLC software. In the Off mode, the equipment is prohibited from responding from the PLC control.

7. HMI: Human machine interface: PLC based operator interface device consisting of an alphanumeric or graphic display with operator input functionality. The HMI is typically a flat panel type of display mounted on the front of a PLC enclosure with either a touch screen or tactile button interface.

8. IJB: Instrument junction boxes: A panel designed with cord sets to easily remove, replace or relocate instrument signals.

9. I/O: Input/Output.

10. IP: Internet protocol or ingress protection.

11. LCP: Local control panel: Operator interface panel that may contain an HMI, pilot type control devices, operator interface devices, control relays, etc. and does not contain a PLC or RIO.

12. LAN: Local area network: A control or communications network that is limited to the physical boundaries of the facility.

13. LOR: Local-Off-Remote control function. In the Remote mode, equipment is started or stopped, and valves are opened or closed through the PLC based upon the selection of the HOA. In the Local mode, equipment is started or stopped, valves are opened or closed based upon hardwired control circuits completely independent of the PLC with minimum interlocks and permissive conditions. In the Off mode, the equipment is prohibited from responding to any control commands.

14. NJB: Network junction box. An enclosure that contains multiple access points to various networks within the facility. Networks could be Ethernet, Ethernet/IP, Fieldbus, RIO etc.

15. OIT: Operator interface terminal: PC-based interface device used for operator interface with the SCADA system.

16. P&ID: Process and instrumentation diagram.

17. PC: Personal computer.

18. PCIS: Process control and instrumentation system: Includes the entire instrumentation system, the entire control system, and all of the Work specified in the Instrumentation and Control Specifications and depicted on the Instrumentation Drawings.

19. PCM: Process control module: An enclosure containing any of the following devices: PLC, RTU, or RIO.

20. PJB: Power junction box: An enclosure with terminal blocks that distribute power to multiple instruments.

21. PLC: Programmable logic controller.

22. RIO: Remote I/O device for the PLC consisting of remote I/O racks, or remote I/O blocks.

23. RTU: Remote telemetry unit: A controller typically consisting of a PLC, and a means for remote communications. The remote communications devices typically are radios, modems, etc.

24. SCADA: Supervisory control and data acquisition system: A general name for the computerized system that gathers and processes data from sensors and applies operational controls to the process equipment. It includes the PLCs and/or RTUs, HMI PLC-based operator interface units, related interconnecting communications systems, and the CCS operator interface and data management system.

25. SI: System Integrator: Subcontractor who specializes in the design, construction, fabrication, software development, installation, testing, and commissioning of industrial instrumentation and control systems.

26. SPDT: Single-pole, double-throw.

27. SPST: Single-pole, single-throw.

28. UPS: Uninterruptible power supply.

29. VCP: Vendor control panel: Control panels that are furnished with particular equipment by a vendor other than the SI. These panels may contain PLCs, RIO, OIT, HMI, etc.

30. WAN: Wide area network: A control or communications network that extends beyond the physical boundaries of the facility.

END OF SECTION 40 70 00.1

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SECTION 40 70 00.2 – INSTRUMENTATION AND CONTROL, SYSTEM DESCRIPTION

1.1 SYSTEM DESCRIPTION

A. Scope of work.

1. SCADA Hardware/Software Upgrades. Provide primary SCADA server and new thin clients. Upgrade existing software to most current version.

2. PCIS PLCs – To be Provided by the Contractor.

   a. PLC-A100. Well #2R.

   b. PLC-B100. Well #22R.

3. Instrumentation. Contractor to provide and install control system instrumentation as described in the drawings and specifications. Refer to 40 70 00 A – Device List for complete list of instrumentation

4. Control Panels. Contractor to provide control panels as described in the drawings and specifications. Refer to 40 67 00 – Control Panels.

5. Control Panel design drawings will be provided by the Engineer to the Contractor near the beginning of Construction after instrumentation submittals have been finalized.

6. Contractor to provide conduit and cable for associated instrumentation and control as described in the drawings and specifications. Refer to cable schedules in drawings

7. Contractor Programming/Startup/Commissioning/Training. Provide complete system installation, programming, commissioning, and training as described in these drawings and specifications and as necessary to provide a complete and functional instrumentation and control system.

B. Control system installation and startup constraints:

1. Every effort shall be made to minimize downtime and maintain SCADA access to existing PLC hardware during construction and startup.

2. All PCIS and network outages shall be scheduled and pre-approved by the Engineer. The Contractor shall submit a PCIS and network cutover plan to the Engineer for approval.

3. The new SCADA server shall be fully and completely tested as specified prior to installation, cut-over, and commissioning. The existing SCADA server shall remain in service through the duration of construction until the new SCADA server is prepared and ready to be put online.

4. The new serial radio network shall be fully installed, terminated, tested per specifications, and approved by the Engineer.

C. General requirements:

1. The Work includes everything necessary for and incidental to executing and completing the Instrumentation and Control System Work indicated on the Drawings and specified in the Specifications and reasonably inferable there from including but not limited to:

a. Preparing hardware submittals for field instrumentation.

b. Design, develop, and draft control panel designs and all other drawing submittals specified in the Instrumentation and Control Specifications.

c. Prepare the test plan, the training plan, and the spare parts submittals.

d. Provide all SCADA system hardware and software as indicated in documentation.

e. Fabricate panels.

f. Perform factory tests on panels.

g. Perform bench calibration and verify calibration after installation.

h. Oversee and certify installation of the PCIS.

i. Oversee, document, and certify loop testing.

j. Oversee, document, and certify system pre-commissioning.

k. Conduct the performance tests.

l. Prepare operation and maintenance manuals.

m. Conduct training classes.

n. Integrate the PCIS with instrumentation and control devices provided under other sections.

o. Prepare Record Drawings.

1) Develop all Record Drawings associated with instruments and equipment provided under the scope of this contract.

2) Contract Documents and all Owner furnished and any existing equipment the system is interfacing.

p. Resolve signal, power, or functional incompatibilities between the PCIS and interfacing devices.

q. Perform all required corrective and preventative maintenance.

2. Coordinate all aspects of the Work between Contractor and all subcontractors before bidding to ensure that all costs associated with a complete installation are included. The Owner is not responsible for any change orders due to lack of coordination of the Work between the Contractor, the SI, the other subcontractors or suppliers.

3. Furnish detailed, complete, and thorough operations and maintenance documentation, including but not limited to operations manuals, maintenance manuals, as-built wiring drawings, training manuals, as-built software documentation, and all other documentation required to operate, modify, and maintain all parts of the PCIS.

4. Portions of this Project involve installation in existing facilities and interfaces to existing circuits, power systems, controls, and equipment. Perform and document detailed field investigations of existing conditions (circuits, power systems, controls, equipment, etc) before performing any Work.

5. Defective Work:

a. As specified in Section C-700 – General Conditions.

D. Operating facility:

1. Portions of this existing facility must remain fully functional throughout the entire construction period. In consideration of this requirement, comply with the following guidelines:

a. All outages must be of minimal duration and fully coordinated and agreed to by the Owner. Adjust the construction to meet the requirements of the Owner.

b. As weather and facility demand conditions dictate, re-adjust the construction schedule to meet the demands placed upon Owner by its users.

2. The Contractor is responsible for the integrity and measurement accuracy of all loops. However, any defect found in existing equipment is the responsibility of the Owner.

3. The standards of documentation, instrument tagging, cable and conductor termination, terminal identification and labeling that apply to the new installation apply equally to the existing installation effected by this work.

END OF SECTION 40 70 00.2

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SECTION 40 70 13 - IN-LINE LIQUID FLOW MEASURING SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide in-line liquid flow measuring systems, complete and operable, in accordance with the Contract Documents. The transmitter portion of the system shall be remotely mounted as shown on Contract Drawings.

1.2 REFERENCE STANDARDS

A. Commercial Standards:

1.	ISA – S 5.1	Instrumentation Symbols and Identification
2.	ANSI – B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
3.	ANSI/AWWA C207	Steel Pipe Flanges for Waterworks Service – Sized 4-inch through 144-inch
4.	ANSI/AWWA C700	Cold Water Meters
5.	ASME Report	Fluid Meters, Sixth Edition, 1971

1.3 SUBMITTALS

A. Shop Drawings: At a minimum, the following information shall be submitted with each meter supplied:

1. Data sheets and catalog literature for the flow meter and the microprocessor-based signal converter.
2. Connection diagrams for equipment wiring.
3. Materials of construction and connection fittings.
4. Recommended spare parts list.

B. Test Data: Signed, dated, and certified calibration data for each flow metering system which requires factory testing, submitted before shipment of equipment.

C. Certifications: The Contractor shall provide Manufacturer's certification of proper installation and certification of satisfactory field testing.

D. Owner’s Manual: Submit Owner’s manual as specified in Special Provisions, to include operation and maintenance data and other information for the equipment.

1.4 QUALITY ASSURANCE

A. Each flow metering system shall be hydraulically calibrated at a facility which is traceable to the National Institute of Standards and Technologies. The calibration procedure shall conform to the requirements of ANSI/NCSL Z 540-1 Calibration. A real-time computer-generated printout of the actual calibration data shall be submitted to the Engineer at least 30 days prior to shipment to the site.

B. Accuracy Requirements: Unless otherwise indicated, flow meters shall be guaranteed to register flow to an accuracy of plus and minus 0.3% of actual flow throughout the range indicated.

C. Guarantees, Warranties: After completion the Contractor shall furnish to the Owner the manufacturer's written guarantee that the metering system swill operate within the published accuracies and flow ranges and meet these specifications. The Contractor shall also furnish the manufacturer's warranties as published in its literature.

PART 2 - PRODUCTS

2.1 GENERAL

A. All meters shall be capable of operating at an minimum ambient temperature ranging from -4 to 140 degrees F.

B. All meters shall be rated for NFPA hazardous areas, see Drawings for further information.

C. The Contractor shall be responsible for confirming necessary cable length with meter manufacturer prior to ordering any meter equipment.

2.2 ELECTROMAGNETIC (MAG) FLOW METERS

A. The electromagnetic flowmeter shall consist of a flow sensor based on Faraday's Law of Electromagnetic Induction, the flow of liquid through the sensor induces an electrical voltage that is proportional to the velocity of the flow.

B. Electromagnetic flowmeter systems shall be the low frequency electromagnetic induction type which produces a DC pulsed signal directly proportional to and linear with the liquid flow rate. Complete zero stability shall be an inherent characteristic of the flowmeter system. Each magnetic flow metering system shall include a metering tube, signal cable, transmitter, and flowmeter grounding rings.

C. Meter Tube: The tube shall be constructed of 304 or 316 stainless steel tube with ductile iron flanged or Carbon Steel connections and include a minimum of two (2) self-cleaning electrodes. The electrodes shall be constructed of materials conforming to the manufacturer's recommendation for the intended service. The meter housing shall be IP67 or IP68, rated for a submergence depth of 3 meters for a duration of 48 hours. Grounding rings shall conform to the manufacturer's bore and material recommendation for the intended service. Grounding rings shall be designed to protect and shield the liner's edge interface from abrasion at the meter end.

D. Performance Requirements: The flow metering system shall conform to the following:

No.	Item	Units	Value
1	Time Constant	Secs	0.5 – 1,000
2	Accuracy	%	0.5 of Full Flow
3	Repeatability	%	0.25 full scale
4	Power Consumption	watts	30 or less
5	Power Requirements	VAC	120

E. Transmitter: The microprocessor-based signal converter/transmitter shall be remote mounted outdoors on disconnect support structure and shall have the following:

1. Transmitter shall be suitable for installation outdoors, subject to direct sunlight and full temperature range at installed location. Transmitter housing to be NEMA 4X, with min. IP65 ingress protection. Provide with sun shield and/or other accessories as recommended by manufacturer.

2. DC pulse technique to drive flux-producing coils and capability to convert DC pulse signal from the tube to a standardized flow VDC pulse contact and a 4-20 mA DC signal into a minimum of 700 ohms.

3. Six digit LCD displays for flow rate, percent of span, and totalization. An operator interface with keypad which responds to English text entry.

4. Integral low flow cutoff and zero return to produce a consistent zero output signal in response to an external dry contact closure.

5. Automatic range change and capability to measure flow in both directions.

6. Programmable parameters including meter size, full scale Q, magnetic field frequency, primary constant, time constant.

7. Data retention for minimum of five (5) years without auxiliary power (main or battery).

8. Self diagnostics and automatic data checking.

9. Protected terminals and fuses in a separate compartment which isolates field connection from electronics.

10. Flow Meter shall be on IDWR’s approved list of flow meters.

F. Schedule: Provide the magnetic meters listed in following table.

Size (in)	Velocity Range (fps)	Pipe Type / Dia (in)	P&ID	Service
10	0-30	DI, flanged/10	EI-701-A	Well #2R
12	0-30	DI, flanged/12	EI-701-B	Well#22R

G. Manufacturer:

1. Siemens Sitrans Mag 5100W w/ Mag5000 Transmitter

2. Any other manufacturer shall be approved by the Engineer/Owner prior to bid opening

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall assemble and install all equipment specified herein, in strict accordance with the manufacturer's published instructions, under the supervision of the manufacturer's representative, under the general review of the Engineer. All installations shall be accomplished by competent craftsmen in a workmanlike manner.

B. Final acceptance of the equipment is contingent on satisfactory operation after installation.

3.2 INSTALLATION

A. The meters shall be installed in easily accessible locations for ease of reading and maintenance, and where shown, for balancing of flow in several lines, in conjunction with throttling and shut-off valves. Where possible, all meters shall be installed in such a way to provide the manufacturer's recommended straight approach and straight piping downstream. All meters, shut-off and balancing valves shall be firmly supported from the structure or from the floor with approved supports. In-line meters shall be installed to provide full-line flow and not less than the manufacturer's recommended head at all items.

B. Wiring between flow sensors and remote mounted signal converters shall use cable type and procedures as per the manufacturer's recommendations. Provide sufficient cable from meter vault to location where local display will be located. Confirm cable lengths prior to submitting shop drawings.

3.3 TESTING

A. Equipment shall be prepared for operational use in accordance with manufacturer's instructions, including bench test and calibration, where required.

B. Each item shall be subjected to an operating test over the total range of capability of the equipment. Where applicable, tests shall be conducted in accordance with the Test Code of the Standards of the Hydraulic Institute. The Contractor shall notify the Engineer one week in advance of all tests to be conducted on site.

3.4 CLEANUP

A. After completion and testing of its work, the Contractor shall remove all debris from the site, clean all meters, controls, cabinets, and other metering appurtenances, to hand over each system in perfect operating condition.

END OF SECTION 40 70 13

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SECTION 40 72 00 - LEVEL MEASURING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide level sensing equipment, complete and operable, in accordance with the Contract Documents.

1.2 SUBMITTALS

A. Furnish submittals in accordance with Section 40 70 00 – Instrumentation and Controls, General.

1.3 QUALITY ASSURANCE

A. Calibration: All level sensing equipment shall be shipped to the project site factory calibrated and accompanied with certificate of such.

B. Warranty: All sensors shall be provided with manufacturer's standard one-year product warranty.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE PRESSURE SENSOR

A. The level transmitter shall be of the submersible type with no moving parts. The transmitter will be 316 S.S or titanium.

B. Contractor shall be responsible for ordering the correct length of level transmitter cable to ensure termination can properly be made.

C. Transmitter electronics shall be a 2 wire 4-20ma output device with built in noise immunity, thermal compensation and transient protection. The transmitter shall be protected from reverse polarity connection, under current and over current. Transmitter shall be powered by a 9-24 VDC regulated supply.

D. Support cable shall be a 4 wire with integral breather tube and a Polyurethane cable jacket.

E. All wetted materials must comply with applicable AWWA standards and be certified by an accredited ANSI certification body to meet ANSI/NSF Standard 53,58, or 61.

