springville
WATER

BURT SPRINGS RENOVATION PROJECT

BIDDING DOCUMENTS VOLUME I

JULY 2023

HANSEN ALLEN & LUCE inc
ENGINEERS

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SPRINGVILLE CITY

BURT SPRINGS RENOVATION

BIDDING DOCUMENTS



Project Engineer

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MAY 2023

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BIDDING REQUIREMENTS

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ADVERTISEMENT FOR BIDS

Notice is hereby given that SPRINGVILLE CITY (OWNER) will accept bids for the construction of the BURT SPRINGS RENOVATION according to Drawings and Specifications prepared by ENGINEER - HANSEN, ALLEN & LUCE, INC., and described in general as:

> The work is comprised of the rehabilitation of the existing Burt Springs collection system consisting of new collection piping, concrete junction box, concrete spring box, bypass/overflow pipe, chain link fencing, concrete plug on existing collection pipe, and other appurtenances for a complete and operable spring collection system. The work also includes the construction of a new drinking water pump station consisting of a masonry block structure with pitched roof; furnishing and installing a 200 HP vertical turbine pump and a 40 HP vertical turbine pump, pump cans, pump motors, and VFD starters; pump station piping, bladder style surge tank, flow meters, and valves, drain piping, chlorination facilities, HVAC, electrical, controls; new SCADA Antenna, relocate existing radio antenna; relocation of aeration system panels and 2-inch diameter PVC piping, concrete flow meter vault, overflow structure; concrete sidewalks, concrete curb and gutter, paving, final site grading and restoration, exterior piping including a 16-inch diameter waterline with connection to the existing 12-inch diameter waterline; and all other associated items and appurtenant work.

Separate sealed bids will be received by OWNER in their office located at Springville City, 110 South Main, Springville, Utah 84663-1399 Attention: Bruce Riddle, Finance Director, until **2:00 p.m. on August 29, 2023,** and then at said office publicly opened and read aloud. Bids shall be addressed and delivered to the City offices prior to the bid opening.

Bidding Documents may be obtained on or after **August 7, 2023,** on-line at https://tinyurl.com/springvillebids. (From the link above, search for Springville City – Burt Springs Renovation). No paper copies of the Contract Documents will be available for purchase from Owner.

Bid security in the amount of 5% of the base bid will be required to accompany bids.

Prospective Bidders are required to attend a Pre-Bid Conference which will be held at Springville City Hall, 110 South Main, Springville, Utah at **1:30 p.m. on August 15, 2023**. The object of the conference is to acquaint Bidders with the site conditions, specifications, and to answer any questions which Bidders may have concerning the project.

All communication/questions relative to the project shall be submitted on-line (https://tinyurl.com/springvillebids) at the “Questions and Answers” section for this project. (From the link above, search for Springville City – Burt Springs Renovation)

OWNER reserves the right to reject any or all bids; or to accept or reject the whole or any part of any bid; or to waive any informality or technicality in any bid in the best interest of Springville City. Only bids giving a firm quotation properly signed will be accepted.

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DOCUMENT 00 21 13
INSTRUCTIONS TO BIDDERS

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.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither OWNER nor ENGINEER assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 OWNER and ENGINEER, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, within five days of OWNER's request Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be called for below.

ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.01 *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 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.

4.02 *Existing Site Conditions*

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify:

a. those reports known to OWNER of explorations and tests of subsurface conditions at or adjacent to the Site.
b. those drawings known to OWNER of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
c. reports and drawings known to OWNER relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
d. Technical Data contained in such reports and drawings.

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

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

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site are set forth in the Contract Documents and are based upon information and data furnished to OWNER and ENGINEER by owners of such Underground Facilities, including Owner, or others.

C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

4.03 *Site Visit and Testing by Bidders*

A. Bidder shall conduct the required Site visit during normal working hours and shall not disturb any ongoing operations at the Site. To arrange for access to the site please contact Shawn Barker with Springville City at 801-420-0421.

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

C. On request, and to the extent OWNER has control over the Site, and schedule permitting, OWNER will provide Bidder 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.

D. Bidder shall 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.

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

4.04 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an OWNER safety program. As the General Conditions indicate, if an OWNER safety program exists, it will be noted in the Supplementary Conditions.

4.05 *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 5 – BIDDER'S REPRESENTATIONS

5.01 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;

B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;

E. consider 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 Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;

F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. promptly give ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by ENGINEER is acceptable to Bidder;

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and

J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 6 – PRE-BID CONFERENCE

6.01 A pre-Bid conference will be held at the time and location stated in the invitation or advertisement to bid. The pre-Bid conference is mandatory. Representatives of OWNER and ENGINEER will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. ENGINEER will transmit to all prospective Bidders of record such Addenda as ENGINEER considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to ENGINEER in writing. Interpretations or clarifications considered necessary by ENGINEER in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to OWNER in an amount of 5 percent of Bidder’s maximum Bid price (determined by adding the base bid and all alternates) and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.

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 Documents, 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 Documents 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. Such forfeiture shall 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 seven days after the

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

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

ARTICLE 9 – CONTRACT TIMES

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

ARTICLE 10 – LIQUIDATED DAMAGES

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

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that ENGINEER authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by ENGINEER until after the Effective Date of the Contract.

11.02 All prices that Bidder sets forth in its Bid shall 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 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents (most commonly in the Specifications) to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

12.02 Subsequent to the submittal of the Bid, OWNER may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.

12.03 The apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to OWNER a list of the Subcontractors or Suppliers proposed for the following portions of the Work: **pumps and motors, electrical sub-contractor, variable frequency drive supplier, and flow meters**.

If requested by OWNER, such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If OWNER or ENGINEER, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, OWNER may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which

case apparent Successful Bidder shall submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and OWNER may consider such price adjustment in evaluating Bids and making the Contract award.

12.04 If apparent Successful Bidder declines to make any such substitution, OWNER may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity 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 7.06 of the General Conditions.

ARTICLE 13 – PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents.

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

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

13.02 A Bid by a corporation shall 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 shall be shown. The corporate seal shall be affixed and attested by the corporate secretary or an assistant corporate secretary.

13.03 A Bid by a limited liability company shall 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 shall be shown.

13.04 A Bid by an individual shall show the Bidder's name and official address.

13.05 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.

13.06 All names shall be printed in ink below the signatures.

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

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

13.09 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 – BASIS OF BID

14.01 *Unit Price*

A. Bidders shall 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.

14.02 *Allowances*

A. For cash allowances the Bid price shall 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 15 – SUBMITTAL OF BID

15.01 The Bid Form is to be completed and submitted with all the attachments outlined in Article 7 of the Bid Form.

15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall 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 shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation “BID ENCLOSED.” A mailed Bid shall be addressed to OWNER at address in Article 1.01 of Bid Form.

15.03 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 16 – MODIFICATION AND WITHDRAWAL OF BID

16.01 A 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.

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.

16.03 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, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 – OPENING OF BIDS

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

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 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 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 OWNER reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. OWNER will reject the Bid of any Bidder that OWNER finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the OWNER will reject the Bid as nonresponsive; provided that OWNER also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 If OWNER awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.

19.03 Evaluation of Bids

A. In evaluating Bids, OWNER will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

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.

C. <u>OWNER will consider the proposed date of completion provided by the Bidder on the Bid Form in the Bid Evaluation. OWNER reserves the right to award the Work to a higher responsive Bid if the higher responsive Bidder can complete the Work sooner than the lowest responsive Bid.</u>

19.04 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.

19.05 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 20 – BONDS AND INSURANCE

20.01 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 and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to OWNER, it shall be accompanied by required bonds and insurance documentation.

ARTICLE 21 – SIGNING OF AGREEMENT

21.01 When OWNER issues a Notice of Award to the Successful Bidder, it shall 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 shall 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 ten days thereafter, OWNER shall 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.

- END OF SECTION -

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DOCUMENT 00 41 43
BID FORM

Project Identification: Springville City – Burt Springs Renovation

Contract Identification and Number:

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

Springville City, 110 South Main, Springville, Utah 84663-1399

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 – BIDDER'S ACKNOWLEDGEMENTS

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

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

Addendum No.	Addendum, Date

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified

in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. 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 any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

G. 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.

H. Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents and confirms that the written resolution thereof by ENGINEER is acceptable to Bidder.

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

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

A. 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;

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

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

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;
2. "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;

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.

ARTICLE 5 – BASIS OF BID

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

BASE BID SCHEDULE					
Item No.	**Description**	**Estimated Quantities**	**Unit**	**Bid Unit Price**	**Bid Price**
1	Mobilization/Demobilization	1	LS		
2	Construction Surveying	1	LS		
3	Testing Agency Services	1	LS		
4	Preparation and Implementation of the Storm Water Pollution Prevention Plan (SWPPP)	1	LS		
5	Traffic Control	1	LS		
6	Site Clearing, Grubbing, and Excavation	1	LS		
7	Dewatering	1	LS		
8	Utility Potholing	4	EA		
9	14-inch Diameter Spring Collection Piping	305	LF		
10	36-inch Diameter Spring Collection Piping	86	LF		
11	Spring Clay Cut-Off Wall	391	LF		
12	Spring Junction Box at Sta 2+70.79	1	LS		
13	Spring Box at Sta 3+56.64	1	LS		
14	Existing 36-inch Spring Pipe Concrete Plug	1	LS		
15	16-inch Diameter PVC C900 DR18 Pipe With Fittings	77	LF		