F. Desiccant Vent Filters shall be provided to prevent moisture from entering the vent tube for at least one year without maintenance.

G. The level sensor shall be mounted in such a way that the cabling is clean and secure.

H. Wiring between level transmitter and PLC shall use cable type and procedures as per the manufacture's recommendations.

I. Level transmitter power shall be supplied by a fused terminal in the PLC cabinet.

J. Level transmitter shall be NSF-61 approved.

K. The submersible level transmitter shall be as manufactured by Endress Hauser model FMX21with an outer diameter of 0.87 inches or approved equal.

1.

END OF SECTION 40 72 00

SECTION 40 73 00 - PRESSURE MEASURING AND DETECTION SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide pressure measuring systems, complete and operable, in accordance with the Contract Documents.

1.2 SUBMITTALS

A. Shop Drawings and Technical Manual, shall be submitted in conformance with the requirements of Section 01 33 00 – Submittal Procedures and Section 40 70 00 – Instrumentation and Controls, General.

1.3 SUBMITTALS

A. Warranty: All pressure measuring and detection systems shall be provided with manufacturer's standard one-year warranty.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pressure gauges shall be provided on suction and discharge connections to pumps; discharge connections from blowers and compressors; each side of pressure reducing valves; and where shown on the Contract Drawings. Vacuum gauges shall be provided for vacuum pumps and where shown on the Contract Drawings. In all locations (such as certain pump suction connections) where pressures may vary below and above atmospheric head, compound gauges shall be installed.

2.2 PRESSURE AND VACUUM GAUGES

A. Gauges shall be industrial quality type with Type 304 or 316 stainless steel movement and stainless steel or alloy case. Unless otherwise shown or specified, gauges shall have a 4½-inch dial, ¼-inch threaded connection, a Type 304 or 316 stainless steel snubber adapter, and shut-off valve. Gauges shall be calibrated to read in applicable units, with an accuracy of ± 1 percent, to 150 percent of the working pressure or vacuum of the pipe or vessel to which they are connected. Gauges for pumps shall read in feet of water and all gauges for air piping shall read in psi. All gauges shall be vibration and shock resistant.

B. Approved manufacturer

1. Ashcroft

    1) 1259 (0 to 200 psi)

2. WIKA

1) 232.34

C. Schedule: Refer to Device Schedule 40 70 00 A.

2.3 DIFFERENTIAL AND GAUGE PRESSURE TRANSMITTERS

A. Electronic differential transmitters shall consist of a capsule assembly, bottom works, vent plug, drain plug, cover flange, process connector and connection, amplifier unit, integral indicator, terminal box with cover, block and bleed valves, and conduit connections. Pressure applied to the unit shall be transmitted by a sealed fill fluid to both sides of a sensing diaphragm. The sensing diaphragm and the sensor body shall function as the moving and fixed electrodes, respectively, of a differential capacitor. As the applied pressure causes the diaphragm to move, the capacitance of the cell shall change.

B. Performance Requirements: The amplifier unit shall convert the change in capacitance to a 4 - 20 mA DC signal, 2 wire type, with an allowable loop load of no less than 600 ohms. Static pressure rating shall be a minimum of 500 psig. The maximum overrange pressure limit shall be a minimum of 150 percent of the range. Span shall be adjustable over a minimum of 5:1 range. External adjustments shall include zero and span. Output signal damping shall be provided as an internal adjustment.

1. Equipment shall be suitable for an ambient operating range of minus 40 degree F to plus 212 degrees F.

2. The integral indicator shall be calibrated in process units.

3. Power supply shall be 24 VDC, powered by the signal (loop powered).

4. Accuracy, including linearity and repeatability, shall be a plus or minus 0.2 percent of span.

5. Differential pressure transmitters used for flow service shall include square root extraction to produce an output signal linearly proportional to flow.

C. Wetted parts, including block and bleed valve parts, shall be constructed of Type 316 stainless steel.

D. Schedule: Refer to Device Schedule 40 70 00 A.

E. Approved manufacturers, or equal, as approved by Engineer

1. With local indicator and controller:

a. Schneider Electric (Foxboro)

a) IGP10

2.4 SCHEDULE

A. The Contractor shall provide pressure and vacuum gauges as indicated in 2.1.A and pressure transmitters and switches as indicated in the Instrumentation Schedule included as Appendix A to Section 40 70 00 – Instrumentation and Controls, General.

PART 3 - EXECUTION

A. Pressure measuring systems shall be handled, installed, calibrated, loop-tested, pre-commissioned, and performance tested.

END OF SECTION 40 73 00

SECTION 40 74 00 - TEMPERATURE MEASURING SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General: The Contractor shall provide temperature-measuring systems, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 70 00 – Instrumentation and Control, General apply to this Section.

1.2 SUBMITTALS

A. The Contractor shall submit manufacturer's information for Engineer review in accordance with Section 01 33 00 – Submittal Procedures and Section 40 70 00 – Instrumentation and Control, General requirements.

1.3 QUALITY ASSURANCE

A. Warranty: All temperature measuring systems shall be provided with manufacturer's standard one-year product warranty.

PART 2 - PRODUCTS

2.1 TEMPERATURE MEASURING SYSTEMS

A. Temperature transmitters shall be 2 wire devices with continuously adjustable span and zero adjustments, integral direct reading indicator, solid state circuitry, and a 4 - 20 mA DC output linearly proportional to the indicated temperature span.

B. Resistance temperature for room detection shall be Veris TWLA01 Series wall temperature sensor or equal.

C. Refer to Appendix A of Section 40 70 00 – Instrumentation and Control, General for the complete instrument schedule.

PART 3 - EXECUTION

3.1 GENERAL

A. Temperature measuring systems shall be executed according to Section 40 70 00 – Instrumentation and Control, General

END OF SECTION – 40 74 00

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SECTION 40 79 23 – TESTING, CALIBRATION, AND COMMISSIONING

PART 1 - GENERAL

1.1 GENERAL PROCEDURES FOR INSPECTION, TEST, AND INSTRUMENT CALIBRATION

A. Each instrument shall be checked against the latest version of the design documents for tagging, manufacturer, model number, range, action, etc., before functional testing or calibration.

B. Any air system, permanent or temporary, used for energizing instrumentation shall be dry and clean at all times, and be blown down thoroughly before use. Any connection between the air supply system shall be via proper filter and regulator.

C. Plastic sealing plugs shall be used for all pneumatic connections and tubing except during test and immediately before final connection in the field.

D. Care shall be observed when connecting electric power supplies to the instrumentation. Insure correct voltage and frequency on AC power supplies. Insure correct voltage, polarity, and superimposed ripple on DC power supplies. Insure correct polarity of the supply and proper grounding before connecting instruments.

E. The Instrumentation and Control Systems Contractor shall satisfy the requirement that the installation, calibration, and checkout of the instruments meet the requirements of the project specifications.

F. The Calibration procedures for verifying instrument precision should conform to accepted practices as outlined in ASTM, ASHRAE, ISA, etc. specifications.

G. The Instrumentation and Control Systems Contractor shall provide copies of manufacturer’s installation and calibration instructions to the calibration technicians prior to the commencement of calibration.

1.2 INSTRUMENT QUALITY LEVELS AND METEROLOGY

A. Instrumentation supplied for the calibrating sensing instruments for facility control system shall include documentation concerning the calibration method and traceability to the National Institute for Standards and Testing (NIST).

B. Process instrumentation shall be field checked for accuracy before installation even if the instruments have been calibrated by the manufacturer’s metrology facilities.

PART 2 - PRODUCTS

2.1 CALIBRATION AND TEST EQUIPMENT

A. All calibration and test equipment shall be in proper working order and calibrated using traceable standards and equipment set by the NIST. Certificates of traceability shall be kept on file in the field calibration office or field project office. Copies of the traceability documents shall be included with the submittal of the calibration forms.

B. All calibration and test equipment shall carry a documented current calibration sticker reflecting the date of the last calibration and the name or initials of the technician who performed the calibration. A current calibration will be performed before the equipment is shipped to the site. The calibration equipment shall be shipped directly from the calibrating authority to the site, in packaging provided by the calibrating authority. A current calibration will be performed for all calibration or test equipment every 180 days or within the normal calibration interval, whichever is less.

C. Any field instruments calibrated with test equipment whose calibration has expired will be rejected and will be required to be recalibrated.

D. All Calibration and test equipment shall be of a higher accuracy than the instrument being calibrated. The manufacturer's recommendations for calibration accuracy will prevail in all instances.

E. The Control Systems Contractor shall supply calibration and test equipment of sufficient quantity, quality, and type to calibrate the instruments and sensors used in the installation.

2.2 BENCH TEST AND CALIBRATION FORMS AND METHODOLOGY

A. Calibration forms and calibration procedures for each instrument type shall be generated by the Instrumentation and Control Systems Contractor and approved by the Owner or his representative before proceeding with any calibrations. The manufacturer's procedures or the Owner's existing procedures shall form the basis for the calibration procedure.

B. The following format shall be used for instrument calibration form:

1. A separate calibration form shall be generated for similar types of instruments that have different accuracy and tolerance requirements.

2. The form shall contain as found and as calibrated data areas. The form shall contain areas for the calibrating and test instruments manufacture, serial number, and date of calibration.

3. The forms shall be filled out and signed in black ink.

4. Those instruments that can shall be calibrated on the bench under controlled conditions. Care shall be taken with those instruments that must be calibrated in the field to approximate the conditions of the bench test.

PART 3 - EXECUTION

3.1 GENERAL

A. The Control Systems Contractor shall calibrate all instrumentation in an environment suitable to quality testing procedures. High accuracy comparative instruments or mechanisms shall be the standard against which instrument calibration is tested.

B. Verify that all process and test instruments have been calibrated and traceable to the NIST or other appropriate reference standards. Verify that a calibration sticker has been affixed to the instrument and that each instrument is within its calibration period at the time that the calibration is performed.

C. Each instrument shall be calibrated as per Owner approved calibration procedures and forms.

D. Each instrument shall have a calibration sheet completely filled out with all pertinent data related to the calibration and system. These calibration sheets shall be organized in a binder by system and turned over to the Owner at the completion of the project.

E. Instruments shall have a calibration sticker placed on the instrument. The sticker shall not be placed until the instrument has successfully completed the calibration procedure and the associated calibration form has been filled out and signed. The sticker shall bear the date of calibration and expiration and initials of the technician certifying calibration.

END OF SECTION 40 79 23

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SECTION 43 05 01 - EQUIPMENT GENERAL PROVISIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The provisions of this Section apply to all sections of Divisions 41 to 43 and Division 46 unless specifically revised therein.

B. Furnish each piece of equipment complete with its base, drives, shafting, couplings, controls, guards, and other appurtenances which are specified or are required for proper and safe operation.

C. Furnish any special tools or equipment required for proper operation maintenance, testing, or adjusting.

1.2 REFERENCE STANDARDS

A. Codes: All codes, as referenced herein, are specified in Section 01 42 19 – Reference Standards.

B. Equipment shall be in accordance with the following standards, as applicable and as indicated in each equipment specification:

1.	AFBMA	Anti-Friction Bearing Manufacturers Association, Inc.
2.	ASTM	American Society for Testing and Materials
3.	ANSI	American National Standards Institute
4.	ASME	American Society of Mechanical Engineers
5.	AWWA	American Water Works Association
6.	ASHREA	American Society of Heating, Refrigerating, and Air Conditioning Engineers
7.	AWS	American Welding Society
8.	NFPA	National Fire Protection Association
9.	NEMA	National Electrical Manufacturers Association
10.	OSHA	General Industry Safety Orders

C. The following standards are referenced in this and other Divisions 41 to 43 and Division 46:

1.	ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800

2.	ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy and other Special Alloys
3.	ANSI B46.1	Surface Texture
4.	ANSI S12.6	Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors
5.	ASME B1.20.1	General Purpose Pipe Threads (Inch)
6.	ASME B31.1	Power Piping
7.	AWWA C206	Field Welding of Steel Water Pipe
8.	AWWA C207	Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144-inches (100 mm through 3,600 mm)
9.	AWWA D100	Welded Steel Tanks for Water Storage
10.	ASTM A48	Gray Iron Castings
11.	ASTM A108	Steel Bars, Carbon, Cold-Finished, Standard Quality
12.	ASME B17.1	Keys and Keyseats
13.	ASME B106.1M	Design of Transmission Shafting

1.3 SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 00 – Submittal Procedures and the specific equipment specifications sections.

B. Shop Drawings: Furnish complete drawings and technical information for equipment, piping, valves, electrical and controls. Where indicated or required by the Engineer, Shop Drawings shall include clear, concise calculations showing equipment anchorage forces and the capacities of the anchorage elements proposed by the Contractor.

C. Spare Parts List: The Contractor shall obtain from the manufacturer and submit at the same time as Shop Drawings a list of suggested spare parts for each piece of equipment. Contractor shall also furnish the name, address, and telephone number of the nearest distributor for each piece of equipment.

D. Operation and Maintenance Manual: Provide technical operation and maintenance manuals in accordance with Section 01 78 23 – Operation and Maintenance Data.

1.4 ADAPTATION OF EQUIPMENT

A. The Contractor shall furnish equipment readily adaptable for installation and operation. Equipment furnished shall be compatible with all other equipment furnished under the Contract.

B. The Contractor shall assume full responsibility for all modifications of mechanical and electrical controls, equipment, wiring, piping, as required to accomplish function intended by the Contract Documents.

1.5 QUALITY ASSURANCE

A. Guarantees: Unless otherwise accepted herein, guarantee all equipment and its install required. Guarantees shall cover the following: (1) Faulty or inadequate design; (2) Improper assembly or erection; (3) Leakage, breakage, or other failure; and (4) Defective workmanship or materials.

B. Inspection, Start-up and Field Adjustment: The Contractor shall demonstrate that all equipment meets the specified performance requirements. Contractor shall provide the services of an experienced, competent, and authorized service representative of the manufacturer of each item of major equipment who shall visit the site of Work to perform the following tasks:

1. Assist the Contractor in the installation of the equipment.

2. To inspect, check, adjust if necessary and approve the equipment installation.

3. To start-up and field-test the equipment for proper operation, efficiency, and capacity.

4. To perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the Engineer.

5. To instruct the Owner's personnel in the operation and maintenance of the equipment. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment.

C. Quality and Tolerances: Tolerances and clearances shall be as shown on the Shop Drawings and shall be closely adhered to.

D. Machine Finish: The type of finish shall be the most suitable for the application and shall be shown in micro-inches in accordance with ANSI B46.1

E. Manufacturer's Experience: Equipment manufacturer shall have a record of at least 5 years of successful, trouble free operation in similar applications and size equal or larger than the equipment in this contract.

PART 2 - PRODUCTS

2.1 GENERAL

A. Protection of Equipment: Equipment shall be boxed, crated, or otherwise protected from damages and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities prior to installation. For extended storage period, plastic equipment wrappers shall be avoided to prevent accumulation of condensate in gears and bearings. In addition, motor space heaters shall be energized, and shafts shall be rotated. Equipment delivered to the Site with rust or corroded parts shall be rejected. If equipment develops defects during storage, it shall be disassembled, cleaned and recoated to restore it to original condition.

B. Identification Equipment Items: At the time of shipping, each item of equipment shall have a legible identifying mark corresponding to the equipment number in the Contract Documents for the particular item.

C. Protective Coating: Equipment shall be painted or coated in accordance with Section 09 90 00 – Painting and Coating, unless otherwise indicated. Non-ferrous metal and corrosive-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly and shipping.

D. Controls: Equipment and system controls shall be in accordance with Division 26 and Division 40.

E. All flanges on equipment and appurtenances provided under this Section shall conform to ANSI B16.1, Class 125; or B16.5, Class 150, unless otherwise shown. All pipe threads shall be in accordance with ANSI/ASME B1.20.1, and with requirements of Section 40 05 00– Piping, General.

F. Nameplates: Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins. Nameplates shall contain the manufacturer’s name, model, serial number, size, characteristics, and appropriate date describing the machine performance ratings.

G. Tools: The Contractor shall furnish one complete set of special wrenches and other special tools necessary for the assembly, adjustment, and dismantling of the equipment. Tools shall be of best quality hardened steel forgoing with bright finish. Wrench heads shall have work faces dressed to fit nuts. Tools shall be suitable for professional work and manufactured by Snap On, Crescent, Stanley, or equal. The set of tools shall be neatly mounted in a labeled toolbox of suitable design provided with a hinged cover.

H. Lubricants: The Contractor shall install lubricants for all equipment during storage and prior to initial testing of the equipment. After successful initial testing, final testing, and satisfactory completion startup testing as specified in Section 01 75 16 – Startup Procedures, the Contractor shall conduct one complete lubricant change on all equipment. In addition, the Contractor shall be responsible for the proper disposal of all used lubricants. The Owner will then be responsible for subsequent lubricant changes.

2.2 EQUIPMENT SUPPORTS

A. All pipe connections to equipment shall be supported, anchored and guided to avoid stresses and load on equipment flanges and equipment. Supports and hangers shall be in accordance with the requirements of Section 43 05 50 - Equipment Mounting.

2.3 NOISE REQUIREMENTS

A. Noise Level: When in operation, no single piece of equipment shall exceed the OSHA noise level requirement of 105 dBA for one-hour exposure per day.

B. High Noise Level Location: The Contractor shall provide two personal hearing protection stations at the Blower Room.

C. Personal Hearing Protection: In each hearing protection station, the Contractor shall furnish three pairs of high attenuation hearing protectors in the original unopened packaging. The ear protectors shall be capable of meeting the requirements of ANSI S12.6 and shall produce a noise level reduction of 25 dBA at a frequency of 500 Hz. The hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband. The protectors shall be stored in a weatherproof, labeled, steel cabinet, provided at an approved location near the noise producing equipment.

2.4 VIBRATION LIMITATIONS

A. Vibration frequencies shall span the range from 5.0 to 5,000 Hz. Where specified, measurements shall be obtained while the installed equipment is operating within the specified speed range.

B. Centrifugal Machines with Sleeve Bearings: Unless otherwise specified, centrifugal machines with sleeve bearing shafts shall not exhibit unfiltered RMS readings for vibration displacement in excess of the following:

Shaft speed range range, rpm	Displacement peak to peak, mils
Up to 900	3.5
901-1800	3.0
1801-3000	2.5
3001-4500	2.0
Above 4500	1.6

Displacement measurements shall be taken radially on the shaft at two points at each bearing. Measuring points shall be 90 degrees apart.

C. Centrifugal Machines with Antifriction Bearings: Unless otherwise specified, centrifugal machines with antifriction bearing shafts shall not exhibit unfiltered RMS readings for vibration velocity in excess of 0.12 inch per second. Velocity measurements shall be taken on one point of each bearing housing.

D. Positive Displacement Machines: Unless otherwise specified, positive displacement machines of the rotary, reciprocating and controlled volume types shall operate without any lateral or torsional vibration characteristics that may accelerate wear of the equipment. The Contractor shall provide manufacturer's certification that the manufacturer has inspected the machine under operating conditions and found it to comply with the manufacturer’s requirements.

E. Vibration Isolators: Air compressors, blowers, engines, inline fans shall be provided with restrained spring-type vibration isolators or pads per manufacturer's written recommendations. Vibration isolations shall be provided with seismic restraint.

2.5 CRITICAL SPEED REQUIREMENTS

A. Unless otherwise specified, rotating mechanical equipment shall not exhibit critical speeds within the specified range of operating speeds and impeller blade pass frequencies. Critical speeds for equipment with rigid rotor systems shall be at least 20 percent greater than maximum operating speed and maximum impeller blade pass frequency, whichever is greater. Critical speeds for equipment with flexible shaft-rotor systems shall be at least 15 percent below minimum operating speed and 20 percent above maximum operating speed and blade pass frequency.

2.6 DRIVE TRAINS AND SERVICE FACTORS

A. Drive Trains and Service Factors: Service factors shall be applied in the selection or design of mechanical power transmission components. All components of drive train assemblies between the prime mover and the driven equipment shall be designed and rated to deliver the maximum peak or starting torque, speed, and horsepower. All of the applicable service factors shall be considered, such as mechanical (type of prime mover), load class, start frequency, ventilation, ambient temperature, and fan factors. Drive train components include couplings, shafts, gears, and gear drives, drive chains, sprockets, and V-belt drives. Unless otherwise indicated, the following load classification shall apply in determining service factors:

Type of Equipment	Service Factor	Load Classification
Centrifugal Fans	1.0	Uniform
Pumps		
Centrifugal or Rotary	1.0	Uniform
Reciprocating	1.8	Moderate Shock
Cranes or Hoists	1.25	Moderate Shock

B. Mechanical Service Factors

	Mechanical Service Factors
Uniform	1.25
Moderate Shock	1.50
Heavy Shock	2.0

C. For thermal rating adjustments such as start frequency, ambient temperature, and hourly duty cycle factor, ventilation factor, and fan factor, refer to gear manufacturer sizing information.

D. For service factors of electric motor, see Section 40 05 93 – Common Motor Requirements for process Equipment

Where load classifications are not indicated, service factors based on AGMA 514.02 shall be used for standard load classification and for flexible couplings.

2.7 SHAFTING

A. Shafting shall be continuous between bearings and shall be sized to transmit the power required. Keyways shall be accurately cut in line. Shafting shall not be turned down at the ends to accommodate bearings or sprockets whose bore is less than the diameter of the shaft. Shafts shall rotate in the end bearings and shall be turned and polished, straight, and true.

B. Design Criteria: All shafts shall be designed to carry the steady state and transient loads suitable for unlimited number of load applications, in accordance with ASME B 106.1 M - Design of Transmission Shafting. Where shafts are subjected to fatigue stresses, such as frequent start and stop cycles, the mean stress shall be determined by using the modified Goodman Diagram. The maximum torsional stress shall not exceed the endurance limit of the shaft after application of the factor of safety of 2 in the endurance limit and the stress concentration factor of the fillets in the shaft and keyway. Stress concentration factor shall be in accordance with ASME Standard B17.1 - Keys and KeySeats.

C. Materials: Shafting materials shall be appropriate for the type of service and torque transmitted. Environmental elements such as corrosive gases, moisture, and fluids shall be taken into consideration. Materials shall be as indicated unless furnished as part of an equipment assembly.

1. Low carbon cold-rolled steel shafting shall conform to ASTM A 108, Grade 1018.

2. Medium carbon cold-rolled shafting shall conform to ASTM A 108, Grade 1045.

3. Other grades of carbon steel alloys shall be suitable for service and load.

4. Corrosion-resistant shafting shall be stainless steel or Monel, whichever is most suitable for the intended service.

D. Differential Settlement: Where differential settlement between the driver and the driven equipment may occur, a shaft of sufficient length with sets of universal type couplings shall be provided.

2.8 BEARINGS

A. Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA).

B. To assure satisfactory bearing application, fitting practice, mounting, lubrication, sealing, static rating, housing strength, and lubrication shall be considered in bearing selection.

C. All re-lubricatable type bearings shall be equipped with an hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

D. All lubricated-for-life bearings shall be factory-lubricated with the manufacturer's recommended grease to insure maximum bearing life and best performance.

E. Anti-Friction Type Bearing Life: Except where otherwise indicated, bearings shall have a minimum 10 life expectancy of 10 years or 20,000 hours, whichever occurs first. Where so indicated, bearings shall have a minimum rated L-10 life expectancy corresponding to the type of service, as follows:

Type of service	Design Life, years	L-10 Design Life, hours
	(Whichever comes first)	
8-hour shift	10	20,000
16-hour shift	10	40,000
Continuous	10	60,000

F. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as indicated or as recommended in the published standards of the manufacturer. Split-type housings may be used to facilitate installation, inspection, and disassembly.

G. Sleeve Type Bearings: Sleeve-type bearings shall have a steel, cast iron or ductile iron housing and Babbitt or bronze liner. Bearing housing shall be bolted and doweled to the lower casing half. These housings shall be provided with cast iron caps bolted in place and the bearing end caps shall be bored to receive the bearing shells. Sleeve bearings shall be designed on the basis of the maximum allowable load permitted by the bearing manufacturer. If the sleeve bearing is connected to an equipment shaft with a coupling, the coupling transmitted thrust will be assumed to be the maximum motor or equipment thrust. Lubricant, lubrication system, and cooling system shall be as recommended by the bearing manufacturer.

H. Plate Thrust Bearings: Thrust bearings shall be the Kingsbury Type, designed and manufactured to maintain the shaft in the fixed axial position without undue heating or the necessity of adjustment or attention. Bearings shall be oil lubricated to suit the manufacturer's standard method of lubrication for the specific bearing. If bearing cooling is required, manufacturer shall provide necessary piping, filters, and valves.

2.9 ELECTRIC MOTORS

A. All motors shall comply with requirements listed in Section 40 05 93 – Common Motor Requirements for Process Equipment. All variable frequency drive (VFD) controlled motors shall comply with NEMA MG-1 Design “B” requirements.

2.10 SPARE PARTS

A. Spare parts, where specified, shall be provided in clearly labeled boxes. Labels shall display “City of ~~Lewiston~~Pocatello" a major piece of equipment to which the part belongs, the part name, and the manufacturer's part number.

PART 3 - EXECUTION

3.1 PROTECTION

A. Box, crate, or otherwise completely enclose and protect all equipment during shipment, handling, and off-site storage. Responsibility for storage on the job site will be assigned to the installing Contractor.

B. Protect equipment from exposure to elements and keep all items thoroughly dry at all times. Protect against impact, abrasion, discoloration and other damage. Protect electrical equipment, controls and insulation against moisture, freezing, or water damage.

3.2 INSTALLATION

A. Equipment shall be installed in accordance with the manufacturers written recommendations. The Contractor shall select or recommend the size and type of coupling required to suit each specific application; installation shall be per equipment manufacturer's printed recommendations. All insulating connections shall be installed in accordance with the manufacturer's printed instructions.

B. Alignment: Equipment shall be field tested to verify proper alignment.

3.3 SERVICES OF MANUFACTURER

A. Inspection, Startup, and Field Adjustment: Where required by individual sections, an authorized, experienced, and competent service representative of the manufacturer shall visit the Site for the number of days indicated in those sections to witness or perform the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.

1. Installation of equipment

2. Inspection, checking, and adjusting the equipment and approving its installation

3. Startup and field testing for proper operation, efficiency, and capacity

4. Performing field adjustments during the test period to ensure that the equipment installation and operation comply with requirements

B. Instruction of the Owner's Personnel: Where required by the individual equipment sections, an authorized training representative of the manufacturer shall visit the Site for the number of days indicated in those sections to instruct the Owner's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction shall be specific to the models of equipment provided.

1. The representative shall have at least two years' experience in training. A resume of the representative shall be submitted.

2. Training shall be scheduled three weeks in advance of the scheduled session.

3. Proposed training material and a detailed outline of each lesson shall be submitted for review. Review comments from the Engineer shall be incorporated into the material.

4. The training materials shall remain with the trainees after the session. The Contractor shall videotape the training for later use by the Owner's personnel.

3.4 PACKAGED EQUIPMENT

A. When any system is furnished as pre-packaged equipment, the Contractor shall coordinate all necessary space and structural requirements, clearances, utility connections, signals, and outputs with subcontractors to avoid later change orders.

B. If the packaged system has any additional features (as safety interlocks, etc.) other than required by the Contract Documents, the Contractor shall coordinate such features with the Engineer and provide all material and labor necessary for a complete installation as required by the manufacturer.

3.5 FIELD TESTS

A. Where indicated by the individual equipment sections, equipment shall be field tested after installation to demonstrate satisfactory operation without excessive noise, vibration, or no overheating of bearings or motor.

B. The following field testing shall be conducted:

1. Start, check, and operate the equipment over its entire operating range. Vibration level shall be within the amplitude limits as indicated or as recommended by the reference applicable Standards.

2. Obtain, record and provide to Engineer concurrent readings of motor voltage, amperage, capacity, vibration, and bearing temperatures for each piece of major equipment.

C. The Engineer shall witness field testing. The Contractor shall notify the Engineer of the test schedule seven days in advance.

D. In the event that any equipment fails to meet the test requirements, the equipment shall be modified and resettled until it satisfies the requirement.

END OF SECTION 43 05 01

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SECTION 43 05 50 - EQUIPMENT MOUNTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section specifies mounts, supports, and the anchorage for equipment, tanks, piping and accessories.

1.2 REFERENCE STANDARDS

A. Federal Specifications

1.	MIL-A-907E	Antiseize Thread Compound, High Temperature

B. Commercial Standards

1.	ASTM A 48	Gray Iron Castings
2.	ASTM A 193	Alloy Steel and Stainless Steel Building Materials for High Temperature Service
3.	ASTM A 194	Carbon and Allow Steel Nuts for Bolts for High Pressure and High Temperature Service
4.	ASTM A 307	Carbon Steel Bolts and Studs, 600,000 psi Tensile Strength
5.	ASTM A 325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

1.3 SUBMITTALS

A. Calculations and shop drawings shall be submitted for all of the work required above in accordance with Section 01 33 00 – Submittal Procedures. Anchor bolt and expansion bolt submittals shall be in accordance with requirements specified herein. All calculations must be made and signed by a civil or structural engineer currently registered in the State of Idaho.

B. Inasmuch as some anchorage or equipment mounting is to be made to poured-in-place concrete elements, it is imperative that these types of anchorage be coordinated with the concrete subcontractor so that anchorage may be installed at time of pouring. If calculations and anchorage details are not submitted prior to pouring of concrete, the Contractor shall become responsible for any strengthening of concrete elements because of superimposed seismic loading.

1.4 QUALITY ASSURANCE

A. Support, anchorage and mounting of all tanks, piping and equipment shall be designed and provided by Contractor according to manufacturer's recommendation, 2018 International

Building Code and industry standards requirements, unless otherwise specified. All elements required to resist the calculated forces described herein or required by the equipment manufacturer shall be provided by the Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

A. Equipment mountings shall be as shown. All equipment located in floor slabs shall be mounted on concrete pads. Where a steel or cast base is shown or specified between the equipment and the concrete pedestal, it shall be hot-dip galvanized after fabrication.

B. For belt driven equipment shown as in-line and piggyback, the base shall be, rectangular and the motor shall always be behind and above the driven equipment and never over the driven equipment unless approved by the Engineer. Motor mounting hardware for any belt driven configuration shall allow for belt tension adjustment.

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. Steel Bases: Structural steel bases shall be rectangular in shape for all equipment other than centrifugal refrigeration machines and pump bases, which may be "T" or "L" 1 shaped where shown. Pump bases for split case pump shall include supports for suction and discharge base ells. All perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimension of the base. Beam depth need not exceed 14 inches provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Grout holes shall be provided for the bases of all equipment where vibration isolation is not specified. Where vibration isolation is required, height saving brackets shall be employed in all mounting locations to provide a base clearance of 1 inch.

2.3 CONNECTIONS

A. All pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment. Supports and hangers shall be in accordance with the requirements of Section 40 05 07 – Hangers and Supports for Process Piping.