BASE BID SCHEDULE					
Item No.	**Description**	**Estimated Quantities**	**Unit**	**Bid Unit Price**	**Bid Price**
16	Pump House Concrete Foundation and Slab	1	LS		
17	Pump House Masonry	1	LS		
18	Pump House Roof Framing	1	LS		
19	Pump House Finishes	1	LS		
20	Pump House Piping	1	LS		
21	200 HP Vertical Turbine Pump and Motor	1	LS		
22	40 HP Vertical Turbine Pump and Motor	1	LS		
23	Electrical System Complete	1	LS		
24	HVAC System Complete	1	LS		
25	CP-1 Main Control Panel	1	LS		
26	Flow Meter Vault	1	LS		
27	Overflow Structure	1	LS		
28	Relocation of Aeration Panels and Piping	1	LS		
29	Chlorination System Complete	1	LS		
30	Concrete Curb and Gutter APWA Plan 205.2	399	LF		
31	Concrete Slab-on-Grade	378	SF		
32	Asphalt Pavement Including Roadbase	505	SY		
33	6’ High Chain Link Fence	1340	LF		
34	16’ Wide Chain Link Double Swing Gate	1	EA		
35	Final Site Grading and Seeding	1	LS		
36	Surge Tank	1	LS		

BASE BID SCHEDULE					
Item No.	**Description**	**Estimated Quantities**	**Unit**	**Bid Unit Price**	**Bid Price**
Total Base Bid				**$**	

5.02 Bidder will complete the Work for the Additive Bid Item, if decided by OWNER to include in the Work, in accordance with the Contract Documents for the following price:

ADDITIVE/DEDUCTIVE BID SCHEDULE					
Item No.	**Description**	**Estimated Quantities**	**Unit**	**Bid Unit Price**	**Bid Price**
1	Extend 16-inch Pipe to Tank	1	LS		
2	Replace Existing VFD with New VFD for 40 HP Pump	1	LS		

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

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement or the Work will be substantially complete by _____. (Bidder to provide alternate substantial completion date no later than date indicated in the Agreement.)

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

ARTICLE 7 – ATTACHMENTS TO THIS BID

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

A. Required Bid security (Section 00 43 12);

B. Contractors Qualifications and Experience Affidavit (Section00 42 00);

C. List of Proposed Subcontractors and Suppliers (Section 00 45 30);

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

E. Contractor's License No.: _____

ARTICLE 8 – DEFINED TERMS

8.01 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 9 – BID SUBMITTAL

9.01 This Bid is submitted by:

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____ SEAL, if required

(Individual's signature)

Doing business as:

_____

A Partnership

Partnership Name: _____

By: _____ SEAL, if required

(Signature of general partner -- attach evidence of authority to sign)

Name (typed or printed):

_____

A Corporation

Corporation Name:

_____

State or Jurisdiction of Incorporation: _____

Type (General Business, Profession, Service, Limited Liability):

_____

By: _____

(Signature -- attach evidence of authority to sign)

Name (typed or printed):

_____

Title: _____

Attest _____ CORPORATE SEAL, if required by State

(Signature of Corporate Secretary)

Date of Qualification to do business in _____ [State or other jurisdiction where Project is located] is ___/___/_____

A Joint Venture

Name of Joint Venture:

_____

SEAL, if required by State

First Joint Venture Name: _____

By: _____

(Signature of joint venture partner -- attach evidence of authority to sign)

Name (typed or printed):

_____

Title: _____

Second Joint Venture Name:

_____

SEAL, if required by State

By: _____

(Signature of joint venture partner -- attach evidence of authority to sign)

Name (typed or printed):

_____

Title: _____

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

Bidder's Business address: _____

_____

Business Phone No. (_____)_____

Business FAX No. (_____)_____

Business E-Mail Address

_____

State Contractor License No. _____. (If applicable)

Employer's Tax ID No. _____

Phone and FAX Numbers, and Address for receipt of official communications, if different from Business contact information:

_____

_____

9.02 Bid submitted on _____, 20___.

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DOCUMENT 00 42 00
CONTRACTOR'S QUALIFICATION AND EXPERIENCE AFFIDAVIT

The Bidder shall furnish the following information. Failure to comply with this requirement will render the Bid non-responsive and may cause its rejection. Additional sheets shall be attached as required.

A. CONTRACTOR's name and Address:

_____

_____

B. CONTRACTOR=s Representative: _____

C. CONTRACTOR's Telephone Number: _____

D. CONTRACTOR's License: Primary Classification _____

State License No. _____

Supplemental Classifications held, if any. _____

E. Number of years as a contractor in Construction Work of this type: _____

F. Names and titles of Principal Officers of CONTRACTOR's Firm:

_____

Name Title

_____

Name Title

_____

Name Title

G. Name of person who inspected site of proposed work for your firm:

Name: _____ Date of Inspection: _____

H. Name, address, and telephone number of surety company and agent who will provide the required bonds on this Contract:

_____

_____

I. A certified copy of financial statement prepared during current fiscal year as prepared for bank or bonding company will not be required with submission of the bid, but may be required by the OWNER of the apparent successful bidder prior to award as part of the evaluation and review process.

J. List of current jobs now under construction (use additional sheets if necessary):

	Client Reference	Telephone No.	Dollar Amt.	Type of Job
1.				
2.				
3.				
4.				

K. List similar projects (regardless of size) completed within the last ten years (use additional sheets if necessary). **CONTRACTOR must have successfully completed at least one (1) spring development project.**

	Client Reference	Telephone No.	Dollar Amt.	Type of Job
1.				
2.				
3.				
4.				
5.				

L. Have you ever failed to complete any work awarded to you? If so, when, where and why?

M. List your major equipment available for this Contract (use additional sheets if necessary):

CONTRACTOR's Signature

- END OF DOCUMENT -

DOCUMENT 00 43 12
BID BOND

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

BIDDER *(Name and Address)*:

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

OWNER *(Name and Address)*:
Springville City
110 South Main
Springville, UT 84663-1399

BID
Bid Due Date: May 25, 2023
Description: **Burt Springs Renovation**

BOND
Bond Number:
Date:
Penal sum _____ $ _____
(Words) (Figures)

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

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
Title	Title

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

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators,

successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur 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 shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, 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 shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

DOCUMENT 00 45 30
LIST OF SUBCONTRACTORS AND SUPPLIERS

The bidder shall list below the names and business address of each subcontractor or supplier for the items listed below and for those not listed below who will perform Work under this Contract in excess of five percent (0.05) of the total bid price and shall also list the portion of the work which will be done by such subcontractor or supplier. After the opening of proposals, no changes or substitutions will be allowed without the written approval of OWNER.

NOTE: Attach additional sheets, if required.

WORK TO BE PERFORMED	SUBCONTRACTOR'S NAME AND ADDRESS
1. Vertical Turbine Pumps and Motors	
2. Electrical Subcontractor	
3.Variable Frequency Drives	
4.Flow Meters	
5.Chlorination System	
6.	
7.	

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PART 2
CONTRACT FORMS

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DOCUMENT 00 51 00
NOTICE OF AWARD

Date of Issuance:		
Owner:	Springville City	Owner's Contract No.:
Engineer:	Hansen, Allen & Luce, Inc.	Engineer's Project No.: 260.42.210
Project:	Burt Springs Renovation	Contract Name:
Bidder:		
Bidder's Address:		

TO BIDDER:

You are notified that OWNER has accepted your Bid dated _____, 2023 for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

The work is comprised of the rehabilitation of the existing Burt Springs collection system consisting of new collection piping, concrete junction box, concrete spring box, bypass/overflow pipe, chain link fencing, concrete plug on existing collection pipe, and other appurtenances for a complete and operable spring collection system. The work also includes the construction of a new drinking water pump station consisting of a masonry block structure with pitched roof; furnishing and installing a 200 HP vertical turbine pump and a 40 HP vertical turbine pump, pump cans, pump motors, and VFD starters; pump station piping, flow meters, and valves, drain piping, chlorination facilities, HVAC, electrical, controls; relocation of aeration system panels and 2-inch diameter PVC piping, concrete flow meter vault, overflow structure; concrete sidewalks, concrete curb and gutter, paving, final site grading and restoration, exterior piping including a 16-inch diameter waterline with connection to the existing 12-inch diameter waterline; and all other associated items and appurtenant work.

The Contract Price of the awarded Contract is: $_____ (subject to unit prices including _____)

Three 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.

A set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 10 calendar days of the date of receipt of this Notice of Award:

1. Deliver to OWNER three counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security (*performance and payment bonds)* and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.

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

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

Owner Springville City

Authorized Signature

By:

Title:

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DOCUMENT 00 52 00
AGREEMENT

THIS AGREEMENT is by and between _____ ("Owner") and _____("Contractor").

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 is comprised of the rehabilitation of the existing Burt Springs collection system consisting of new collection piping, concrete junction box, concrete spring box, bypass/overflow pipe, chain link fencing, concrete plug on existing collection pipe, and other appurtenances for a complete and operable spring collection system. The work also includes the construction of a new drinking water pump station consisting of a masonry block structure with pitched roof; furnishing and installing a 200 HP vertical turbine pump and a 40 HP vertical turbine pump, pump cans, pump motors, and VFD starters; pump station piping, bladder style surge tank, flow meters, and valves, drain piping, chlorination facilities, HVAC, electrical, controls; new SCADA Antenna, relocate existing radio antenna; relocation of aeration system panels and 2-inch diameter PVC piping, concrete flow meter vault, overflow structure; concrete sidewalks, concrete curb and gutter, paving, final site grading and restoration, exterior piping including a 16-inch diameter waterline with connection to the existing 12-inch diameter waterline; and all other associated items and appurtenant work.

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Springville City – Burt Springs Renovation

ARTICLE 3 – ENGINEER

3.01 The Project has been designed by Hansen, Allen & Luce, Inc.

3.02 The Owner has retained Hansen, Allen & Luce, Inc. ("Engineer") to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

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

4.02 *Contract Times: Dates*

A. The Work will be substantially completed on or before October 2, 2025, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before November 7, 2025. The Contractor will have 480

days to complete the work commencing on the day construction activities begin at the site. Offsite work, such as submittals processing, equipment procurement, and fabrication can begin after receiving the Notice to Proceed and will not be counted in the 480 day time limit.