B. Flanges and Pipe Threads: All flanges on equipment and appurtenances provided under this Section shall conform to ANSI B16.1, Class 125; or B16.5, Class 150, unless otherwise shown. All pipe threads shall be in accordance with ANSI/ASME B1.20.1, and with requirements of Section 40 05 00 – Piping, General.

C. Unless otherwise indicated, equipment supports, anchors, and restrainers shall be adequately designed for static, dynamic, wind, and seismic loads. The design horizontal seismic force shall be the greater of: that noted in the general structural notes or as required by the governing building code, or 10 percent of gravity. Submitted design calculations for equipment supports shall bear the signature and seal of an engineer registered in the state wherein the project is to be built, unless otherwise indicted.

D. Equipment Foundations: Mechanical equipment, tanks, control cabinets, enclosures, and related equipment shall be mounted on minimum 4-inch high concrete bases unless otherwise indicated. Equipment foundations are indicated on Drawings. The Contractor through the equipment manufacturer shall verify the size and weight of equipment foundation to insure compatibility with equipment.

E. Couplings: Mechanical couplings shall be provided between the driver and the driven equipment. Flexible couplings shall be provided between the driver the driven equipment to accommodate sight angular misalignment, parallel misalignment, end float, and to cushion shock loads.

1. Unless otherwise indicated or recommended by the equipment manufacturer, coupling type shall be furnished with the respective equipment as follows:

Equipment Type	Coupling Type
Horizontal and end suction pumps	Gear or flexible spring
Vertical nonclog pumps, closed coupled	Flexible disk pack
Single stage centrifugal blowers	Flexible disk pack
Air compressors	Gear or flexible pack

2. Each coupling size shall be determined based on the rated horsepower of the motor, speed of the shaft, and the load classification service factor. The Contractor shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

3. Taper-Lock or equal bushing may be used to provide for easy installation and removal of shafts of various diameters.

2.4 ANCHOR BOLTS

A. The CONTRCTOR shall be responsible in providing anchor bolts for all owner–furnished and other equipment supplied to this project. For all bolts, nuts, and washers requirements see Section 05 50 00 – Metal Fabrications.

B. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 25 percent, up to a limiting maximum oversizing of 1/4 inch. Minimum anchor bolt diameter shall be 1/2 inch. Anchor bolts shall be furnished with leveling nuts, the faces of which shall be tightened against flat surfaces as shown to not less than 10 percent of the bolt's safe tensile stress.

C. Tapered washers shall be provided where mating surface is not square with the nut.

D. Adhesive anchors shall comply with requirements listed in Section 05 50 00 - Metal Fabrications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Each piece of equipment shall be anchored to resist a minimum lateral force required by the code, the manufacturer of the equipment or a lateral seismic force of 40 percent of the operating weight of the equipment, whichever is greater. This force shall be considered acting at the center of gravity of the piece under consideration. No equipment shall be anchored to vertical structural elements without written approval of the Engineer.

B. Equipment which is not vibration isolated shall be anchored directly to the, supporting floor system. In addition to the anchorage, all such equipment shall be internally designed so that all static and moving parts are anchored to the supporting framework to resist the imposed seismic force. All forces must be transmitted to the base in order to be anchored as required. Vibration isolated equipment shall be specially designed to meet these same requirements.

C. Equipment, tanks, piping supports, and anchorage located outside the building shall be designed to comply with 2018 International Building Code requirements.

D. All piping, raceways, accessories, and appurtenances, furnished with equipment shall be anchored to resist a lateral seismic force of 40 percent of its operating weight without excessive deflection. This force shall be considered acting at the center of gravity of the piece under consideration.

END OF SECTION 43 05 50

SECTION 43 05 60 – PROCESS EQUIPMENT TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Testing of mechanical equipment and systems.

B. Related Sections:

1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

3. The following sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.

a. Section 01 75 16 – Startup Procedures

b. Section 40 05 93 – Process Equipment

c. Section 26 08 00 – Field Electrical Acceptance Tests

d. Section 31 23 33 – Trenching and Backfilling

e. Section 40 05 00 – Piping, General

f. Section 40 79 23 – Testing, Calibration, and Commissioning

1.2 REFERENCES

A. American National Standards Institute (ANSI):

1. S1.4 Specification for Sound Level Meters.

B. Hydraulic Institute (HI).

1.3 SUBMITTALS

A. Schedule of factory tests and field tests as specified in Section 01 75 16 – Startup Procedures and this Section.

B. Test instrumentation calibration data.

C. Start-up plan as specified in Section 01 75 16 – Startup Procedures.

D. Test plan specified in this Section.

E. Test result reports.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 QUALITY CONTROL TESTING AND REPORTING

A. Scheduling and notification:

1. Witnessed source quality control tests: Schedule test date and notify Engineer at least 30 days prior to start of test.

2. Field quality control tests: Schedule test date and notify Engineer at least 7 days prior to start of test.

B. Testing levels:

1. Test equipment based on test levels specified in the equipment section of this Project.

2. Requirements for Test Levels 1 to 4 are defined below.

3. Test levels apply for both Source (Factory) Quality Control Tests and Field Quality Control Tests as specified in the equipment sections of this Project.

4. If testing is not specified in the equipment section, provide Level 1 testing.

5. Requirements of Section 01 75 16 – Startup Procedures apply to Test Levels.

C. Witnessing: Source Quality Control Tests not witnessed unless specified otherwise in the equipment section or Section 01 75 16 – Startup Procedures; Field Quality Control Tests shall be witnessed.

D. Instrumentation: Provide necessary test instrumentation which has been calibrated within 1 year from date of test to recognized test standards traceable to the National Institute of Standards and Technology, Washington, D.C. or approved source. Properly calibrated field instrumentation permanently installed as a part of the Work may be utilized for Field Quality Control Tests.

E. Temporary facilities and labor: Provide necessary fluids, utilities, temporary piping, temporary supports, temporary access platforms or access means and other temporary facilities and labor necessary to safely operate the equipment and accomplish the specified testing. With Owner's permission, some utilities may be provided by fully tested permanently installed utilities that are part of the Work.

F. Test fluids:

1. Factory tests: Use water or air as appropriate at ambient conditions unless specified otherwise in the equipment section.

2. Field tests: Use specified process fluid at available conditions.

G. Pressure testing: Hydrostatically pressure test pressure containing parts in the factory at the appropriate standard or code required level above the equipment component specified design pressure or operating pressure, whichever is higher. Submit pressure test reports before shipping.

H. Test measurement and result accuracy:

1. Use test instruments with accuracies as recommended in the appropriate referenced standards. When no accuracy is recommended in the referenced standard, use 1 percent or better accuracy test instruments. Improved (lower error tolerance) accuracies specified elsewhere prevail over this general requirement.

2. Do not adjust results of tests for instrumentation accuracy. Measured values and values directly calculated from measured values shall be the basis for comparing actual equipment performance to specified requirements.

I. Field testing:

1. Submit test plan as specified in Section 01 75 16 – Startup Procedures and this Section. Indicate test start time and duration, equipment to be tested, other equipment involved or required; temporary facilities required, number and skill or trade of personnel involved; safety issues and planned safety contingencies; anticipated effect on Owner's existing equipment and other information relevant to the test. Provide locations of all instruments to be used for testing. Provide calibration records for all instrumentation.

2. Perform general start-up and testing procedures as specified in Section 01 75 16 – Startup Procedures.

3. Prior to testing, verify equipment protective devices and safety devices have been installed, calibrated, and tested.

J. Reports: Submit reports for source and field-testing. Submit Source Quality Control Test result reports before shipping equipment to the field. Report features:

1. Report results in a bound document in generally accepted engineering format with title page, written summary of results compared to specified requirements, and appropriate curves or plots of significant variables in English units.

2. Include appendix with a copy of raw, unmodified test data sheets indicating test value, date and time of reading, and initials of person taking the data.

3. Include appendix with sample calculations for adjustments to raw test data and for calculated results.

4. Include appendix with the make, model, and last calibration date of instrumentation used for test measurements.

5. Include in body of report a drawing or sketch of the test system layout showing location and orientation of the test instruments relative to the tested equipment features.

3.2 EQUIPMENT TESTING, GENERAL

A. Tests for pumps, all levels of testing:

1. Test in accordance with applicable HI Standards in addition to the requirements in this and other sections.

2. Test tolerances: In accordance with appropriate HI Standards, except the following modified tolerances apply:

a. From 0 to plus 5 percent of head at the specified flows [rated design point flow].

b. From 0 to plus 5 percent of flow at the rated design point head.

c. No negative tolerance for the efficiency at the specified flows [rated design point].

d. No positive tolerance for vibration limits. Vibration limits and test methods in HI Standards do not apply, use limits and methods specified in this or other sections of the Specifications.

B. Tests for drivers: Test motors as specified in Section 40 05 93 – Process Equipment. Test other drivers as specified in the driver equipment section.

3.3 REQUIREMENTS FOR VIBRATION TESTING

A. Definitions:

1. Peak-to-peak displacement: The root mean squared average of the peak-to-peak displacement multiplied by the square root of 2.

2. Peak velocity: The root mean squared average of the peak velocity multiplied by the square root of 2.

3. Peak acceleration: The root mean squared average of the peak acceleration multiplied by the square root of 2.

4. High frequency enveloping: A process to extract very low amplitude time domain signals associated with impact or impulse events such as bearing or gear tooth defects and display them in a frequency spectrum of acceleration versus frequency.

a. Manufacturers: One of the following or equal:

1) Rockwell Automation, Entek Group, "Spike Energy" analysis.

2) CSI, "PeakVue."

5. Low speed equipment: Equipment or components of equipment rotating at less than 600 revolutions per minute.

6. High speed equipment: Equipment and equipment components operating at or above 600 revolutions per minute.

B. Vibration instrumentation requirements:

1. Analyzers: Use digital type analyzers or data collectors with anti-aliasing filter, 12 bit A/D converter, fast fourier transform circuitry, phase measurement capability, time wave form data storage, high frequency enveloping capabilities, 35 frequency ranges from 21 to 1,500,000 cycles per minute, adjustable fast fourier transform resolution from 400 to 6,400 lines, storage for up to one hundred 3,200 line frequency spectra, RS232C data output port, circuitry for integration of acceleration data to velocity or double integration to displacement.

   a. Manufacturers: One of the following or equal:

      1) Entek-IRD, Division of Rockwell Automation, Enpac 1200 with applicable data analysis software or Entek Model 838 analyzer with built in printer.

      2) Computational Systems Inc., (CSI) Division of Emerson Electric, Model 2120A, Data Collector/analyzer with applicable analysis software.

2. Analyzer settings:

   a. Units: English, inches/second, mils, and gravitational forces.

   b. Fast fourier transform lines: Most equipment 1,600 minimum; for motors, enough lines as required to distinguish motor current frequencies from rotational frequencies, use 3,200 lines for motors with a nominal speed of 3,600 revolutions per minute; 3,200 lines minimum for High Frequency Enveloping; 1,600 lines minimum for low speed equipment.

   c. Sample averages: 4 minimum

   d. Maximum frequency (Fmax): 40 times rotational frequency for rolling element bearings, 10 times rotational frequency for sleeve bearings.

   e. Amplitude range: Auto select but full scale not more than twice the acceptance criteria or the highest peak, whichever is lower.

   f. Fast fourier transform windowing: Hanning Window.

   g. High pass filter: Minus 3 dB at 120 cycles per minute for high speed equipment. Minus 3 dB at 21 cycles per minute for low speed equipment.

3. Accelerometers:

   a. For low speed equipment: Low frequency, shear mode accelerometer, 500 millivolts per gravitational force sensitivity, 10 gravitational force range, plus/minus 5 percent frequency response from 0.5 hertz to 850 hertz, magnetic mount.

1) Manufacturers: One of the following or equal:

a) Wilcoxon Research, Model 797L.

b) PCB, Model 393C.

b. For high speed equipment: General purpose accelerometer, 100 millivolts per gravitational force sensitivity, 50 gravitational force range, plus/minus 3dB frequency response range from 2 hertz to 12,000 hertz when stud mounted, with magnetic mount holder.

1) Manufacturers: One of the following or equal:

a) Wilcoxon Research, Model 793.

b) Entek-IRD Model 943.

C. Accelerometer mounting:

1. Use magnetic mounting or stud mounting.

2. Mount on bearing housing in location with best available direct path to bearing and shaft vibration.

3. Remove paint and mount transducer on flat metal surface or epoxy mount for High Frequency Enveloping measurements.

D. Vibration testing results presentation:

1. Provide equipment drawing with location and orientation of measurement points indicated.

2. For each vibration measurement take and include appropriate data on equipment operating conditions at the time vibration data is taken; for pumps, compressors, and blowers record suction pressure, discharge pressure, and flow.

3. When Vibration Spectra Data required:

a. Plot peak vibration velocity versus frequency in cycles per minute.

b. Label plots showing actual shaft or part rotation frequency, bearing inner and outer race ball pass frequencies, gear mesh frequencies and relevant equipment excitation frequencies on the plot; label probable cause of vibration peaks whether in excess of specification limits or not.

c. Label plots with equipment identification and operating conditions such as tag number, capacity, pressure, driver horsepower, and point of vibration measurement.

d. Plot motor spectra on a log amplitude scale versus frequency.

4. For low speed equipment, plot peak vibration displacement versus frequency as well as velocity versus frequency.

5. Provide name of manufacturer and model number of the vibration instrumentation used, including analyzer and accelerometer used together with mounting type.

3.4 TESTING LEVELS

A. Level 1 Quality Control Tests:

1. Level 1 General Equipment Performance Test:

a. For equipment, operate, rotate, or otherwise functionally test for 15 minutes minimum after components reach normal operating temperatures.

b. Operate at rated design load conditions.

c. Confirm that equipment is properly assembled, equipment moves or rotates in the proper direction, shafting, drive elements and bearings are installed and lubricated in accordance with proper tolerances, and that no unusual power consumption, lubrication temperatures, bearing temperatures, or other conditions are observed.

2. Level 1 Pump Performance Test:

a. Measure flow and head while operating at or near the rated condition; for factory testing, testing may be at reduced speeds with flow and head corresponding to the rated condition when adjusted for speed using the appropriate affinity laws.

b. Use of a test driver is permitted for factory tests when actual driver is given a separate test at its point of manufacture as specified in Section 26 08 00 – Field Electrical Acceptance Tests or the applicable equipment section. Use actual driver for field tests.

c. Record measured flow, suction pressure, discharge pressure, and make observations on bearing temperatures and noise levels.

3. Level 1 Vibration Test:

a. Test requirement:

1) Measure filtered vibration spectra versus frequency in 3 perpendicular planes at each normally accessible bearing housing on the driven equipment, any gears and on the driver; 1 plane of measurement to be parallel to the axis of rotation of the component.

2) Vibration spectra versus frequency shall be in accordance with Vibration Acceptance Criteria.

b. Equipment operating condition: Test at specified maximum speed.

4. Level 1 Noise Test:

a. Measure unfiltered overall A-weighted sound pressure level in dBA at 3 feet horizontally from the surface of the equipment and at a mid-point of the equipment height.

B. Level 2 Quality Control Tests:

1. Level 2 General Performance Test:

a. For equipment, operate, rotate, or otherwise functionally test for at least 2 hours after components reach normal operating temperatures.

b. Operate at rated design load conditions.

c. Confirm that equipment is properly assembled, equipment moves or rotates in the proper direction, shafting, drive elements and bearings are installed and lubricated in accordance with proper tolerances, and that no unusual power consumption, lubrication temperatures, bearing temperatures, or other conditions are observed.

2. Level 2 Pump Performance Test:

a. Test 2 hours minimum for flow and head at the rated condition; for factory testing, testing may be at reduced speeds with flow and head corresponding to the rated condition when adjusted for speed using the appropriate affinity laws.

b. Use of a test driver is permitted for factory tests when actual driver is given a separate test at its point of manufacture as specified in Section 26 08 00 – Field Acceptance Tests. Use actual driver for field tests.

c. Test for flow and head at 2 additional conditions; 1 at 25 percent below the rated flow and 1 at 10 percent above the rated flow.

d. Record measured flow, suction pressure, discharge pressure, and observations on bearing temperatures and noise levels at each condition.

3. Level 2 Vibration Test:

a. Test requirement:

1) Measure filtered vibration spectra versus frequency and measure vibration phase in 3 perpendicular planes at each normally accessible bearing housing on the driven equipment, any gears and on the driver; 1 plane of measurement to be parallel to the axis of rotation of the component; measure actual rotational speeds for each vibration spectra measured using photometric or other tachometer input connected directly to the vibration data collector.

2) Vibration spectra versus frequency shall be in accordance with Vibration Acceptance Criteria.

b. Equipment operating condition: Repeat test requirements at design specified maximum speed and at minimum speed for variable speed equipment.

c. Natural frequency test of field installed equipment:

1) Excite the installed equipment and support system in 3 perpendicular planes, use same planes as operating vibration measurement planes, and determine the as-installed natural resonant frequency of the driven equipment, the driver, gears and supports.

2) Perform test at each bearing housing, at each support pedestal, and for pumps on the suction and discharge piping.

3) Perform with equipment and attached piping full of intended service or process fluid.

4. Level 2 Noise Test:

a. Measure filtered A-weighted overall sound pressure level in dBA for each of 8 octave band mid-points beginning at 63 hertz measured at 3 feet horizontally from the surface of the equipment at mid-point height of the noise source.

C. Level 3 Quality Control Tests:

1. Level 3 General Equipment Performance Tests:

a. For equipment, operate, rotate, or otherwise functionally test for at least 4 hours after components reach normal operating temperatures.

b. Operate at rated design load conditions for 1/2 the specified time; operate at each of any other specified conditions for a proportionate share of the remaining test time.

c. Confirm that equipment is properly assembled, equipment rotates in the proper direction, shafting and bearings are installed and lubricated in accordance with proper tolerances, and that no unusual noise, vibration or temperatures are observed.

d. Take appropriate capacity, power or fuel consumption, torque, revolutions per minute, pressure and temperature readings using appropriate test instrumentation to confirm equipment meets specified performance requirements at the design rated condition.

e. Bearing temperatures: During maximum speed or capacity performance testing, measure and record the exterior surface temperature of each bearing versus time.

2. Level 3 Pump Performance Test:

   a. Test 4 hours minimum for flow and head at or near the rated condition; for factory testing, testing may be at reduced speeds with flow and head corresponding to the rated condition when adjusted for speed using the appropriate affinity laws.

   b. Use of a test driver is permitted for factory tests when actual driver is given a separate test at its point of manufacture as specified in Section 26 08 00 – Field Electrical Acceptance Tests. Use actual driver for field tests.

   c. Test each specified flow and head condition at the rated speed and test at minimum as well as maximum specified speeds; operate at each test condition for a minimum of 15 minutes; for factory testing, test at other speeds may be omitted if test driver at reduced speeds is used for rated condition testing.

   d. Record measured shaft revolutions per minute, flow, suction pressure, discharge pressure; record measured bearing temperatures (bearing housing exterior surface temperatures may be recorded when bearing temperature devices are not required by the equipment section) and record observations on noise levels.

3. Level 3 Vibration Test:

   a. Requirements: Same as Level 2 vibration test except data taken at each operating condition tested and with additional requirements below.

   b. Perform High Frequency Enveloping Analysis for gears and bearings.

      1) Measure bearing element vibration directly on each bearing cap in a location close as possible to the bearing load zone that provides a smooth surface and direct path to the bearing to detect bearing defects.

      2) Report results in units of acceleration versus frequency in cycles per minute.

   c. Perform Time Wave Form analysis for gears, low speed equipment and reciprocating equipment; plot true peak amplitude velocity and displacement versus time and label the period between peaks with the likely cause of the periodic peaks (relate the period to a cause).

   d. Plot vibration spectra on 3 different plots; peak displacement versus frequency, peak acceleration versus frequency and peak velocity versus frequency.

4. Level 3 Noise Test: Measure filtered, un-weighted overall sound pressure level in dB at 3 feet horizontally from the surface of the equipment at mid-point height and at 4 locations approximately 90 degrees apart in plan view; report results for each of 8 octave band mid-points beginning at 63 hertz.

D. Level 4 Quality Control Tests:

1. Level 4 General Equipment Performance Test:

a. For equipment, operate, rotate, or otherwise functionally test for at least 8 hours after components reach normal operating temperatures.

b. Operate at rated design load conditions for1/2 the specified time; operate at each of any other specified conditions for a proportionate share of the remaining test time.

c. Confirm that equipment is properly assembled, equipment rotates in the proper direction, shafting and bearings are installed and lubricated in accordance with proper tolerances, and that no unusual noise, vibration or temperatures are observed.

d. Take appropriate capacity, power or fuel consumption, torque, revolutions per minute, pressure and temperature readings using appropriate test instrumentation to confirm equipment meets specified performance requirements at the design rated condition.

e. Bearing temperatures: During maximum speed or capacity testing, measure and record the exterior surface temperature of each bearing versus time.

2. Level 4 Pump Performance Test:

a. Test 8 hours minimum for flow and head; begin tests at or near the rated condition; for factory and field-testing, test with furnished motor at full speed.

b. Test each specified flow and head condition at the rated speed and test at minimum as well as maximum specified speeds; operate at each test condition for a minimum of 20 minutes or longer as necessary to measure required performance, vibration and noise data at each test condition.

c. Record measured shaft revolutions per minute, flow, suction pressure, discharge pressure; record measured bearing temperatures (bearing housing exterior surface temperatures may be recorded when bearing temperature devices not required by the equipment section) and record observations on noise levels.

d. Bearing temperatures: During maximum speed or capacity testing, measure and record the exterior surface temperature of each bearing versus time.

e. Perform efficiency and/or Net Positive Suction Head Required (NPSHr) and/or priming time tests when specified in the equipment section in accordance with the appropriate HI standard and as follows:

1) Perform NPSHr testing at maximum rated design speed, head and flow with test fluids at ambient conditions; at maximum rated speed, test at 15 percent above rated design flow, and 25 percent below rated design flow.

2) Perform efficiency testing with test fluids at maximum rated speed.

3) Perform priming time testing with test fluids at maximum rated speed.

3. Level 4 Vibration Test: Same as Level 3 vibration test.

4. Level 4 Noise Test: Same as Level 3 Noise Test except with data taken at each operating condition tested.

3.5 SOURCE QUALITY CONTROL

A. Test equipment as specified for each type of test at the test levels specified in equipment sections. Prepare and submit test reports as specified.

B. Inspection and balancing:

1. Statically and dynamically balance each of the individual rotating parts as required to achieve the required field vibration limits. Statically and dynamically balance the completed equipment rotating assembly and drive shaft components.

2. Furnish copies of material and component inspection reports including balancing reports for equipment system components and for the completed rotating assembly.

C. Critical speed of rotating equipment: Satisfy the following:

1. The first lateral and torsional critical speed of all constant, variable, and 2-speed driven equipment that is considered rigid such as horizontal pumps, all non-clog pumps, blowers, air compressors, and engines shall be at least 25 percent above the equipment's maximum operating speed.

2. The first lateral and torsional critical speed of all constant, variable, and 2-speed driven equipment that is considered flexible or flexibly mounted such as vertical pumps (vertical in-line and vertical non-clog pumps excluded) and fans shall at least 25 percent below the equipment's lowest operating speed.

3. The second lateral and torsional critical speed of all constant, variable, and 2-speed equipment that is considered flexible or flexibly mounted shall be at least 25 percent above the maximum operating speed.

3.6 FIELD QUALITY CONTROL

A. Test equipment as specified for each type of test at the test levels specified in equipment sections. Prepare and submit test reports as specified. Comply with latest version of applicable standards.

B. For variable speed equipment, conduct test to establish performance over the entire speed range and at the average operating condition. Establish performance curves for:

1. The speed corresponding to the rated maximum capacity.

2. The speed corresponding to the minimum capacity.

3. The speed corresponding to the average operating conditions.

3.7 VIBRATION ACCEPTANCE CRITERIA

A. Testing of rotating mechanical equipment: Tests are to be performed by an experienced, factory trained, and independent authorized vibration analysis expert.

B. Vibration displacement limits: Unless otherwise specified, equipment operating at speeds 600 revolutions per minute or less is not to exhibit unfiltered readings in excess of following:

Operating Speed (revolutions per minute)	Unfiltered (Overall) Peak-to-Peak Amplitude (mils)
	All Rotating Equipment
0 - 300	6.5
301 - 600	4.5
Note: For all equipment, axial shaft displacements not to exceed 50 percent of the maximum radial shaft displacements shown in the table relative to the casing.	

C. Vibration velocity limits: Unless otherwise specified, equipment operating at speeds greater than 600 revolutions per minute is not to exceed the following peak velocity limits:

Item	Unfiltered Overall Limit (inches per second)	Any Filtered Peak Limit (inches per second)
Non-Clog Solids Handling Centrifugal Pumps	0.35	0.25
Horizontal and Vertical In-Line Centrifugal Pumps (other than Non-Clog type)	0.18 (Input BHP 25 or less)	0.14 (Input BHP 25 or less)
	0.22 (Input BHP more than 25 but less than 100)	0.18 (Input BHP more than 25 but less than 100)

Item	Unfiltered Overall Limit (inches per second)	Any Filtered Peak Limit (inches per second)
	0.25 (Input BHP 100 or more)	0.20 (Input BHP 100 or more)
Vertical Turbine, Mixed Flow, and Propeller Pumps	0.31 (Input BHP 100 or less)	0.22
	0.35 (Input BHP 125 or more)	0.25
Vertical Turbine, Mixed Flow, and Propeller Short Set Pumps	0.28 (Input BHP 100 or less)	0.21
	0.33 (Input BHP 125 or more)	0.24
Motors	See Applicable Motor Specification	
Gear Reducers, Radial	Not to exceed AGMA 6000-A88 limits	
Other Reducers, Axial	0.10	0.10
Centrifugal Fans and Blowers	0.15	0.10
Other Equipment, Radial	0.16	0.10
Other Equipment, Axial	0.10	0.10

D. Equipment operation: Measurements are to be obtained with equipment installed and operating within capacity ranges specified and without duplicate equipment running.

E. Additional criteria:

1. No narrow band spectral vibration amplitude components, whether sub-rotational, higher harmonic, or synchronous multiple of running speed, are to exceed 40 percent of synchronous vibration amplitude component without manufacturer's detailed verification of origin and ultimate effect of such excitation.

2. The presence of discernable vibration amplitude peaks in Test Level 2 or 3 vibration spectra at bearing inner or outer race frequencies shall be cause for rejection of the equipment.

3. For motors, the following shall be cause for rejection:

   a. Stator eccentricity evidenced by a spectral peak at 2 times electrical line frequency that are more than 40 percent of the peak at rotational frequency.

   b. Rotor eccentricity evidenced by a spectral peak at 2 times electrical line frequency with spectra side bands at the pole pass frequency around the 2 times line frequency peak.

   c. Other rotor problems evidenced by pole pass frequency side bands around operating speed harmonic peaks or 2 times line frequency side bands around rotor bar pass frequency or around 2 times the rotor bar pass frequency.

d. Phasing problems evidenced by 1/3 line frequency side band spectral peaks around the 2 times electrical line frequency peak.

4. The presence of peaks in a High Frequency Enveloping spectra plot corresponding to bearing, gear or motor rotor bar frequencies or harmonics of these frequencies shall be cause for rejection of the equipment; since inadequate lubrication of some equipment may be a cause of these peaks, lubrication shall be checked, corrected as necessary and the high frequency envelope analysis repeated.

3.8 NOISE REQUIREMENTS AND CONTROL

A. Make measurements in relation to reference pressure of 0.0002 microbar.

B. Make measurements of emitted noise levels on sound level meter meeting or exceeding ANSI S1.4, Type II.

C. Set sound level meter to slow response.

D. Unless otherwise specified, maximum free field noise level not to exceed 85 dBA measured as sound pressure level at 3 feet from the equipment.

3.9 FUNCTIONAL AND OPERATIONAL TESTING OF EQUIPMENT

A. Functional testing as specified in Section 01 75 16 – Startup Procedures and this Section.

B. General checkout: Prior to operating equipment, inspect, test, and check supporting systems, including but not limited to power systems, control systems, piping systems, lubrication systems, and safety systems.

1. Test and calibrate instrumentation and electrical devices as specified in Section 26 08 00 - Field Electrical Acceptance Tests and Section 40 79 23 - Testing, Calibration, and Commissioning.

2. Test and prepare piping as specified in Section 31 23 33 - Trenching and Backfilling and Section 40 05 00 - Piping, General.

3. As a minimum for control systems associated with the equipment, perform the following:

a. Individual Loop Tests: Test from field device to intermediate terminations to controller and back to controlled element.

b. End-to-end test: Simulate input at field device and observe control system response at the final field control element.

4. Prior to testing, provide signed and dated certificates of calibration for test instrumentation and equipment.

C. Operation of related existing equipment: Owner will operate related existing equipment or facilities necessary to accomplish the testing.

D. Acceptable tests: Demonstrate the equipment performance meets the requirements of this Section and the equipment section; when the equipment fails to meet the specified requirements, perform additional more detailed testing to determine the cause, correct, repair, or replace the causative components and repeat the testing that revealed the deficiency.

E. Operational testing: As specified in Section 01 75 16 – Startup Procedures.

END OF SECTION 43 05 60

SECTION 43 20 00 - PUMPS, GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall provide and install all pumps and pumping appurtenances, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section apply to all pumps and pumping equipment except where otherwise indicated in the Contract Documents.

C. Unit Responsibility: The pump manufacturer shall be made responsible for furnishing the Work and for coordination of design, assembly, testing, and installation of the Work of each pump section; however, the Contractor shall be responsible to the Owner for compliance with the requirements of each pump section.

D. Single Manufacturer: Where two (2) or more pump systems of the same type or size are required, the pumps shall all be produced by the same manufacturer.

1.2 REFERENCE STANDARDS

A.	ANSI/IEEE 112	Test Procedure for Polyphase Induction Motors and Generators
B.	ANSI/IEEE 115	Test Procedure for Synchronous Machines
C.	ANSI/HI 9.6.4	Centrifugal and Vertical Pumps – Vibration Measurements and Allowable Values
D.	ANSI/HI 14.6	Rotodynamic Pumps for Hydraulic Performance Acceptance Tests
E.	ASTM A 48	Gray Iron Castings
F.	ASTM B 62	Composition Bronze or Ounce Metal Castings,
G.	ASTM B 584	Copper Alloy Sand Castings for General Applications
H.	ANSI/ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
I.	ANSI/ASME B16.5	Pipe Flanges and Flanged Fittings

1.3 SUBMITTALS

A. Shop Drawings shall be submitted in accordance with Section 01 33 00 – Submittal Procedures. At a minimum, the following information shall be submitted with each pump supplied:

1. Pump name, identification number, and specification section number.

2. Performance data curves showing head, capacity, horsepower demand, NPSH required, and pump efficiency over the entire operating range of the pump. The equipment manufacturer shall indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the design flow conditions and the maximum and minimum flow conditions. Performance curves at intervals of 100 rpm from minimum speed to maximum speed shall be furnished for each centrifugal pump equipped with a variable speed drive.

3. The Contractor shall require the manufacturer to indicate the limits on the performance curves recommended for stable operation without surge, cavitation, or excessive vibration. The stable operating range shall be as wide as possible based on actual hydraulic and mechanical tests.