4.03 *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 times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. 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 $500.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A 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 Time (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $250.00 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 Substantial Completion and final completion are not additive and will not be imposed concurrently.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraph 5.01.A below:

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

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 1st 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 Work completed (with the balance being retainage). If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

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

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 97.5 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 100 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

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

ARTICLE 7 – INTEREST

7.01 All amounts not paid when due shall bear a maximum interest rate of up to or equal to Owner's maximum interest rate, but in no case greater than 4 percent per annum.

7.02 All moneys held in retainage as provided in Article 6.02A of this Agreement shall be placed in an escrow account. Accrued interest shall be to the benefit of the Contractor.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

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

A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.

B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have

been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. 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 Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.

F. 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.

G. 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.

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

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

J. 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.

K. CONTRACTOR understands that OWNER has pre-ordered certain equipment for this project. Procurement Contracts are included in Appendix A. CONTRACTOR has included the cost of this pre-ordered equipment in the Bid, and has included all appropriate shipping and handling and sales tax. CONTRACTOR understands that when a Notice of Award is issued to CONTRACTOR, the procurement contracts OWNER has entered into with the various vendors will be assigned to CONTRACTOR (form Section 00 43 30 Purchase Order Assignment shall be executed), and CONTRACTOR from that date forward accepts full liability for the final purchase, delivery, installation, start-up, and warrantee of this equipment. Assignment of Procurement Contracts relieves OWNER of all liability associated with the Procurement Contracts.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

A. The Contract Documents consist of the following:

1. This Agreement (pages 1 to 8, inclusive).
2. Performance bond (pages 1 to 4, inclusive).
3. Payment bond (pages 1 to 4, inclusive).
4. General Conditions (pages 1 to 78, inclusive).
5. Supplementary Conditions (pages 1 to 12, inclusive).

6. Specifications as listed in the table of contents of the Project Manual.
7. Drawings (not attached but incorporated by reference) consisting of 58 sheets with each sheet bearing the following general title “Burt Springs Renovation” as listed in the Index of Drawings on Sheet G-2 of said drawings.
8. Addenda (numbers # to #, inclusive).
9. Exhibits to this Agreement, identified as follows:
    a. Exhibit A - Notice of Award – Document 00 51 00
    b. Exhibit B – Notice to Proceed – Document 00 55 00
    c. Exhibit C – Contractor’s Bid (including Documentation Accompanying Bid)
    d. Exhibit D – Insurance Certificates
10. Appendices to this Agreement, identified as follows:
    a. None

B. The documents listed in Paragraph 9.01.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 9.

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

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

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

10.02 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto 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 Documents.

10.03 *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.

10.04 *Severability*

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part

thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 *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 10.05:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing 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.

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

This Agreement will be effective on _____, 2023 (which is the Effective Date of the Contract).

OWNER:	CONTRACTOR:
Springville City	.
By:	By:
Title:	Title:
	(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest:	Attest:
Title:	Title:
Address for giving notices:	Address for giving notices:
Springville City	,
110 South Main	
Springville, Utah 84663-1399	
	License No.: _____ *(where applicable)*
(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)	*NOTE TO USER: Use in those states or other jurisdictions where applicable or required.*

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DOCUMENT 00 55 00

NOTICE TO PROCEED

Owner:	Springville City	Owner's Contract No.:	
Contractor:		Contractor's Project No.:	
Engineer:	Hansen, Allen & Luce, Inc.	Engineer's Project No.:	260.42.210
Project:	Burt Springs Renovation	Contract Name:	
		Effective Date of Contract:	

TO CONTRACTOR:

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

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

Before starting any Work at the Site, Contractor must comply with the following:
[Note any access limitations, security procedures, or other restrictions]

Owner**:** Springville City

Authorized Signature

By:

Title:
Date

Copy: Engineer

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DOCUMENT 00 61 13
PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER: Springville City
110 South Main,
Springville, UT 84663

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description: Burt Springs Renovation

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

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

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	**Attest:** _____
Signature	Signature
_____	_____
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 shall be 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 shall 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 shall 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 shall 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 shall 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 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

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

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

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

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

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

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

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

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

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall 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;

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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 shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than 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 may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after 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 shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall 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 shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall 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 shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:

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DOCUMENT 00 61 14
PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER: Springville City
110 South Main,
Springville, UT 84663

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description: Burt Springs Renovation

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 18

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

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	**Attest:** _____
Signature	Signature
_____	_____
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 shall be 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 shall 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 shall 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 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation shall 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 shall 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 shall 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

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the Contractor in the performance of the Construction Contract are dedicated to satisfy 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 shall 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 shall be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall 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 shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall 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:

    1. The name of the Claimant;
    2. The name of the person for whom the labor was done, or materials or equipment furnished;
    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;
    4. A brief description of the labor, materials, or equipment furnished;
    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;
    6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
    7. The total amount of previous payments received by the Claimant; and
    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 shall be 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

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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 shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

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DOCUMENT 00 62 50

Certificate of Substantial Completion

Project: Burt Springs Renovation	
Owner: Springville City	Owner's Contract No.:
Contract:	Engineer's Project No.: 260.42.210

This [tentative] [definitive] Certificate of Substantial Completion applies to:

☐ All Work under the Contract Documents: ☐ 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 Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

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

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

☐ Amended Responsibilities ☐ Not Amended

Owner's Amended Responsibilities:

Contractor's Amended Responsibilities:

The following documents are attached to and made 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.

Executed by Engineer	Date
Accepted by Contractor	Date
Accepted by Owner	Date

DOCUMENT 00 63 63

Change Order No. _____

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

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

Description:

Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE	**CHANGE IN CONTRACT TIMES** *[note changes in Milestones if applicable]*
Original Contract Price: $_____	Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: $_____	[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: Substantial Completion: _____ Ready for Final Payment: _____ days
Contract Price prior to this Change Order: $_____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] of this Change Order: $_____	[Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
Contract Price incorporating this Change Order: $_____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ days or dates

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer (if required)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title _____	Title _____
Date: _____	Date _____	Date _____

Approved by Funding Agency (if applicable)

By: _____ Date:

Title: _____

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PART 3
CONDITIONS OF CONTRACT

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SECTION 00 72 00
GENERAL CONDITIONS

The General Conditions to be used for the Project are the Standard General Conditions of the Construction Contract prepared by Engineers Joint Contract Documents Council (No. EJCDC C-700, 2018 Edition) as included in this Section.

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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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SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (No. EJCDC C-700, 2018 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

The terms used in these supplementary conditions which are defined in the standard general conditions of the construction contract (EJCDC C-700, 2018 edition) have the meanings assigned to them in the general conditions.

ARTICLE 2 – PRELIMINARY MATTERS

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 executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies of insurance (including all endorsements, and identification of applicable self-insured retentions and deductibles) required to be provided by Contractor in Article 6. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

C. Evidence of Owner's Insurance: After receipt from Contractor of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner under Article 6 (if any). Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

SC-2.02.A Delete Paragraphs 2.02.A and B in their entirety and insert the following Paragraph 2.02.A. to read as follows:

A. Owner shall furnish to Contractor one copy in electronic portable document format (PDF) of the conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract. Printed copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction. The PDF of the Specifications shall be in 8-1/2" x 11" format and Drawings shall be in 11"x17" format.

SC-2.06.D Add the following new Paragraph immediately after Paragraph 2.06.C:

D. Requests by Contractor for Electronic Documents in Other Formats

1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.

2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor ("Request") in formats other than those identified in the Electronic

Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner's response to the Request, and to the following conditions to which Contractor agrees:

a. The content included in the Electronic Documents created by Engineer and covered by the Request was prepared by Engineer as an internal working document for Engineer's purposes solely, and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, but not limited to any implied warranties of fitness for any purpose. As such, Contractor is advised and acknowledges that the content may not be suitable for Contractor's application, or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.

b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Engineer to Contractor under the request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.

c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from Contractor's use, adaptation, or distribution of any Electronic Documents provided under the Request.

d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

SC-3.01.C Delete Paragraph 3.01.C in its entirety.

SC-3.03.B Add the following new Paragraph immediately after Paragraph 3.03.B:

C. In the event of an inconsistency between provisions in any of the contract documents, the order of precedence shall be established by the most stringent of the criteria and conditions.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.01.A Delete paragraph 4.01.A of the General Conditions and insert the following in its place:

The Contract Times will commence to run on the day indicated in the Notice to Proceed. Any Work undertaken by CONTRACTOR prior to the date indicated in the Notice to Proceed will be entirely at his own risk.

SC-4.03.A Delete paragraph 4.03.A of the General Conditions and insert the following in its place:

A. Owner shall provide engineering survey control (which in Engineer's judgment are necessary to enable Contractor to proceed with the Work) with which the Contractor shall establish reference points for construction. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

ARTICLE 5 – SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL 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 Investigation – Burt Springs Collection Gallery and Booster Station, 2900 East Canyon Road, Springville, Utah prepare by Applied Geotechnical Engineering Consultants, Inc. (AGEC)	*December 24, 2015*	*boring logs; recorded measurements of subsurface water levels; laboratory test results*

F. There are not any known drawings of existing physical conditions at or adjacent to the Site, that contain Technical Data upon which Contractor may rely.

SC 5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:

A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.