4. Assembly and installation drawings including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.

5. Data, in accordance with Section 40 05 93 – Common Motor Requirements Process Equipment, for the electric motor proposed for each pump.

6. Elevation of proposed local control panel showing panel-mounted devices, details of enclosure type, single line diagram of power distribution, and current draw of panel, and list of all terminals required to receive inputs or to transmit outputs from the local control panel.

7. Wiring diagram of field connections with identification of terminations between local control panels, junction terminal boxes, and equipment items.

8. Complete electrical schematic diagram.

B. Technical Manual: The Technical Manual shall contain the required information for each pump section.

C. Spare Parts List: A spare parts list shall contain the required information for each pump section.

D. Factory Test Data: Signed, dated, and certified factory test data for each pump system which requires factory testing, submitted before shipment of equipment.

E. Certifications: The Contractor shall provide Manufacturer's certification of proper installation and certification of satisfactory field testing.

1.4 FACTORY TESTING

A. Motors: Electric motors shall be tested in accordance with Section 40 05 93 – Common Motor Requirements for Process Equipment.

B. The following minimum test results shall be submitted:

1. At maximum speed, a minimum of five hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, recorded on data sheets as defined by the Hydraulic Institute. For variable speed driven pumps, each pump shall be tested between maximum and minimum speed at 100 rpm increments.

2. Pump curves showing head, flow, bhp, and efficiency requirements. Include calculated NPSH required curve and certification that the pump shaft horsepower demand did not exceed the rated motor horsepower of 1.0 service rating at any point on the curve.

C. Acceptance: In the event of failure of any pump to meet any of the requirements, the Contractor shall make all necessary modifications, repairs, or replacements to conform to the requirements of the Contract Documents and the pump shall be retested until found satisfactory.

PART 2 - PRODUCTS

2.1 GENERAL

A. All components that are in contact with potable water shall be certified to NSF Standard 61.

B. Compliance with the requirements of the individual pump sections may necessitate modifications to the manufacturer's standard equipment.

C. Performance Curves: All centrifugal pumps shall have a continuous rising curve or the system operating range shall not cross the pump curve at two different capacities or "dip region." Unless indicated otherwise, the required pump shaft horsepower at any point on the performance curve shall not exceed the rated horsepower of the motor or engine or encroach on the service factor.

D. Each unit of pumping equipment shall incorporate all basic mechanisms, couplings, electric motors or engine drives, variable speed controls, necessary mountings, and appurtenances.

2.2 MATERIALS

A. All materials shall be suitable for the intended application; materials not indicated shall be high-grade, standard commercial quality, free from all defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended, and shall conform to the following requirements. The following materials shall only govern if there is not an individual pump specification.

Casings and Bowls	Cast iron pump casings and bowls shall be of close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or equal.
Impellers	Stainless or bronze pump impellers. Bronze shall conform to ASTM B 62 - Composition Bronze or Ounce Metal Castings, or B 584 - Copper Alloy Sand Castings for General Applications, where dezincification does not occur.
Shafts	Stainless steel pump shafts shall be Type 416 or 316. Miscellaneous stainless steel parts shall be Type 316.
Anchor Bolts	Anchor bolts, washers, and nuts in non-corrosive areas, shall be galvanized steel. Anchor bolts, washers, and nuts in corrosive or submerged conditions shall be stainless steel.

2.3 PUMP COMPONENTS - GENERAL

A. Flanges and Bolts: Suction and discharge flanges shall conform to ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800 or ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings dimensions.

B. Lubrication: Vertical pump shafts of clean water pumps shall be product water lubricated, unless otherwise indicated. Deep-well pumps and pumps with dry barrels, shall have water- or oil-lubricated bearings and seals and open or enclosed line shafts as specified in Section 43 30 50.

C. Handholes: Handholes on pump casings shall be shaped to follow the contours of the casing to avoid any obstructions in the water passage.

D. Drains: All gland seals, air valves, cooling water drains, and drains from variable speed drive equipment shall be piped to the nearest floor sink or drain, with galvanized steel pipe or copper tube, properly supported with brackets.

2.4 PUMP APPURTENANCES

A. Nameplates: Each pump shall be equipped with a stainless steel nameplate indicating serial numbers, rated head and flow, impeller size, pump speed, and manufacturer's name and model number.

B. Solenoid Valves: The pump manufacturer shall provide solenoid valves on the water or oil lubrication lines and on all cooling water lines. Solenoid valve electrical ratings shall be compatible with the motor control voltage and shall be NSF 61 approved.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Pumping equipment shall be installed in accordance with the manufacturers written recommendations.

B. Alignment: All equipment shall be field tested to verify proper alignment and freedom from binding, scraping, shaft runout, or other defects. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

C. Lubricants: The Contractor shall provide the necessary oil and grease for initial operation. All lubricants in contact with potable water shall be NSF 60/61 approved for their intended use.

3.2 SERVICES OF MANUFACTURER

A. Instruction of the Owner's Personnel: An authorized training representative of the manufacturer shall visit the Site for the number of days as indicated in the individual pump specification to instruct the Owner's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction shall be specific to the models of equipment provided.

1. The representative shall have at least two (2) years experience in training. A resume for the representative shall be submitted a minimum of 4 weeks prior to the site visit.

2. Training shall be scheduled a minimum of three (3) weeks in advance of the first session.

3. Proposed training material and a detailed outline of each lesson shall be submitted for review. Comments shall be incorporated into the material.

4. The training materials shall remain with the trainees. The Owner may videotape the training for later use with the Owner's personnel.

3.3 FIELD TESTING

A. Test Protocols: Startup, check, and operate the pump system over its entire speed range. If the pump is driven by a variable speed drive, the pump and motor shall be tested at 100 RPM increments. If the pump is driven at constant speed, the pump and motor shall be tested at normal maximum RPM. Unless otherwise indicated, vibration shall be within the amplitude limits recommended by the Hydraulic Institute Standards at a minimum of four pumping conditions defined by the Engineer.

1. Obtain concurrent readings of motor voltage, amperage, pump suction head, and pump discharge head for at least 4 pumping conditions at each pump rotational speed if variable speed at 100 RPM increment or at max RPM if constant speed. Check each power lead to the motor for proper current balance.

2. Determine bearing temperatures by contact type thermometer. A run time until bearing temperatures have stabilized shall precede this test, unless insufficient liquid volume is available.

3. Electrical and instrumentation tests shall conform to the requirements of the sections under which that equipment is specified.

4. Field testing will be witnessed by the Engineer. The Contractor shall furnish 3 days advance notice of field testing.

B. In the event any pumping system fails to meet the indicated requirements, the pump shall be modified or replaced and re-tested as above until it satisfies the requirements.

C. After each pumping system has satisfied the requirements, the Contractor shall certify in writing that it has been satisfactorily tested and that all final adjustments have been made. Certification shall include the date of the field tests, a listing of all persons present during the tests, and the test data.

D. The Contractor shall be responsible for all costs of field tests, including related services of the manufacturer’s representative, except for power and water, which the Owner will bear. If available, the Owner's operating personnel will provide assistance in field testing.

3.4 PROTECTIVE COATING

A. Materials and equipment shall be coated per Manufacturer’s written instructions, or as specified in the individual pump specification.

END OF SECTION 40 20 00

SECTION 43 21 50 – INLINE VERTICAL MULTISTAGE PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install inline vertical multistage pumps with associated appurtenances, complete and operable, as specified herein and as shown on the drawings.

B. The requirements of Section 43 20 00 – Pumps, General apply to Work of this Section.

C. All pumps specified in this Section shall be furnished by and be the product of one manufacturer.

D. **These booster pumps should be used for boosting the water to the gas chlorine system in each well house and should be supplied by the chlorination supplier.**

1.2 QUALITY ASSURANCE

A. General: Pump and motor shall be coordinated by the Contractor to provide operable pumping systems as indicated by the drawings and specifications. The motor horsepower shall not be exceeded when the pump is operating anywhere on its curve. Pump, motor, and controls shall be coordinated by the Contractor to provide an operable pumping system as indicated by the drawings and specifications.

B. Manufacturer's qualifications: Firms regularly engaged in manufacture of pumping equipment of types required, whose equipment have been in satisfactory use in similar service for not less than 5 years.

C. The Manufacturer shall examine the Site conditions, intended application, and operation of the pump system and recommend the pump that will best satisfy the indicated requirements.

D. Factory Tests: Pumps shall be tested in accordance with specification requirements listed in Section 43 20 00 – Pumps, General. Each pump shall be non-witness performance tested at the factory for capacity, power requirement, and efficiency at minimum head, rated head and shutoff head or point of discontinuity, and at as many other points as necessary for accurate performance curve plotting. All tests and test reports shall conform to the requirements and recommendations for the Hydraulic Institute Standards. Acceptance criteria shall be Grade 1B as defined in table 14.6.3.4 in Hydraulic Institute 14.6 – 2011. Hydrostatic test the pump to 150 percent of shutoff head.

E. Warranty: A written manufacturer warranty shall be provided. The warranty shall be for a minimum period of one (1) year from the date of Substantial Completion. Manufacturer shall repair or replace all defects of materials or workmanship in the equipment during the warranty period. The warranty shall include removal, reinstallation, start-up, testing, and calibration, as necessary.

1.3 SUBMITTALS

A. Product data: Submit manufacturer's technical product data performance curves, materials of construction and installation instructions for the pump in accordance with Section 01 33 00 – Submittal Procedures, and Section 43 20 00-Pumps General.

B. The Contractor shall submit Operation and Maintenance Manuals in accordance with Section 01 78 23 – Operation and Maintenance Data.

1.4 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt or dust, or other contaminants.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pump shall be multi-stage, inline vertical pumps. Attach a stainless steel nameplate to the pump indicating rated head and flow, impeller size, speed, manufacturer's name and model number.

B. It is the intent of this specification that the complete pumps, motors, and ancillary components necessary for a complete and functional system be provided by the pump manufacturer for complete system responsibility.

C. Operating Conditions: The work of this Section shall be suitable for long term operation under the following conditions:

Duty	Continuous
Drive	Variable
Ambient Environment	Indoors, Ventilated And Heated
Ambient Temperature (degrees F)	30 to 100
Ambient Relative Humidity (Percent)	10 to 60
Fluid Service	Potable water
Fluid Temperature (degrees F)	45 to 75
Fluid pH Range	6 to 9
Project Site Elevation (ft, above msl)	Per DRAWINGS

D. Performance Requirements: Pumps shall meet or exceed the performance requirements as defined below. The pumps shall be selected such that the highest efficiency is obtained for the average pumping conditions as identified below. Efficiency listed includes pump and motor. **Chlorination manufacturer shall confirm that the booster pumps are adequately sized.**

Booster Duty: Primary Design Performance	
BP-A120	
Design Point 1 - Flow (gpm)	4
Design Point 1 - Total Dynamic Head (ft)	270
Design Point 1 - Min. Pump Efficiency (percent)	20%
Design Point 2 - Flow (gpm)	3
Design Point 2 - Total Dynamic Head (ft)	310
Design Point 2 - Min. Pump Efficiency (percent)	20%
Max Operating Speed (rpm)	3450
Pump HP (Single Phase Power)	1
Equipment Number	BP-A120
BP-B120	
Design Point 1 - Flow (gpm)	4
Design Point 1 - Total Dynamic Head (ft)	270
Design Point 1 - Min. Pump Efficiency (percent)	20%
Design Point 2 - Flow (gpm)	3
Design Point 2 - Total Dynamic Head (ft)	310
Design Point 2 - Min. Pump Efficiency (percent)	20%
Max Operating Speed (rpm)	3450
Pump HP (Single Phase Power)	1
Equipment Number	BP-B120

2.2 PUMP REQUIREMENTS

A. Pump Construction: Construction of vertical multistage pumps shall conform to the following requirements:

Pump Body and Base	Cast Iron (ASTM Class 35/40B) Epoxy Coat
Impeller	Stainless Steel

Diffuser	Stainless Steel
Casing,	Stainless Steel
Shaft	Stainless Steel
Adaptor	Cast Iron (ASTM Class 35/40B)
Coupling	Flexible heavy duty, Aluminum A384.0-F
Coupling Guard	Stainless Steel
Seal Plate	Stainless Steel
Mechanical Seal	Silicon Carbide / Carbon / Viton / EPDM
Mech Seal Flush	Product Water
Elastomers	Viton
Wear Rings	PPS
Shaft Sleeve & Bushing	Stainless Steel Sleeve and Tungsten Carbide Bushing
Fill & Drain Plugs	AISI 304 Stainless Steel
Tie Rods	Carbon Stl / Zinc Plated
Seal Gland	Stainless Steel
Mounting	Vertical
Inlet / Outlet Flange Locations	Low Inlet and Low Outlet Flanges 180 degrees apart at Pump Base

B. Motor:

1. The motor shall be NEMA MG-1 standard design B, Vertical Solid Shaft, ODP enclosure (Consider TEFC if outdoor/hard environment), squirrel cage induction full voltage type. Motor shall be a premium efficiency, 115/208-230 volt, 1-phase, 60 Hz. Each motor shall be capable of driving the pump under all head conditions without exceeding the rated capacity of the motor. Motor shall conform to AIEE and NEMA, standards.

2. The motors shall be designed and manufactured to meet all applicable sections of NEMA MG1, 1993. Specific reference is to Part 30 and Part 31, as applicable.

3. Motors shall be capable of operating at 1.0 service factor on inverter power. Nameplate sinewave service factor shall be 1.15 or greater.

4. Motors shall be rated for continuous operation in a 50º C ambient temperature 2,000 feet above sea level.

5. Motors shall not exceed class F insulation limits with 115º C allowable winding hot spot temperature, when operated on inverter power across the entire speed and torque envelope specified.

6. Motors shall meet NEMA design “B” performance levels.

7. Motors shall be nameplated for 30-60 hertz operation. The motor shall be capable of operating a variable torque load over 2:1 speed range. The pump/motor combination shall be capable of operating continuously at 30 hz without overheating.

8. Acceptable motor manufacturers are Baldor, US Motors, WEG, or General Electric.

C. Motor Thrust Bearing: The motor thrust bearing shall be designed to carry the hydraulic thrust plus the weight of the shaft and the impellers. The thrust bearing life expectancy shall have a five-year average rating based on 24 hours per day usage. Bearings shall be oil or grease lubricated as per manufactures standard design. Each motor shall be provided with a corrosion-resistant nameplate giving the name of the manufacturer, horsepower, voltage, frequency, speed, efficiency and current for unit at full load.

D. Manufacturers, or equal

1. Grundfos CR 1S-13

2. Equal must be approved during bidding process.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prior to shipping, the contractor shall field verify all existing conditions and coordinate new equipment connections to ensure proper alignment. All conflicts identified shall be brought to the attention of the Project Engineers for direction.

B. Install pump as shown in the drawings and as recommended by the pump manufacturer.

C. The Contractor shall employ qualified, competent personnel for the installation, testing, and start-up of all pumps and controls. Contractor shall include as part of the contract, the services of a field representative from the firm supplying the pump system to supervise the installation and start-up of the system. The field representative shall remain on the job until each pump is operating satisfactorily and the control system has been fully tested for conformance to the Contract Documents.

3.2 MANUFACTURER'S SERVICE

A. Inspection, Startup, and Field Adjustment: The service representative of the manufacturer shall be at the site a minimum of one day total for the installation, startup and field adjustment services.

B. The installed pumping units shall operate without excessive vibration. Balance of rotating parts shall be maintained throughout the pumps rated performance curve, which will include shut-off points. Vibration amplitude shall not exceed Hydraulic Institute limits, at any operating point along pump curve. Contractor shall provide for vibration analysis at no cost to the Owner to verify vibration requirements are met. Contractor shall be responsible to make required adjustments to ensure vibration is less than the maximum allowable amount. Excessive vibration will be defined as that which exceeds the limits outlined by the Hydraulic Institute.

C. Perform on-site (hydraulic testing for each pump to verify performance on the pump curve. Data shall include flow measurement and discharge pressure at three (3) different points for each pump.

D. Contractor shall provide Owner with written certification that the system is operational, fully functional, and ready for service. Contractor shall also provide the results for the flow test as specified in the Contract Documents.

END OF SECTION 43 21 10

SECTION 43 30 50 – DEEP WELL-LINE SHAFT TURBINE PUMP

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Both Well Pumps and associated motors (PMP-A001 & PMP-B001) are going to be supplied by the Owner to the Contractor. Contractor is responsible for installing the Owner provided pumps and motors and incorporating them into each Well House startup. This specification provides information on the materials that the Owner will be supplying to the Contractor for installation along with what is shown in the drawings.

B. Install deep well turbine pump and drive with associated piping, controls, wiring, and appurtenances, complete and operable, in accordance with the Contract Documents. Deep well turbine pump manufacturer shall be the same for both wells for this project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. The requirements of the specification divisions listed below apply to this section.

Section	Title
01 33 00	Submittal Procedures
43 20 00	Pumps, General
40 05 93	Common Motor Requirements for Process Equipment

1.3 REFERENCE STANDARDS

ASTM B 505 Specification for Copper-Base Alloy Continuous Castings

ASTM A 120 Welded Steel Pipes, Galvanized, Threaded and Coupled

1.4 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures and Section 43 20 00 – Pumps, General.

B. Product Data: Submit Manufacturer's technical product data, performance curves, materials of construction, and installation instructions for the pump.

C. Operation and Maintenance Data: Submit operation and maintenance data and parts list for the equipment. Include this data and product data in maintenance manual, in accordance with requirements of Section 01 78 23 – Operation and Maintenance Data.

1.5 QUALITY ASSURANCE

A. General: Motor horsepower shall not be exceeded when the pump is operating anywhere on its curve. All pumps shall have a continuously rising curve, or the system operating range shall not cross the pump curve at two different capacities ("dip region").

B. Manufacturers: Firms regularly engaged in manufacture of pumping equipment of types required, whose equipment has been in satisfactory use in similar service for not less than 5 years. Vertical turbine pumps shall be Goulds, Floway, Flowserve. Pumps shall be a factory supplied and tested system including the pump (bowls and impellers), shaft, column, and head.

C. Service: Authorized factory warranty service for pumps supplied shall be available within a 200-mile driving distance from the City of Pocatello.

D. Factory Tests: Pumps shall be tested in accordance with specification requirements listed in Section 43 20 00 – Pumps, General. Each bowl assembly shall be non-witness performance tested at the factory for capacity, power requirement, and efficiency at minimum head, rated head and shutoff head or point of discontinuity, and at as many other points as necessary for accurate performance curve plotting. All tests and test reports shall conform to the requirements and recommendations for the Hydraulic Institute Standards. Acceptance criteria shall be Grade 1B as defined in table 14.6.3.4 in Hydraulic Institute 14.6 – 2011. Hydrostatic test the bowl assembly and discharge head to 150 percent of shutoff head.

E. Warranty: Pump shall be provided with manufacturer one (1) year standard warranty.

F. Flow, head and efficiency specified in this Section are minimums unless stated otherwise.

G. Suction Head: Gauge pressure available at pump intake flange or bell in feet of fluid above atmospheric.

H. Tolerances: This Section and related sections contain tolerances that are more stringent than Hydraulic Institute Standard tolerances, where tolerances are not mentioned; Hydraulic Institute Standards 2.1-2.5, 2.6, and 9.1-9.5 tolerances apply to this Section of the specifications.

I. All of the pump components shall be by a single pump manufacturer. The pump assembly shall be assembled by the pump manufacturer at the manufacturer's facility. Pumps shall be NSF 61 & NSF 372 certified.

J. Analysis: Pump anchorages shall be verified for lateral earthquake effects in the appropriate zone as stated by the UBC, applied simultaneously with normal pump operation forces, as well as for maximum reactions due to other pump design events. Seismic calculations performed by a registered civil engineer are to be submitted for approval during the submittal phase.

K. The pumping unit shall be designed to safely operate free of resonant frequency. A natural frequency analysis of the head, motor stand (if applicable) and electric motor shall be performed by a licensed Professional Engineer. A report shall be provided with submittals showing that the natural frequencies and mode shapes of the pump and motor have been considered in the design of the discharge head and certify that the critical frequency is at least 20% above or below the operating range.

L. Pump Manufacturer must be ISO 9001 certified.

1.6 MANUFACTURER'S SERVICE

A. A factory Representative of the pumping equipment shall be present to supervise start-up and ensure proper operation of all components and provide training to the Owner's operators. The factory Representative shall be on site for 4 hours' minimum for each well pump. The Owner shall obtain and pay for the factory representative services.

1.7 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt or dust, or other contaminants.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pumps shall be multi-stage, open line shaft, deep set vertical turbine pumps suitable for pumping potable water. Two pumps (PMP-A001 and PMP-B001) shall be furnished and installed.

B. Attach a stainless-steel nameplate to the discharge head of each pump indicating rated head and flow, impeller size, speed, manufacturer's name and model number.

C. Design of pumps shall account for minimum pump fluid temperature of 40 degrees Fahrenheit, a nominal pumped fluid of 50 degrees Fahrenheit, and a maximum pumped fluid of 62 degrees Fahrenheit.

2.2 MATERIALS

A. General: Materials in the Pump Schedule shall be the type and grade as specified in this Article.

B. Cast Iron: ASTM A 48, Class 30 minimum.

C. Nickel Cast Iron: ANSI/ASTM A 48, minimum Class 30, cast iron with 3 percent nickel.

D. Gray Iron Casting: ASTM A 278, Class 30.

E. Iron-Chromium Alloy: ASTM A 73, Grade CA40; ASTM A 276, Type 420 Stainless Steel may be substituted; Brinell Hardness Number of 350 to 380.

F. Bronze: ASTM B 505, Alloy C92700.

G. Red Brass: ASTM B 584, Alloy C83600, red brass.

H. 416 Stainless: ASTM A 582, Type 416 Stainless Steel.

I. Neoprene: Polychloroprene rubber.

J. Steel: ASTM A 283, Grade D.

K. Steel Pipe: ASTM A 53, Grade B.

L. Aluminum Bronze: ASTM B 148.

2.3 PUMP SCHEDULE

Pump Name	Well Pump (PMP-A001)	Well Pump (PMP-B001)
Number of pumps	1	1
Rated Design Point (at Maximum RPM):		
Flow, gpm	2000	3000
Head Range, Feet	365	363
Minimum Pump Efficiency	81	82
Maximum Pump Speed, rpm	1770	1770
Maximum Horsepower	**250**	**350**
Minimum Required Condition 1 (at Maximum RPM):		
Flow, gpm	1600	2800
Head Range, Feet	400	395
Minimum Pump Efficiency, %	76	80
Minimum Required Condition 2 (at Maximum RPM):		
Flow, gpm	2400	3200
Head Range, Feet	290	335
Minimum Pump Efficiency, %	76	80
Other Conditions:		
Min. turndown flow requirement (gpm)	570	677
Maximum NPSHr, ft. (at every Specified Flow)	43	52
Minimum NPSHa, ft. (at every Specified Flow)	64	87
Minimum Suction Static Head (feet)	45	70
Maximum Suction Static Head (feet)	80	75
Maximum Noise, dBA at 3 feet	90	90

Pump Name	Well Pump (PMP-A001)	Well Pump (PMP-B001)
Total Pump Length (feet)	86	152
Column Diameter (inches)	10	12
Interior Diameter of Well Casing (in)	15.25	15.25
Maximum Allowable Bowl Diameter (in)	~14	~14
Pump Characteristics:		
Number of Stages	Per Manufacturer	Per Manufacturer
Impeller Type	Closed	Closed
Pass Minimum Sphere Size, Inch	N/A	N/A
Pump Impeller Bowl Bearing Lubrication	Product Lubricated	Product Lubricated
Suction Bowl Bearing Lubrication	Grease	Grease
Suction Strainer	316 Stainless Steel	316 Stainless Steel
Line Shaft Type	Open	Open
Line Shaft Bearing Spacing, Feet	10.0	10.0
Line Shaft Lubrication	Product	Product
Discharge Shaft Seal Type	Stuffing Box with Packing	Stuffing Box with Packing
Column Connection Type	Per Manufacturer	Per Manufacturer
Maximum Column Section Lengths, Feet	10.0	10.0
Pump Barrel or Can	Not Required	Not Required
Discharge Arrangement	Above Grade	Above Grade
Coupling Type	Per Manufacturer	Per Manufacturer
Maximum Pump Speed, rpm	1770	1770
Pump Materials:		
Suction Bell	Cast Iron	
Suction Bell Bearing	Bismuth Tin Bronze (UNS C83895)	
Bowl Coating	Scotchkote 134 Baked on Epoxy (OD)-12 mil (or equal coating)	
Impeller Cases	Cast Iron	
Impeller	316 Stainless Steel	
Impeller Bearing	Bronze Backed Rubber – Johnson Duramax or equal	
Impeller Shaft Key	416 Stainless Steel Collets	
Line Shaft and Coupling	Type 416 Stainless Steel	
Line Shaft Bearings	Neoprene	
Shaft Sleeve	Standard	

Pump Name	Well Pump (PMP-A001)	Well Pump (PMP-B001)
Column Material	Steel Pipe	
Discharge Head/Driver Stand	Carbon Steel	
Discharge Head Bearing	Bismuth Tin Bronze (UNS C83895)	
Discharge Stuffing Box	Cast Iron	
Discharge Head Coating	Scotchkote 134 Baked on Epoxy (OD/ID) -12 mil (or equal coating)	
Driver Characteristics		
Driver Type	Motor	
Drive Arrangement	Vertical Hollow Shaft	
Non-Reverse Ratchets	Required	
Motor Characteristics:		
Motor Specification Section	40 05 93	
Service Factor	1.15	
Voltage/Phases/Hertz	460/3/60	
NEMA Enclosure Type	WP-1	
Speed Control	VFD – Inverter Duty Rated	
Max. Driver Speed, rpm	1800	

2.4 PUMP CONSTRUCTION

A. Bowl: Bowl assembly shall include pump bowls, impellers, shaft and bearings.

1. Bowls shall be close-grained, cast-iron conforming to ASTM A-48 Class 30 standards. Bowls shall have integrally-cast vanes. 316 Stainless bolts shall be used. Bowls shall have replaceable wear rings at the impeller/bowl seal. Bowl bearings shall be bronze backed rubber bearings or (UNS C83895).

2. Bowls OD shall be enamel lined with Scotchkote 134 baked on epoxy coating or nap-guard mark x 7-2500 coating, consisting of a one-part thermosetting powdered epoxy coating which conforms to AWWA standard C 213 and C 550 for use as a coating for potable water. Bowl ID shall be vitreous enamel lined. Bottom bowl shall have a 416-stainless steel intake screen.

B. Impellers: Impellers shall be of the enclosed type and shall be constructed of 316 Stainless Steel or Bronze (ASTM B584-903). Impellers shall be both statically and dynamically balanced.

C. Wear Rings (bowl & impeller): Design replicable wear rings for both the bowl and impeller on each impeller bowl. Bowl and impeller wear rings shall be aluminum bronze and have a 50 bhn hardness difference.

D. Bowl Shaft: 416 Stainless Steel

E. Pump Shaft: Material shall be as specified above. The shaft construction shall not use keyways nor stepped diameters within the bowl assembly. The horsepower rating, machining and straightness of the shaft shall conform to ANSI B58.1 Standard.

F. Pump bearings at the discharge case, inter bowl and suction bell shall be as shown in the schedule above. The suction case bearing shall be lubricated by a non-soluble grease packed chamber located below the bearing. The inter bowl bearings and discharge case bearing shall be water lubricated.

G. Head Shaft: The line shaft shall be connected to the motor by a head shaft fabricated from 416 stainless steel. The head shaft shall be connected to the pump shaft with a solid stainless-steel coupling. The head shaft shall be threaded on the top end with an adjusting nut for axial adjustment of the line shaft.

H. Shaft Seal: The packing box in the discharge head shall use a stuffed packing consisting of five rings of packing and a lantern ring. The packing shall be lubricated by the product being pumped. Provide a rubber slinger on the shaft above the packing box.

I. Discharge Head: Discharge head shall be ASTM A53 Grade B fabricated steel. The discharge head shall be Type F with a faced discharge flange and drilled standard ANSI flanges with bolt holes straddling vertical centerline. The base of the discharge head shall be a square steel sole plate with holes for bolting to the concrete pump support base. The discharge head shall have a cast iron packing box. Discharge head OD and ID shall be coated with Scotchkote 134 and shall be provided with flange, base plate, and minimum 1.5-inch diameter 3,000 lb forged steel half couplings as required in the drawings. At a minimum, a tap for the pre-lube system shall be made in the side of the discharge head, and taps for a submersible level transducer, vent, and sounder port shall be made through the base plate.

J. Line Shaft: Line shaft shall be C 1045 carbon steel. Line shaft sections shall not exceed 10 feet in length and shall be connected by C 1045 carbon steel threaded couplings machined from solid bar stock. At each bearing area the line shaft shall be electro chrome plated or be fitted with stainless steel sleeves at the bearing areas. Line shafts shall be adequate diameter to transmit the required horsepower of the driver and be adequate to not exceed the shaft stretch requirements of the pump. The minimum allowable line shaft diameter shall be 1.5 inch, but as recommended by manufacturer.

K. Line Shaft Bearings: Line shaft bearings shall be spaced no more than 10 feet on centers along the line shaft. The bearings shall be fluted rubber retained in a bronze centering spider at each bearing. The rubber bearings shall be lubricated by the product being pumped.

L. Column: Column shall be 10- or 12- inch schedule 40 steel pipe conforming to ASTM A-53 machined both ends to provide a butt fit between pipe sections and the centering spiders. Pipe sections shall be no longer than the line shaft sections. Pipe ends shall be threaded 8 threads per inch. Pipe section shall be connected by threaded couplings which are fabricated from high tensile steel and the coupling threads shall be cadmium plated.

M. Motor: The motor shall be a high-efficiency (or premium-efficiency) vertical hollow shaft high thrust electric induction motor conforming to the requirements of Section 40 05 93 – Common Motor Requirements for Process Equipment.

N. Motor Steady Bushing: The lower end of the motor shaft shall be furnished with a steady bushing between the motor drive shaft and the motor quill.

O. Drive Coupling: The drive shall be a non-reverse drive which prevents reversal of the motor during pump shutdown. The drive shall have energy absorbing springs and a centrifugal ball ratchet. Standard threaded coupling should be used for the vertical hollow shaft motor.

P. Shaft Guard: Provide a guard to protect operating personnel from the exposed shaft in the discharge head.

Q. Pre-lube: A pre-lube line tap will need to be installed in the discharge head in accordance with the plans.

2.5 SPARE PARTS

A. Each pump shall be provided with the following spare parts:

1. Two sets of all gaskets and o-rings.

2. Spare packing

2.6 MANUFACTURERS

A. Goulds Pumps, Inc.

B. Weir Floway

C. Flowserve

D. or an Owner and Engineer preapproved equal manufacturer prior to bid opening

PART 3 - EXECUTION

3.1 INSTALLATION

A. **Contractor to install pumps as shown in the drawings and as recommended by the pump Manufacturer.**

B. Steel mounting plate for the discharge head shall be coated with 16 mils of baked on epoxy and provided by the pump Manufacturer. Threaded holes shall be tapped into the mounting plate to by the pump manufacturer, to allow attachment of the discharge head.