B. Not Used.

ARTICLE 6 – BONDS AND INSURANCE

SC 6.03.D Add the following new paragraphs immediately after to Paragraph 6.03.C:

D. Automobile liability insurance shall be comprehensive form and shall cover owned, hired, and non-owned vehicles.

E. *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: Hegerhorst Power Engineering, Inc., Conder Engineering.*

F. *The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:*

1. *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

State:		Statutory
Federal, if applicable (e.g., Longshoreman's):		Statutory
Employer's Liability:		
Bodily injury, each accident	$	2,000,000
For work performed in monopolistic states, stop-gap liability coverage shall be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	$	
Foreign voluntary worker compensation		Statutory

G. 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.

H. *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.

I. *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.

2. Contractor's Commercial General Liability – Minimum Policy Limits

General Aggregate (except products completed operations)	$ 2,000,000
Products - Completed Operations Aggregate	$ 2,000,000
Personal and Advertising Injury	$ 2,000,000
Each Occurrence (Bodily Injury and Property Damage)	$ 2,000,000

Property Damage Liability Insurance will provide Explosion, Collapse, and Underground coverages where applicable.

3. Excess Liability in Umbrella form:

Each Occurrence	$ 2,000,000
General Aggregate	$ 4,000,000

4. 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:*

Bodily Injury:	
Each person	$ 2,000,000
Each accident	$ 2,000,000
Property Damage	
Each Accident	$ 2,000,000
Combined Single Limit (Bodily Injury, Property Damage) Each accident)	$ 2,000,000

5. Contractor's Pollution Liability:

Each Occurrence	$ NA
General Aggregate	$ NA

☒ If box is checked, Contractor is not required to provide Contractor's Pollution Liability insurance under this Contract

6. Other person, or entities (other than those already listed in the General Conditions) to be included on the policy as additional insureds shall include:

   (1) Springville City, its officers, employees, agents, and volunteers.

   (2) Hansen, Allen & Luce, Inc. and its' subconsultants

   (3) Other Engineering or testing groups employed by OWNER for work at the site or this Project.

7. Contractor's Professional Liability:

Each Claim	$ NA
Annual Aggregate	$ NA

L. Umbrella or Excess Liability: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The

coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$1,000,000
General Aggregate	$2,000,000

M. 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.

SC-6.05. Add the following to the list of requirements in Paragraph 6.05.A, as a numbered item:

13. include by express endorsement coverage of damage to Contractor's equipment.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.03.C Amend the first and second sentences of Paragraph 7.02.C to state "…all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor shall not perform Work on a Saturday, Sunday, or any legal holiday without written authorization from *Springville City*."

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

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

For purposes of administering the foregoing requirement, additional overtime costs are defined as any hours over 8 hours on any regular workday and any hours worked on Saturday, Sunday, and any legal holiday.

ARTICLE 8 – OTHER WORK AT THE SITE

SC-8.02 Add a new paragraph immediately after paragraph 8.02.B of the General Conditions which is to read as follows:

C. Should CONTRACTOR cause damage to the work or property of any separate contractor at the site, or should any claim arising out of CONTRACTOR's performance of the Work at the site be made by any separate contractor against CONTRACTOR, OWNER, ENGINEER, ENGINEER's

Consultants, the Construction Coordinator or any other person, CONTRACTOR shall promptly attempt to settle with such other contractor by agreement, or otherwise resolve the dispute by arbitration or at law. CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold OWNER, ENGINEER, ENGINEER's Consultants and the Construction Coordinator harmless from and against all claims, damages, losses and expenses (including, but not limited to, fees of engineers, architects, attorneys and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any separate contractor against OWNER, ENGINEER, ENGINEER's Consultants or the Construction Coordinator to the extent based on a claim arising out of CONTRACTOR's performance of the Work. Should a separate contractor cause damage to the Work or property of CONTRACTOR or should the performance of Work by any separate contractor at the site give rise to any other claim, CONTRACTOR shall not institute any action, legal or equitable, against OWNER, ENGINEER, ENGINEER's Consultants or the Construction Coordinator or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from OWNER, ENGINEER, ENGINEER's Consultants or the Construction Coordinator on account of any such damage or claim. If CONTRACTOR is delayed at any time in performing or furnishing Work by any act or neglect of a separate contractor and OWNER and CONTRACTOR are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, CONTRACTOR may make a claim for an extension of times in accordance with Article 11. An extension of the Contract Times shall be CONTRACTOR's exclusive remedy with respect to OWNER, ENGINEER, ENGINEER's Consultants and Construction Coordinator for any delay, disruption, interference or hinderance caused by any separate contractor. This paragraph does not prevent recovery from OWNER, ENGINEER, ENGINEER's Consultant or Construction Coordinator for activities that are their respective responsibilities.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

No changes to the General Conditions in this Article.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

C. The Resident Project Representative (RPR) will be Engineer's representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.

1. General: RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.

2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.

3. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.

4. 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 proper execution of the Work.

5. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

6. Shop Drawings and Samples:

    a. Record date of receipt of Samples and Contractor-approved Shop Drawings.

    b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

    c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.

7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.

8. Review of Work and Rejection of Defective Work:

    a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.

    b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

9. Inspections, Tests, and System Start-ups:

    a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.

b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.

10. Records:

    a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

    b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

    c. Maintain records for use in preparing Project documentation.

11. Reports:

    a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.

    b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.

    c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

13. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

14. Completion:

    a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.

    b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.

    c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.

D. The RPR shall 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 Contractor’s work.
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. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

11 – CHANGES TO THE CONTRACT

No changes to the General Conditions in this Article.

12 – CLAIMS

No changes to the General Conditions in this Article.

13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC 13.03.E Delete Paragraph 13.03.E.1 in its entirety and insert the following in its place:

1. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:
   a. if the extended price of a particular item of Unit Price Work amounts to 25 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. if there is no corresponding adjustment with respect to any other item of Work; and
   c. if Contractor believes that Contractor has incurred additional expense as a result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, Owner may make a Claim, seeking an adjustment in the Contract Price.

ARTICLE 14 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

No changes to the General Conditions in this Article.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

SC 15.01.B.1 The first sentence of paragraph 15.01.B.1 of the general conditions is hereby deleted in its entirety and the following is substituted in lieu thereof:

1. At least thirty (30) 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.

SC 15.01.B Add the following new paragraphs immediately following paragraph 4:

5. Interest on Retainage: If the Contractor seeks to obtain interest on the retainage held by the Owner, it shall be the responsibility of the Contractor to establish an escrow account in the name of the Owner for said retainage. This account shall be established prior to the issuance of notice to proceed. If no account is established by this time, the Contractor hereby waives and forfeits any claim to interest on retainage against the Owner.

6. As partial payments are made; two checks will be issued by the Owner: one check to the Contractor for the requested amount less retainage and a second check to the escrow account for retainage. At the time of final payment, the escrow amount will be released to the Contractor by the Owner. If the Contractor has set up an interest-bearing account as described, the accrued interest, if any, will also be paid to the Contractor by the Owner as part of the final payment.

SC15.01.D.1. The first sentence of paragraph 15.01.D.1 of the general conditions is hereby deleted in its entirety and the following is substituted in lieu thereof:

1. *The Engineer will, within ten days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER or return the Application to CONTRACTOR indicating in writing ENGINEER's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application.* Twenty days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner setoffs) will become due, and when due will be paid by Owner to Contractor.

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

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

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

No changes to the General Conditions in this Article.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

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

17.02 Arbitration

All matters subject to final resolution under this Article will be decided by arbitration in accordance with the rules of the State of Utah, subject to the conditions and limitations of this paragraph. This agreement to arbitrate and any other agreement or consent to arbitrate entered into 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 arbitrator or arbitration provider, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in this Article, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event shall any such demand be made after the date when institution of legal or equitable proceedings based on such 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.

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 an 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 a 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 shall 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 is necessary if complete relief is to be afforded among those who are already parties to the arbitration; and

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 rendered by the arbitrator(s) shall be consistent with the agreement of the parties, in writing, and include a concise breakdown of the award, and a written explanation of the award specifically citing the Contract provisions deemed applicable and relied on in making the award.*

I. *The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.*

J. *The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor.*

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.

ARTICLE 18 – MISCELLANEOUS

No changes to the General Conditions in this Article.

- END OF DOCUMENT -

PART 4
TECHNICAL SPECIFICATIONS

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.1 GENERAL

A. The Work to be performed under this Project shall consist of furnishing all labor, materials, and equipment necessary or required to complete the work in all respects as shown on the Contract Drawings and as herein specified. All work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary to complete the construction of the Work in good faith shall be performed, furnished, and installed by CONTRACTOR as though originally so specified or shown, at no increase in cost to OWNER.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The work is comprised of the rehabilitation of the existing Burt Springs collection system consisting of new collection piping, concrete junction box, concrete spring box, bypass/overflow pipe, chain link fencing, concrete plug on existing collection pipe, and other appurtenances for a complete and operable spring collection system. The work also includes the construction of a new drinking water pump station consisting of a masonry block structure with pitched roof; furnishing and installing a 200 HP vertical turbine pump and a 40 HP vertical turbine pump, pump cans, pump motors, and VFD starters; pump station piping, bladder style surge tank, flow meters, and valves, drain piping, chlorination facilities, HVAC, electrical, controls; new SCADA Antenna, relocate existing radio antenna; relocation of aeration system panels and 2-inch diameter PVC piping, concrete flow meter vault, overflow structure; concrete sidewalks, concrete curb and gutter, paving, final site grading and restoration, exterior piping including a 16-inch diameter waterline with connection to the existing 12-inch diameter waterline; and all other associated items and appurtenant work.

B. The work is located at approximately 2900 East Canyon Road, Springville, Utah.

1.3 CONTRACT METHOD

A. The Work hereunder will be constructed under a single unit price contract.

1.4 CONTRACTOR USE OF PROJECT SITE

A. CONTRACTOR's use of the Project Site shall be limited to its construction operations, including on-site storage of materials and on-site fabrication facilities.

1.5 PROJECT SECURITY

A. CONTRACTOR shall make all necessary provisions to protect the Project and CONTRACTOR's facilities from fire, theft, and vandalism, and the public from unnecessary exposure to injury.

1.6 CHANGES IN THE WORK

A. It is mutually understood that it is inherent in the nature of public works construction that some changes in the plans and specifications may be necessary during the course of

construction to adjust them to unforeseen field conditions, and that it is of the essence of the Contract to recognize a normal and expected margin of change. ENGINEER shall have the right to make such changes, from time to time, in the plans, in the character of the Work, and in the scope of the Project as may be necessary or desirable to ensure the completion of the Work in the most satisfactory manner without invalidating the Contract.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

SECTION 01 14 00

WORK RESTRICTIONS

PART 1 GENERAL

A. OWNER and/or utility owners may be working within the Project area while this Contract is in progress. If so, CONTRACTOR shall schedule Work in conjunction with these other entities to minimize mutual interference.

B. All compaction and other testing requirements specified shall be provided and paid for by CONTRACTOR.

C. CONTRACTOR shall notify ENGINEER of the schedule for materials testing as required in Section 01 45 00 Quality Control and Materials Testing and Section 01 45 23 Testing and Inspection Services a minimum of 24 hours in advance to provide ENGINEER time to be present during desired testing. CONTRACTOR shall be responsible for obtaining copies of testing reports or data and ensuring that the Work is in full compliance with the Contract Documents.

D. CONTRACTOR shall notify owners of Private rights-of-way 72 hours prior to work being performed across owner's right-of-way.

E. If required to work in City Streets or Utah Department of Transportation (UDOT) right-of-way, CONTRACTOR shall notify right-of-way owner 72 hours prior to work being performed therein. Work within the City Streets or UDOT right-of-way shall be in accordance with required permits and any license agreement with OWNER. CONTRACTOR shall obtain and comply with all required permits.

F. CONTRACTOR must work with all adjacent property owners to ensure no harm or damage is caused to homes or property during construction of the project.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

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SECTION 01 22 00
MEASUREMENT AND PAYMENT

PART 1 GENERAL

A. All work completed under this contract shall be in accordance with the Contract Drawings and Specifications and will be measured by ENGINEER/OWNER. The quantities appearing on the Bid Schedule are approximate only and are prepared for the comparison of bids. Payment to CONTRACTOR on bid items with unit prices other than "Lump Sum" will be made for actual quantities of work performed and accepted, or material furnished in accordance with the Contract. The scheduled quantities of work to be done and materials to be furnished may be increased or decreased in accordance with the General Conditions.

B. The term "Lump Sum" when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure, portion of work, or unit is specified "Lump Sum" as the unit of measurement, the unit will include fittings, accessories, and all work necessary to complete the work as shown on the Contract Drawings and as specified.

C. When the accepted quantities of work vary from the quantities in the Bid Schedule, CONTRACTOR shall accept as payment in full, so far as contract items are concerned, payment at the original contract unit prices for the work done. OWNER reserves the right to add to or delete from quantities listed in the bid schedule in order to match the total bid with the budgeted money available.

1.2 BASE BID SCHEDULE

A. BID ITEM NO. 1 - "MOBILIZATION/DEMOBILIZATION"

1. **GENERAL** This bid item is provided to cover CONTRACTOR's cost for general and miscellaneous responsibilities and operations not normally attributed to any other single bid item within this schedule. Mobilization shall be limited to 5% of the Total Base Bid amount. This shall include, but is not limited to, work described or enumerated in Section 01 71 13 - Mobilization.

2. **METHOD OF MEASUREMENT "**Mobilization/Demobilization" shall not be measured but shall be paid for on a lump sum basis for the completion of the work as required in Section 01 71 13 - Mobilization.

3. **BASIS OF PAYMENT** Payment for "Mobilization/Demobilization" will be made at the contract lump sum bid price. Payments will be made in accordance with the following schedule:
   a. When 10% of the original contract amount is earned, 25% of the amount bid for mobilization/demobilization will be paid.
   b. When 25% of the original contract amount is earned, an additional 25% for a total of 50% of the amount bid for mobilization will be paid.
   c. When 50% of the original contract amount is earned, an additional 25% for a total of 75% of the amount bid for mobilization will be paid.
   d. When 75% of the original contract amount is earned, an additional 25% for a total of 100% of the amount bid for mobilization will be paid.

A. **BID ITEM NO. 2 - "CONSTRUCTION SURVEYING"**

1. **GENERAL** This item is provided to cover CONTRACTOR's cost for general and miscellaneous responsibilities and operations associated with Construction Surveying. "Construction Surveying" shall be performed by a Utah registered professional land surveyor.
2. **METHOD OF MEASUREMENT** "Construction Surveying" shall be measured based on the percentage of work completed for the project according to the amount defined in the Bid Schedule.
3. **BASIS OF PAYMENT** Payment for "Construction Surveying" will be made at the contract lump sum bid price as shown and accepted by OWNER and ENGINEER in the Bid Schedule. Payments will be made in accordance with the following schedule:
   a. When 5% of the original contract amount is earned, 50% of the amount bid for construction surveying will be paid.
   b. When 75% of the original contract amount is earned, an additional 50% for a total of 100% of the amount bid for "Construction Surveying" will be paid.

B. **BID ITEM NO. 3 - "TESTING AGENCY SERVICES"**

1. **GENERAL** This item is provided to cover CONTRACTOR's cost for general and miscellaneous responsibilities and operations associated with materials testing. This item shall include, but is not limited to, work described or enumerated in Section 01 45 23 - Testing Agency Services and Section 01 45 00 - Quality Control and Materials Testing.
2. **METHOD OF MEASUREMENT** "Testing Agency Services" shall be measured based on the percentage of work completed for the project according to the amount defined in the Bid Schedule.
3. **BASIS OF PAYMENT** Payment for "Testing Agency Services" will be made at the contract lump sum bid price as shown and accepted by OWNER and ENGINEER in the Bid Schedule. Payments will be made in accordance with the following schedule:
   a. When 10% of the original contract amount is earned, 25% of the amount bid for "Testing Agency Services" will be paid.
   b. When 25% of the original contract amount is earned, an additional 25% for a total of 50% of the amount bid for "Testing Agency Services" will be paid.
   c. When 50% of the original contract amount is earned, an additional 25% for a total of 75% of the amount bid for "Testing Agency Services" will be paid.
   d. When 75% of the original contract amount is earned, an additional 25% for a total of 100% of the amount bid for "Testing Agency Services" will be paid.

C. **BID ITEM NO. 4 - "PREPARATION AND IMPLEMENTATION OF THE STORM WATER POLLUTION PREVENTION PLAN (SWPPP)"**

1. **METHOD OF MEASUREMENT** "Preparation and Implementation of the Storm Water Pollution Prevention Plan (SWPPP)" shall be paid for on a lump sum basis for the implementation of the approved Plan as completed by CONTRACTOR.
2. **BASIS OF PAYMENT** Payment for "Preparation and Implementation of the Storm Water Pollution Prevention Plan (SWPPP)" shall be paid for at the lump sum bid price as a percentage of work completed. Payment shall be considered full compensation for preparing of an approved plan and implementation thereof. The implementation shall include as necessary installing and maintaining silt fences, rock filled bags or straw bales for inlet protection, a 20' coarse aggregate construction

entrance, and monitoring and maintaining the requirements of the SWPPP, preparation of required reports, and meeting all other requirements of the Utah Division of Water Quality and Springville City.

D.BID ITEM NO. 5 - "TRAFFIC CONTROL"

1. **GENERAL** This bid item is provided to cover CONTRACTOR's cost for general and miscellaneous responsibilities and operations related to pedestrian, bicycle, and vehicle traffic control.
2. **METHOD OF MEASUREMENT** "Traffic Control" shall not be measured, but shall be paid for on a lump sum basis for the completion of the work.
3. **BASIS OF PAYMENT** Payment for "Traffic Control" will be made at the contract lump sum bid price. Payments will be made in accordance with the following schedule:
   a. When 5% of the original contract amount is earned, 50% of this bid item will be paid.
   b. When 50% of the original contract amount is earned, 30% of this bid item will be paid.
   c. When 90% of the original contract amount is earned, 20% of this bid item will be paid.

E.BID ITEM NO. 6 - "SITE CLEARING, GRUBBING, AND EXCAVATION"

1. **METHOD OF MEASUREMENT** "Site Clearing, Grubbing, and Excavation" shall be paid for on a lump sum basis according to the amount defined in the Bid Schedule and as completed by CONTRACTOR.
2. **BASIS OF PAYMENT** Payment for "Site Clearing, Grubbing, and Excavation" shall be made at the contract lump sum bid price for CONTRACTOR to remove, transport, disposal, applicable dumping fees, cleanup of waste materials, and related costs for clearing, grubbing and stripping which includes removing all unwanted material from the surface and subsurface within the project limits such as trees, vegetation, boulders, stumps, roots, buried logs, and other debris; excavation to subgrade, and excavation of unsuitable material as required below proposed structures; and all other incidentals not specifically paid for in other bid items but which are shown or otherwise required to complete the installation as herein described and as shown on the Contract Drawings.

F.BID ITEM NO. 7 - "DEWATERING"

1. **GENERAL** This item is provided to cover the CONTRACTOR's cost for general and miscellaneous responsibilities and operations for design, installation, maintenance, and removal of the Dewatering System. CONTRACTOR has the responsibility to select the means and methods to be used for the Dewatering System. Dewatering System to be designed by a qualified engineer. ENGINEER will only review the proposed means and methods to verify compliance with the Contract Documents and/or Construction Dewatering Permit requirements. CONTRACTOR shall remain responsible to ensure the means and methods are adequate to protect the Work and the safety of their personnel.
2. **METHOD OF MEASUREMENT** "Dewatering" shall be paid for on a lump sum basis for the design, installation, maintenance, and removal of the dewatering system

according to the amount defined in the Bid Schedule and as completed by CONTRACTOR.