C. Well casing shall be extended to the appropriate elevation by the Contractor and welded to the base plate by the Contractor

D. Ports in the discharge head base plate shall be provided as shown in the drawings by the pump manufacturer.

3.2 SECURE START-UP SERVICE

A. Owner shall secure start-up service for the pump as specified under Paragraph 1.6 above.

B. Field Vibration: Tests for acceptable vibration will be made at no additional cost to the Owner in field on each pump system. Vibration limits shall meet the latest edition of Hydraulic Institute standards as detailed in 9.6.4-2009. All field tests will be running tests with the pump pumping product for which it is intended and each pump system will be tested separately with no other pumps running. All tests will be completed in the presence of the design engineer. Amplitude as used in this Specification will mean peak to peal displacement, the requirement for testing for acceptable vibration will be the measurement of this peak to peak displacement at 5 separate points on the motor and five separate points on the discharge head.

C. Field Harmonics: During start up the pump sytem manufacture will perform a Reed Critical Frequency (RCF) analysis commonly referred to as a “bump test”. The bump test will be done through the full operating range of the pump speeds, from min speed to max speed. If there are any reflections of harmonics through the operating range of the pumps it will be the pump manufactures responsibility to either correct the problem or inform the Owner of the speeds that will need to be avoided through the Variable Frequency Drive Settings. A full report of these findings will be provided to the Owner before final acceptance of the equipment.

D. Field Vibration Tests and Field Harmonics Tests shall be conducted for both PMP-A001, PMP-B001.

END OF SECTION – 43 30 50

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SECTION 46 30 00 – CHEMICAL FEED EQUIPMENT, GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide chemical solution feed equipment, complete and operable, in accordance with the Contract Documents.

B. Equipment shall be from manufacturers with several years of experience in the manufacture and assembly of similar products, with a record of successful installations. Such manufacturers shall maintain a well established, authorized, local service agency with sufficient spare parts and personnel to respond within 48 hours to any service calls.

C. Unless indicated otherwise, the requirements of this Section apply to all chemical feeding equipment in the Contract Documents.

1.2 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal and Procedures.

B. Shop Drawings: Complete fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering materials used, parts, devices, supports, and other accessories forming a part of the equipment.

C. Certification: The supplier shall obtain written certification from the manufacturer, addressed to the Owner, stating that the equipment will efficiently and thoroughly perform the required functions in accordance with these Specifications and the Drawings, that the materials are best suited for the chemicals handled, and that the manufacturer accepts joint responsibility with the supplier for coordination of equipment, including motors, variable speed drives, controls, and services required for proper installation and operation of the completely assembled and installed unit.

D. Technical Manuals: Furnish complete operations and maintenance manuals prior to start-up. Printed instructions relating to proper maintenance, including lubrication, and parts lists indicating the various parts by name, number, and diagram where necessary, shall be furnished with each unit or set of identical units.

E. Spare Parts List: The supplier shall obtain from the manufacturer a list of suggested spare parts for each piece of equipment subject to wear, such as seals, packing, gaskets, nuts, bolts, washers, wear rings, etc.

F. Field Procedures: Instructions for field procedures for erection, adjustments, inspection, and testing shall be furnished prior to installation of the equipment.

1.3 QUALITY ASSURANCE

A. After completion, the supplier shall furnish to the Owner the manufacturer's written guarantees that the equipment will operate with the published efficiencies, heads, criteria, and flow ranges and meet these specifications. The supplier shall also furnish the manufacturer's warranties as published in its literature.

PART 2 - PRODUCTS

2.1 GENERAL

A. Wherever it is required, that a single Manufacturer shall be responsible for the compatible land successful operation of the various components of any equipment unit. It shall be understood to mean that the supplier shall provide only such equipment as the designated manufacturer will certify is suitable for use with its equipment and with the further understanding that this in no way constitutes a waiver of any indicated requirements.

B. Where two (2) or more units of the same type or size of equipment are required, all such units shall be produced by the same manufacturer.

2.2 DESCRIPTION

A. The chlorine gas feed system shall be **Wallace and Tiernan S10K Sonic Chlorinator (Evoqua)** to match the City's existing chlorination facilities.

B. It shall be a vacuum operated, sonically regulated type system consisting of the following components:

1. A vacuum regulator with necessary piping and valving as the two tanks will be switched over manually

2. Rotameters with gas flow rate control valves

3. Anti-siphon Injector

4. Vacuum tubing, connectors, and flexible injector hose

C. The gas feed system shall have a maximum capacity of 200 pounds per day (PPD) chlorine and be sized to accurately feed 20 PPD under continuous operation.

D. Backpressure at the chlorine injection will range from 95 to 119 psi. Therefore, a backpressure of 120 psi can be assumed for the sonic operation injector.

E. The system shall be manually controlled with a feed range of 20:1 and the capability to control within ±4% of the indicated feed rate.

2.3 VACUUM REGULATORS

A. The cylinder mounted vacuum regulators shall be rated for the specified feed rate of chlorine.

B. The vacuum regulators shall be designed to reduce full supply pressure to a vacuum without venting.

C. Self-aligning yokes designed to Chlorine Institute recommendations shall be provided as an integral part of the vacuum regulators.

D. The units shall include selector knobs and icons to indicate the chlorine gas container status.

E. An off position shall be provided to isolate the diaphragm and internal components from atmospheric air when the operator changes containers.

F. The vacuum regulators shall contain internal pressure relief.

G. The check valves shall close in the event of leakage past the primary valve.

2.4 GAS FEED CONTROL UNIT

A. One rotameter assembly with a V-notch rate valve shall be furnished and shall be capable of local or remote mounting.

B. There shall be provisions for interlocking rotameter frames for multiple feed points.

C. The rotameter's tube shall be serviceable without removing the frame from its mounting.

2.5 ANTI-SIPHON INJECTOR

A. Each gas feeder shall have a PVC 3/4 inch fixed throat injector rated for the specified feed rate to generate the operating vacuum for the system.

B. The ejector shall be capable of feeding against a backpressure up to 119 psi with an inlet operating pressure of 225 psi (after manufacturer supplied booster pump).

C. It shall include built-in double check valve protection to prevent water from back flooding into the vacuum regulator.

D. The check valve shall be a positive, tight shut-off, unitized design which doesn't require springs or diaphragms for tight closing.

E. The injector shall include an integral mounting bracket.

F. It shall be capable of mounting in either the vertical or horizontal plane.

G. Nozzle Type: 225 99 C. (Supply Pressure, 99 Nozzle, and C Tailway)

2.6 CHLORINE CYLINDER SCALES

A. A dual cylinder scale set shall be provided for a 150 lb. chlorine cylinder and shall be of the digital readout/hydraulic load cell type. For redundancy, each weighing platform shall have a sole and separate weight indicator with no shared components. The scale platform shall be constructed of non-corrosive PVC plastic and sized to accept one (1) 150 lb.

cylinder. Platform scale coating system shall be a minimum dry thickness of 80 mils and be resistant to moisture, chemicals, abrasion, impact and UV light.

B. Scales shall be of the single hydraulic load cell design. Load cell shall be of the temperature stable, rolling diaphragm type. Flexible PVC coated copper tubing shall connect load cell to indicator to allow easy remote installation of the digital indicator. Tubing shall be six (6) feet in length. Cylinder chain bracket shall be wall mounted and use a double loop coil chain and a spring loaded snap hook to secure cylinder. Chain bracket shall have an integral tool rack for storing cylinder change-out tools.

C. Indicator shall utilize cross technology to convert the hydraulic load cell signal into a digitally displayed weight value. Indicator shall be battery operated and shall not rely on any type of external power for display operation. Batteries shall provide approximately 4000 hours of display time. Indicator shall be housed in a NEMA 4X enclosure with 6 function keys for indicator operation. Net weight shall be displayed in two ways; a numerical display with 0.81-inch-high characters, and an analog 0-100% bar graph display. A third display line shall prompt the user through routine user operations.

D. User shall be able to set the net weight either by scrolling in the net chemical weight, or scrolling in the tank tare weight. A menu key shall provide access to the following 5 functions:

1. Zero Indicator

2. Set bar graph and 4-20mA capacity

3. Set display auto-off time

4. Set alarm relay values

5. Set decimal point

E. Indicator shall have a loop-powered (12-36 volts DC by others) 4-20mA output proportional to net cylinder weight. An 18-inch flying lead shall be provided for termination in a user supplied junction box.

F. Scale shall be provided with a full five (5) year warranty. “Limited” warranties shall be considered unacceptable.

G. Full scale accuracy shall be better than 1%. Scale shall be the **Force Flow Equipment** Cylinder and Scale **Model Solo XT150-2.**

2.7 GAS ALARM SYSTEM DESCRIPTION

A. Manufacturer

1. This gas alarm system shall be **GasSens A14/A11 Modular Gas Detector** manufactured by **Analytical Technology, Inc** or Engineer approved equal.

B. Monitor

1. The gas detection system shall monitor the gas supply storage area and the gas feed equipment area for the presence of Chlorine gas in the ambient atmosphere.

2. The system shall be capable of monitoring a single point for chlorine gas as indicated.

C. The gas detector shall be ranged for 0-10 PPM Chlorine (Cl2).

D. The gas detector shall have two individual alarm set points for each point adjustable from 5% to 100% of range, with separate alarm LED's and an integral audible horn.

1. There will also be a 4 digit sunlight readable LED to display gas concentration in PPM as well as a 4-20 mA output signal proportional to gas concentration.

2. The gas sensors shall be capable of being remotely mounted up to 1,000 ft. away from the control electronics.

a. The sensors shall be fitted with integral gas generators that automatically test the sensors daily with an electrochemically produced gas sample.

b. An alarm shall be sounded if the sensor fails the self-test.

E. The system shall consist of an individual receiver module and a separate Power Supply Module DIN rail-mounted for flexibility in a NEMA 4X polystyrene enclosure suitable for wall mounting.

F. A clear, hinged polycarbonate window with push-button latches shall be included to provide easy access to the control modules.

G. One Receiver Module is required for each gas sensor to provide separate alarm functions.

H. The Sensor/Transmitter shall also be in a NEMA 4X enclosure remotely mounted in an area where gas leakage could occur.

I. Power Module Supply

1. A Power Supply Module should be provided to accept any AC input between 85 and 250 volts, 50/60 HZ and automatically convert this into a 12 VDC output for powering two (2) Receiver Modules

2. Loss of input power shall be indicated by a built-in power failure relay.

3. A battery back-up system shall be provided.

a. Consisting of a sealed lead-acid battery mounted in a separate enclosure.

b. To maintain all gas detection system functions for a minimum of 12 hours in the event of a power failure.

c. The Power Supply Module shall continuously and automatically recharge the Battery.

J. Receiver Module:

1. A 4 digit LED, sunlight readable display

2. Input: digital signal, two (2) wire connection to remote sensor/transmitter

3. Output: isolated 4-20 mA DC, 1000 ohms maximum load

4. Alarms: two (2) adjustable concentration alarms with set points adjustable from -100%of range

5. Alarm indicators: high intensity LED bars for WARNING (low set-point) and ALARM (high set-point)

6. Indicator Function: WARNING indicator non-latching, ALARM latching

7. Alarm Relays: three (3) assignable alarm relays rated 10 A at 120 VAC, 5A at 250 VAC resistive. Alarm relays shall be assignable to either alarm set point.

8. Relay Function shall be configurable for:

   a. Normal/fail-safe

   b. Latching/non-latching

   c. Fast/slow

9. Relay and Indicator Reset shall be activated from front panel switch or through remote reset.

10. Trouble Aram shall have a front panel LED indicator and SPDT, rated 10 A at 120 VAC, 5A at 250 VAC resistive relay. It shall be factory set to fail-safe operation.

11. Trouble Function shall indicate loss of sensor/transmitter input or failure or sensor Auto-Test (if in use).

12. Gas Indicator shall be an LED bar on front panel with gas symbol overlay.

13. Mounting: Module mounts to 35 x 7.5 mm DIN rail

14. Electrical Connection: quick disconnect plug-in terminal blocks

K. Sensor/Transmitter

1. The Sensor/Transmitter shall be housed in a NEMA 4X polystyrene enclosure suitable for wall mounting.

   a. It shall have an integral electrochemical gas generator that automatically produces a specific gas sample to test the Sensor response every 24 hours.

   b. Specific for the gas being monitored

c. Be provided with an operating life of 2 years

2. The Sensor shall not require the addition of chemicals.

3. The electrical connection shall be quick disconnect thermal blocks.

4. The Transmitter shall be powered from the Receiver through a 2-conductor cable up to 1,000 ft. long.

5. This same cable shall transmit a current pulse position signal, for improved noise immunity, representative of gas concentration back to the Receiver.

2.8 SAFETY EQUIPMENT

A. Emergency Eye/Face Wash shall be a self-contained wall mounted eyewash station. The eyewash shall have spray heads that are protected from dust accumulation, contamination, and damage when not in use. The eyewash shall be hands-free and have a minimum of 15-minute fill line volume. The eyewash shall have an emergency sign.

B. Isotonic Eye Saline Solution with a minimum thirty (30) months of shelf life shall be provided for emergency eyewash station.

2.9 MATERIALS

A. General: Materials employed in the equipment shall be suitable for the intended application; materials not specifically called for shall be high-grade, standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.

B. Corrosion Resistance: Materials used in the construction of chemical feeding equipment, shall be resistant to corrosive attacks from the chemicals. The following lists some of the suitable materials for the construction of the corresponding chemicals. Unless the manufacturer proposes more suitable materials, the list shall be adhered to:

Chemical	Suitable Handling Material
Chlorine Solution (Sodium Hypochlorite)	Hastelloy C (fair) Titanium (fair) PVC FRP (suitable grade) Viton Saran Teflon Polyethylene

2.10 APPURTENANCES

A. Nameplate: Each piece of equipment shall be provided with a stainless steel nameplate, indicating equipment characteristics, capacity, manufacturer, model number, and serial number.

B. Equipment Supports: Chemical feeding equipment and piping shall be firmly anchored. Fabricated supports exposed to chemical spills shall be of FRP. All anchor bolts, nuts, and washers of such supports shall be of non-metallic type.

C. Solenoid Valves: The equipment manufacturer shall furnish and install all solenoid valves which are part of the chemical feeding unit. The solenoid valve electrical rating shall be compatible with the equipment feeding unit. The solenoid valve electrical rating shall be compatible with the necessary conduit and wiring from the control panel to the solenoids.

D. Pressure Gauges: All chemical metering pumps, and other equipment, where shown, shall be equipped with pressure gauges with diaphragm seals in accordance with Division 17 except that the size of gauges on small metering pumps may be smaller than specified in the above section.

E. Safety Equipment: Where required by Code, all chemical unloading, storage, and feeding equipment shall be furnished with the necessary safety devices and warning signs, clearly visible.

F. Flexible Tubing: Provide a custom flexible connection with quick connects as shown on the contract drawings. The flexible connection shall be manufactured by Harrington Plastics or equal. The flexible connection shall consist of all 316 stainless steel: polypropylene braided overwrap, convoluted PTFE liner, and quick connects. The flexible connection shall be a minimum length of 2’-6” and shall allow for minimum horizontal and vertical deflection of 4%.

2.11 TOOLS AND SPARE PARTS

A. Tools: Special tools necessary for maintenance and repair of the equipment and one pressure grease gun for each type of grease required for the equipment shall be furnished as a part of the Work; such tools shall be suitably stored in metal tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

B. Spare Parts: Furnish spare seals, and gaskets, as required by the feed equipment sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Chemical feeding equipment shall be installed in accordance with governing safety standards, the Shop Drawings, and as indicated.

END OF SECTION 46 30 00