3. **BASIS OF PAYMENT** Payment for “Dewatering” shall not be measured but shall be made at the contract lump sum bid price for completion of all items to design, install, maintain, and remove the dewatering as specified herein. Payment shall include furnishing all labor, material and equipment required to install the Dewatering System, disposal of construction dewatering water, pumps, piping, gravel, and appurtenances for a safe and operable dewatering system. Payment shall also include any testing and reporting required for the construction dewatering system.

G.BID ITEM NO. 8 - "UTILITY POTHOLING”

1. **GENERAL** This item is provided to cover CONTRACTOR's cost for locating and potholing utilities as required to make connections to existing pipe and to avoid conflicts with existing utilities when installing new pipes.
2. **METHOD OF MEASUREMENT** “Utility Potholing” shall be measured per each utility potholed.
3. **BASIS OF PAYMENT** Payment for “Utility Potholing” shall be made at the contract unit bid price for completion of the work as shown on the Contract Drawings and specified herein. Payment shall be considered complete compensation for all labor, equipment, and materials, including but not limited to: Locate and pothole the utility, determine size, elevation, and material; backfill; compaction; restoration of all surface improvements including but not limited to untreated base course and asphalt patch; and all other items required to complete this item as shown on the Contract Drawings and specified herein.

H.BID ITEM NO. 9 - "14-INCH DIAMETER SPRING COLLECTION PIPING”

1. **METHOD OF MEASUREMENT** Measurement for “14-inch Diameter Spring Collection Piping shall be according to the lineal foot of pipe acceptably installed as shown on the Contract Drawings and specified in the Specifications. Measurement shall be along the horizontal centerline of the acceptably installed pipe. Pipe in vertically or vertically diagonal directions will only be measured in the horizontal plane. CONTRACTOR shall include associated cost for any such pipe as the horizontal cost per foot.
2. **BASIS OF PAYMENT** Work completed under “14-inch Diameter Spring Collection Piping” shall be paid for at the contract unit bid price per lineal foot listed in the bidder’s proposal and shall be considered complete compensation for all labor, equipment, tools and materials necessary to furnish and install the pipeline, fittings and liner system; including but not limited to furnishing 14-inch PVC Sch 80 slotted pipe per Section 33 05 07.1, installing the pipe; excavation including shoring, 3/4" minus disinfected drain rock, 40 mil HDPE NSF 61 certified liner per Section 31 05 20, imported clay liner and compaction, native backfill and compaction; safety locating tape; protection of buried utilities; disinfection of pipe and liner in contact with gravel; commissioning of pipeline, and all other miscellaneous items and appurtenances necessary to complete this portion of the Work as shown and as specified.

I.BID ITEM NO. 10 - "36-INCH DIAMETER SPRING COLLECTION PIPING"

1. **METHOD OF MEASUREMENT** Measurement for "36-inch Diameter Spring Collection Piping shall be according to the lineal foot of pipe acceptably installed as shown on the Contract Drawings and specified in the Specifications. Measurement shall be along the horizontal centerline of the acceptably installed pipe. Pipe in vertically or vertically diagonal directions will only be measured in the horizontal plane. CONTRACTOR shall include associated cost for any such pipe as the horizontal cost per foot.
2. **BASIS OF PAYMENT** Work completed under "36-inch Diameter Spring Collection Piping" shall be paid for at the contract unit bid price per lineal foot listed in the bidder's proposal and shall be considered complete compensation for all labor, equipment, tools and materials necessary to furnish and install the pipeline, fittings, and liner system; including but not limited to furnishing 36-inch PVC C900 DR25 perforated pipe, installing the pipe; excavation including shoring, 3/4" minus disinfected drain rock, 40 mil HDPE NSF 61 certified liner per Section 31 05 20, imported clay liner and compaction, native backfill and compaction; safety locating tape; protection of buried utilities; disinfection of pipeline and liner in contact with gravel; commissioning of pipeline, and all other miscellaneous items and appurtenances necessary to complete this portion of the Work as shown and as specified.

J.BID ITEM NO. 11 - "SPRING CLAY CUT-OFF WALL"

1. **METHOD OF MEASUREMENT** "Spring Clay Cut-Off Wall" shall be measured according to the lineal foot of clay cut-off wall acceptably installed as shown on the Contract Drawings and specified in the Specifications.
2. **BASIS OF PAYMENT** Payment for "Spring Clay Cut-Off Wall" shall be paid for at the contract unit price of clay cut-off wall acceptably installed. Payment shall be considered complete compensation for all labor, equipment, and material including, but not limited to, purchasing, and importing clay material, placement of clay, compaction, transportation, 40 mil HDPE NSF 61 certified liner per Section 31 05 20, disinfection of liner in contact with gravel; and all other necessary items to furnish and place the clay cut-off wall as shown on the Contract Drawings.

K.BID ITEM NO. 12 - "SPRING JUNCTION BOX AT STA 2+70.79"

1. **METHOD OF MEASUREMENT** "Spring Junction Box at Sta 2+70.79" shall be paid for on a lump sum basis according to the amount defined in the Bid Schedule and as completed by CONTRACTOR as shown on the Contract Drawings and specified herein.
2. **BASIS OF PAYMENT** Payment for the "Spring Junction Box at Sta 2+70.79" shall be made at the contract lump sum bid price. Payment shall be considered complete compensation for all labor, equipment, and materials necessary for furnishing and installing the Spring Junction Box including, but not limited to excavation, shoring, 3/4" drain rock, concrete forms, steel reinforcement, waterstop, concrete, curing, concrete footing, access hatch, air vent standpipe, vent screen; connection to new spring collection pipes, removal of existing 36-inch RCP, demolition and off-site disposal of existing junction box, native material backfill and compaction; disinfection of Spring Junction Box; and all other incidentals and materials as herein described and as shown on the Contract Drawings.

L.BID ITEM NO. 13 - "SPRING BOX AT STA 3+56.64"

1. **METHOD OF MEASUREMENT** "Spring Box at Sta 3+56.64" shall be paid for on a lump sum basis according to the amount defined in the Bid Schedule and as completed by CONTRACTOR as shown on the Contract Drawings and specified herein.
2. **BASIS OF PAYMENT** Payment for the "Spring Box at Sta 3+56.64" shall be made at the contract lump sum bid price. Payment shall be considered complete compensation for all labor, equipment, and materials necessary for furnishing and installing the Spring Junction Box including, but not limited to excavation, shoring, 3/4" drain rock, concrete forms, steel reinforcement, waterstop, concrete, curing, ductile iron spools, water level sensor pipe (Detail C/S-9), concrete footing, access hatch, air vent standpipe, vent screen; connection to new spring collection pipes, native material backfill and compaction; disinfection of Spring Box; and all other incidentals and materials as herein described and as shown on the Contract Drawings.

M.BID ITEM NO. 14 - "EXISTING 36-INCH SPRING PIPE CONCRETE PLUG"

1. **METHOD OF MEASUREMENT** "Existing 36-inch Spring Pipe Concrete Plug" shall be paid for on a lump sum basis according to the amount defined in the Bid Schedule and as completed by CONTRACTOR as shown on the Contract Drawings and specified herein.
2. **BASIS OF PAYMENT** Payment for the "Existing 36-inch Spring Pipe Concrete Plug" shall be made at the contract lump sum bid price. Payment shall be considered complete compensation for all labor, equipment, and materials necessary for furnishing and installing the concrete plug including, but not limited to excavation, shoring, concrete forms, steel reinforcement, concrete, curing, 40 mil HDPE NSF 61 certified liner, purchasing and importing clay liner, installing and compacting clay liner, native material backfill and compaction, and all other incidentals and materials as herein described and as shown on the Contract Drawings.

N. BID ITEM NO. 15 - "16-INCH DIAMETER PVC C900 DR18 PIPE WITH FITTINGS"

1. **METHOD OF MEASUREMENT** Measurement for "16-inch Diameter PVC C900 DR18 Pipe with Fittings" shall be according to the horizontal lineal foot of pipe, acceptably installed as shown on the Contract Drawings and specified in the Specifications. Measurement shall be along the centerline of the acceptably installed pipe, excluding payment paid elsewhere beginning with the 12-inch ductile iron reducer outside the pump house and ending at the connection to the existing 12-inch ductile iron pipe.
2. **BASIS OF PAYMENT** Work completed for "16-inch Diameter PVC C900 DR18 Pipe with Fittings" shall be paid for at the contract unit bid price per lineal foot listed in the bidder's proposal and shall be considered complete compensation for all labor, equipment, and materials necessary to make functional culinary water pipeline, including but not limited to furnishing the pipe (16" PVC C900 DR18) and all necessary fittings (bends, reducer, and sleeves), restraint joints, hot tap with gate valve, marking tape, tracing wire, excavation, dewatering, shoring, installing the pipe and fittings etc., restraints; cutting existing 12-inch ductile iron pipe, ductile iron pipe cap with restrain and thrust block; import backfill and bedding, backfilling, removal and disposal of excess excavated materials, compaction, erosion control,

commissioning of pipeline (including cleaning and flushing, disinfection and pressure testing), and all other operations and materials required to complete this portion of the Work as herein described and as shown on the Contract Drawings.

O. BID ITEM NO. 16 - "PUMP HOUSE CONCRETE FOUNDATION AND SLAB"

1. **METHOD OF MEASUREMENT** "Pump House Concrete Foundation and Slab" shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation of the pump house foundation and slab, including all components required on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT** Payment for "Pump House Concrete Foundation and Slab" shall be made at the contract unit lump sum bid price for completion of all the pump house foundation and slab work as shown on the Contract Drawings and specified herein. Payment shall include, but not be limited to, furnishing all material, labor, and equipment for excavation and shoring, structural fill, and compaction; installing all footings, foundation walls, slabs, and pump bases including steel reinforcement, forms, waterstop, concrete, finishing, waterproof membrane system, rigid insulation, moisture proof underlay, sand, backfill and compaction, and all other items as shown on the Contract Drawings.

P. BID ITEM NO. 17 - "PUMP HOUSE MASONRY"

1. **METHOD OF MEASUREMENT** "Pump House Masonry" shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation of the pump house masonry, including all components required on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT** Payment for "Pump House Masonry" shall be made at the contract unit lump sum bid price for completion of all the pump house masonry work as shown on the Contract Drawings and specified herein. Payment shall include, but not be limited to, furnishing all material, labor, and equipment for installing all concrete masonry unit (CMU) blocks including steel reinforcement, anchor bolts, grout, mortar, 2'x2' polycarbonate window, cleaning, waterproof membrane coating, foam insulation, expansion joint material, and all other items as shown on the Contract Drawings.

Q. BID ITEM NO. 18 - "PUMP HOUSE ROOF FRAMING"

1. **METHOD OF MEASUREMENT** "Pump House Roof Framing" shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation of the pump house roof framing, including all components required on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT** Payment for "Pump House Roof Framing" shall be made at the contract unit lump sum bid price for completion of all the pump house roof framing work as shown on the Contract Drawings and specified herein. Payment shall include, but not be limited to, furnishing all material, labor, and equipment for installing the roof framing including manufacturer roof trusses and girder trusses, raker blocking, fascia, bracing, seismic and wind anchor plates, plywood, and all other items as shown on the Contract Drawings.

R. BID ITEM NO. 19 - "PUMP HOUSE FINISHES"

1. **METHOD OF MEASUREMENT** "Pump House Finishes" shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation of the pump house finishes, including all components required on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT** Payment for "Pump House Finishes" shall be made at the contract unit lump sum bid price for completion of all the pump house finish work as shown on the Contract Drawings and specified herein. Payment shall include, but not be limited to, furnishing all material, labor, and equipment for installing roofing system items including standing seam metal roofing, roofing underlayment, ice and water shield, flashing, metal fascia, continuously vented metal soffit and ridge vent, rain gutters and downspouts, pump access hatches, metal siding, rafter vents, roof and hatch insulation with vapor barriers, access hatch metal sheeting, plywood ceiling with batten boards and trim, insulation, polystyrene rafter vents, steel doors and frames, door hardware, coatings, and all other items as shown on the Contract Drawings.

S. BID ITEM NO. 20 - "PUMP HOUSE PIPING"

1. **METHOD OF MEASUREMENT** "Pump House Piping" shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation of Pump House Piping work, including all components required on the Contract Drawings and in the Specifications and includes the following:
   a. The 12-inch diameter discharge piping shall include the 12-inch by 8-inch Tee (Item #24) and extend to, but not include the reducer (Item # 30) outside of the structure.
   b. The suction piping shall begin at the 20-inch Ductile Iron Tee (Item #7) connecting to, but not including the Meter Vault spool and end at the 90-degree bend (Item #9) connected to the wall spool at the overflow structure (Item #10) and includes the 20-inch diameter (Item #11) and 12-inch diameter (Item #13) pump suction pipes.
   c. Pump House Piping includes the 8-inch diameter and 12-inch diameter discharge piping from each pump.
   d. OWNER will purchase the flow meter (M-2) and provide it to CONTRACTOR for installation.

2. **BASIS OF PAYMENT** Payment for "Pump House Piping" shall be made at the contract unit lump sum bid price for completion of all Well House Piping work as shown on the Contract Drawings and specified herein. Payment shall include, but not be limited to, furnishing all material, labor, and equipment for installing all ductile iron piping, valves, meters, installing flow meter purchased by OWNER, fittings, concrete pipe encasement, pipe supports, screened outlet; floor drains, drain piping to the overflow structure, screened outlet, air gap drains; pressure gauges, air relief/vacuum valves, copper piping, PVC pipe sleeves, hose bibs and sample taps, insulating flange kits, connections to other systems, pipe coating, disinfection, commissioning of piping; appurtenances, and all other piping items as shown on the Contract Drawings.

T. BID ITEM NO. 21 – "200 HP PUMP AND MOTOR COMPLETE"

1. **METHOD OF MEASUREMENT** "200 HP Pump and Motor Complete" shall be measured by each pump and motor furnished and installed according to the amount defined in the Bid Schedule and as completed by CONTRACTOR.
2. **BASIS OF PAYMENT** Work completed for "200 HP Pump and Motor Complete" shall be paid at the contract unit bid price per each pump and motor, with accompanying appurtenances furnished and installed. Work shall also include furnishing and installing discharge heads, pump cans; barrel isolation sheet, sleeves, and washers; pump bowls, shafting, columns, motors, testing, and all other pump related items not paid elsewhere as shown on the Contract Drawings and in the Specifications. (Electrical gear and connections paid elsewhere.)

U. BID ITEM NO. 22 – "40 HP PUMP AND MOTOR COMPLETE"

1. **METHOD OF MEASUREMENT** "40 HP Pump and Motor" shall be measured by each pump and motor furnished and installed according to the amount defined in the Bid Schedule and as completed by CONTRACTOR.
2. **BASIS OF PAYMENT** Work completed for "40 HP Pump and Motor Complete" shall be paid at the contract unit bid price per each pump and motor, with accompanying appurtenances furnished and installed. Work shall also include furnishing and installing discharge heads, pump cans; barrel isolation sheet, sleeves, and washers; pump bowls, shafting, columns, motors, testing, and all other pump related items not paid elsewhere as shown on the Contract Drawings and in the Specifications. (Electrical gear and connections paid elsewhere.)

V. BID ITEM NO. 23 - "ELECTRICAL SYSTEM COMPLETE"

1. **METHOD OF MEASUREMENT** "Electrical System Compete" shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation of electrical work, including all components required on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT** Payment for "Electrical System Complete" shall be made at the contract unit lump sum bid price for completion of all electrical work as shown on the Contract Drawings and as specified herein. Payment shall include, but not be limited to, all labor, materials, and equipment for furnishing and installing all electrical equipment in the pump house and spring boxes; 200 HP variable frequency drive, relocation of and modifications to the existing VFD for the 40 HP pump and motor *(Modified Panel shall be UL Listed)*, panelboards, transformers, electrical enclosures, control panels, SCADA radio enclosure, lighting, service outlets, pressure switches, pressure transducers, intrusion switches, flood switches, buried conduits, polymer pull boxes, installation of new mast antenna, relocate irrigation pond antenna to new building, electrical service connection and equipment, lightning protection system, connecting up pump motors (paid under Bid Item 21 and Item 22), connections to HVAC, SCADA, and all other items as shown on the Contract Drawings required for a complete and operable electrical system.

W. BID ITEM NO. 24 - "HVAC SYSTEM COMPLETE"

1. **METHOD OF MEASUREMENT** "HVAC System Compete" shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation

of all HVAC work, including all components required on the drawings and in the specifications.

2. **BASIS OF PAYMENT** Payment for "HVAC System Complete" shall be made at the contract lump sum bid price for HVAC work as shown on the Contract Drawings and as specified herein. Payment shall include, but not be limited to all labor, materials, and equipment for furnishing, installing, and testing all HVAC equipment, including but not limited to, wire and conduit per Division 26, instrumentation, air handling units with exterior mounted condensing units, electric unit heaters, ductwork, exhaust fans, exhaust fan hoods, supports, louvers, and all other related items as shown on the Contract Drawings not paid elsewhere for a complete and operable HVAC system.

X. BID ITEM NO. 25 - "CP-1 MAIN CONTROL PANEL"

1. **METHOD OF MEASUREMENT** "CP-1 Main Control Panel" shall not be measured but shall be paid for on a lump sum unit price basis for the *mounting* of the *City provided* SCADA RTU and Control Panel *and coordination with the City's control panel supplier*, as required on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT** Payment for "CP-1 Main Control Panel" shall be made at the contract unit lump sum bid price for *mounting the City provide control panel as shown on the Contract Drawings and as specified herein. Payment shall include, but not be limited to, all labor, materials, for mounting the control panel to the pump station wall; furnishing and installing conduits, and conductors from the instruments to the control panel, and all other items as shown on the Contract Drawings required for a complete and operable SCADA and station control panel system. The City's control panel provider shall make all terminations inside the panel.*

Y. BID ITEM NO. 26 - "FLOW METER VAULT"

1. **METHOD OF MEASUREMENT** "Flow Meter Vault" shall not be measured but shall be paid for on a lump sum basis for the construction of the Flow Meter Vault and accompanying facilities, including all the work shown and specified on the Contract Drawings and in the Specifications.
   a. Flow Meter Vault piping shall begin with the 20-inch diameter butterfly valve (V-1) connecting to, but not including ductile iron spool (Item #1) and the Spring Box and ends at ductile iron wall spool (Item #4) connecting to, but not including the 20-inch ductile iron Tee (Item #7).
   b. Flow Meter Vault sump pump piping shall include all piping from the Meter Vault to the Overflow Structure.
   c. OWNER will purchase the flow meter (M-1) and provide it to CONTRACTOR for installation.
2. **BASIS OF PAYMENT** Payment for "Flow Meter Vault" shall be made at the contract lump sum bid price. Payment shall be considered complete compensation for all labor, equipment, tools, and materials to complete the Flow Meter Vault, including but not limited to all labor, materials, and equipment for furnishing and installing the cast-in-place vault, excavations, shoring, compacted drain rock wrapped in filter fabric, forming and curing, concrete and reinforcements, and backfilling and compaction; hatch, ladder, vents, sump pump and piping; conduits, supports; ductile iron Class 53 piping, couplings, and fittings, valve (V-1) with valve box, installing city purchased flow meter, cleaning, disinfection, and testing; and all other related items and appurtenances as shown on the Contract Drawings not paid elsewhere for a complete system.

Z. BID ITEM NO. 27 - "OVERFLOW STRUCTURE"

1. **METHOD OF MEASUREMENT** "Overflow Structure" shall not be measured but shall be paid for on a lump sum basis for the construction of the overflow structure and accompanying facilities, including all the work shown and specified on the Contract Drawings and in the Specifications.
   a. Overflow Structure piping shall begin with the 16-inch diameter 90 degree bend (Item #15) connecting to, but not including, the 16-inch ductile iron wall spool (Item #14) and ends and the 16-inch ductile iron wall spool (Item #18).
2. **BASIS OF PAYMENT** Payment for "Overflow Structure" shall be made at the contract lump sum bid price. Payment shall be considered complete compensation for all labor, equipment, tools, and materials to complete the Overflow Structure, including but not limited to all labor, materials, and equipment for furnishing and installing the cast-in-place concrete structure, excavations, shoring, compacted drain rock wrapped in filter fabric, forming and curing, concrete and reinforcements, and backfilling and compaction; ductile iron Class 53 pipe spools, screened outlet; galvanized steel grating, and all other related items and appurtenances as shown on the Contract Drawings not paid elsewhere for a complete system.

AA. BID ITEM NO. 28 - "RELOCATION OF AERATION PANELS AND PIPING"

1. **METHOD OF MEASUREMENT** "Relocation of Aeration Panels and Piping" shall not be measured but shall be paid for on a lump sum basis for the relocation of the existing aeration panels and piping, including all the work shown and specified on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT** Payment for "Relocation of Aeration Panels and Piping" shall be made at the contract lump sum bid price. Payment shall be considered complete compensation for all labor, equipment, tools, and materials to complete the relocation, including but not limited to all labor, materials, and equipment for removing and re-installing the aeration panels, excavations for pipe relocations, bedding, backfilling and compaction; PVC Sch 80 pipe, fittings, and valves; pressure gauges; and valve boxes; and all other related items and appurtenances as shown on the Contract Drawings not paid elsewhere for a complete system.

BB. BID ITEM NO. 29 - "CHLORINATION SYSTEM COMPLETE"

1. **METHOD OF MEASUREMENT** "Chlorination System Compete" shall not be measured but shall be paid for on a lump sum unit price basis for the construction and installation of all chlorination system work, including all components required on the Contract Drawings and in the Specifications.
2. **BASIS OF PAYMENT** Payment for "Chlorination System Complete" shall be made at the contract unit lump sum bid price for completion of all the Chlorination work as shown on the Contract Drawings and specified herein including but not limited to the chlorinators with automatic switchover valves, scales, flow proportioning valve, roto meter, ejector, tubing/piping in the chlorine room, leak detection equipment; booster pump, piping, and valves; start-up testing and commissioning.

CC. BID ITEM NO. 30 – "CONCRETE CURB AND GUTTER APWA PLAN 205.2"

1. **METHOD OF MEASUREMENT** "Concrete Curb and Gutter APWA Plan 205.2" shall be measured according to the lineal foot of curb and gutter acceptably installed as shown on the Contract Drawings and specified in the Specifications.

2. **BASIS OF PAYMENT** Payment for "Concrete Curb and Gutter APWA Plan 205.2" shall be made at the contract lump sum bid price, including all required grading to match the intent of the Drawings and Specifications. Payment shall be considered complete compensation for all work performed. Payment shall include general and final grading for all concrete work and including but not limited to furnishing all labor, equipment, material, roadbase, concrete forms, concrete, finishing, and all other incidentals required complete the concrete curb and gutter work as herein described and as noted on the Drawings and Specifications.

DD. BID ITEM NO. 31 – "CONCRETE SLAB-ON-GRADE"

1. **METHOD OF MEASUREMENT** "Concrete Slab-On-Grade" shall be measured by the square foot for acceptably installed concrete flat work as required on the Contract Drawings and Specifications.
2. **BASIS OF PAYMENT** Payment for "Concrete Slab-On-Grade" shall be made at the contract unit square foot bid price, including all required grading to match the intent of the Drawings and Specifications. Payment shall be considered complete compensation for all work performed. Payment shall include general and final grading for all concrete work and furnishing all labor, equipment, and materials including, but not limited to, roadbase, compaction, steel reinforcement, forms, fiber expansion board, concrete, concrete placement and finishing, concrete curing, and all other incidentals not specifically paid for as herein described and as noted on the Contract Drawings and Specifications.

EE. BID ITEM NO. 32 – "ASPHALT PAVEMENT INCLUDING ROADBASE"

1. **METHOD OF MEASUREMENT** "Asphalt Pavement Including Roadbase" shall be measured by the Square Yard and shall include furnishing and installing the 4" asphalt and 8" roadbase, including preparation of the surface and roadbase for the asphalt pavement as shown on the Contract Drawings.
2. **BASIS OF PAYMENT** Payment for "Asphalt Pavement including Roadbase" shall be considered full compensation for all work completed under this bid item and shall be paid for at the contract unit square yard price. Work shall include all labor, equipment, and materials, including but not limited to final grading, furnishing, and installing the roadbase, asphalt, tack coat, compaction, and all other operations and materials required to complete the asphalt pavement as herein described and as shown on the Contract Drawings and meeting Springville Standards.

FF. BID ITEM NO. 33 – "6' HIGH CHAIN LINK FENCE"

1. **METHOD OF MEASUREMENT** "6' High Chain Link Fence" shall be measured on a lineal foot basis. Measurement shall be along the horizontal centerline of the acceptably installed fence. Fencing in vertically or vertically diagonal directions will only be measured in the horizontal plane. CONTRACTOR shall include associated cost for any such fencing as the horizontal cost per foot.
2. **BASIS OF PAYMENT** Payment for "6' High Chain Link Fence" shall be paid on a lineal foot basis for the completed work. Payment shall be considered full compensation including, but not limited to all labor, materials, and equipment for furnishing and installation of new 6' Chain Link Fence, post excavation, concrete, and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

GG. BID ITEM NO. 34 – "16' WIDE CHAIN LINK DOUBLE SWING GATE"

1. **METHOD OF MEASUREMENT** "16' Wide Chain Link Double Swing Gate" shall be measured per each gate installed as shown on the Contract Drawings and specified herein.
2. **BASIS OF PAYMENT** Payment for "16' Wide Chain Link Double Swing Gate" shall be made at the contract unit bid price as shown on the Contract Drawings and Specifications. Payment shall be considered full compensation including, but not limited to all labor, materials, and equipment for furnishing and installation of new 16' Wide Chain Link Double Swing Gate, post excavation, concrete, fencing, gate keepers (2), and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

HH. BID ITEM NO. 35 - "FINAL SITE GRADING AND SEEDING"

1. **METHOD OF MEASUREMENT** "Final Site Grading and Seeding" shall be paid for on a lump sum basis according to the amount defined in the Bid Schedule and as completed by CONTRACTOR.
2. **BASIS OF PAYMENT** Payment for "Final Site Grading and Seeding" shall be made at the contract lump sum bid price, including all required grading to match the intent of the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor performed and materials and equipment required. Payment shall include general grading cleanup, topsoil placement and final grading; hydroseeding with native grasses mix, and all other incidentals not specifically paid for in other bid items but which are shown or otherwise required to complete the installation as herein described and as shown on the Contract Drawings and Specifications.

II. BID ITEM NO. 36 - "SURGE TANK"

1. **METHOD OF MEASUREMENT** "Surge Tank" shall not be measured, but shall be paid for on a lump sum basis for the construction of the Surge Tank, piping, and accompanying facilities, including all of the work shown and specified on the Contract Drawings and in the Specifications.
   a. Surge Tank piping shall begin with the 10-inch diameter ductile iron spool connecting to, but not including, the 12-inch by 10-inch ductile iron Tee and ending at the connection to the bottom of the surge tank.
2. **BASIS OF PAYMENT** Payment for "Surge Tank" shall be made at the contract lump sum bid price. Payment shall be considered complete compensation for all labor, equipment, tools, and materials to complete the Surge Tank, including but not limited to all labor, materials, and equipment for furnishing and installing the 10-inch diameter ductile iron Class 53 pipe, fittings, valve, dismantling joint, bladder style vertical surge tank, appurtenances, concrete tank supports; cleaning, disinfection, and testing; and all other related items and appurtenances as shown on the Contract Drawings not paid elsewhere for a complete and operable surge tank system.

1.3 ADDITIVE/DEDUCTIVE BID SCHEDULE

A. BID ITEM NO. 1 - "EXTEND 16-INCH PIPE TO TANK"

1. **METHOD OF MEASUREMENT** "Extend 16-inch Pipe to Tank" shall not be measured, but shall be paid for on a lump sum basis for the construction of the pipe,

pipe appurtenances, and restoration, including all of the work shown and specified on the Contract Drawings and in the Specifications.

a. This bid item shall begin at Station 1+76.72 and shall end at the connection to the existing tank (approximately Station 5+90).
b. This bid item shall include a deduction for removing the 16"x12" Tee at Station 1+76.72, all 12-inch diameter pipe, fittings, valve, and hot tap to existing12-inch pipe.
c. This Bid item shall include all costs for AC pavement restoration, concrete curb, gutter, and sidewalk restoration, and any other site restoration.

2. **BASIS OF PAYMENT** Payment for "*Extend 16-inch Pipe to Tank*" shall be paid for at the contract lump sum bid price listed in the bidder's proposal and shall be considered complete compensation for all labor, equipment, and materials necessary to make functional culinary water pipeline, including but not limited to furnishing the pipe (16" PVC C900 DR18) and all necessary fittings (bends, reducer, and sleeves), fitting and pipe joint restraints, marking tape, tracing wire, excavation, dewatering, shoring, installing the pipe and fittings etc.; import backfill and bedding, backfilling, removal and disposal of excess excavated materials, compaction, erosion control, commissioning of pipeline (including cleaning and flushing, disinfection and pressure testing); potholing all existing utilities prior to beginning work; traffic control; AC pavement including road base, pavement marking; concrete curb, gutter, and sidewalk; and all other operations and materials required to complete this portion of the Work as herein described and as shown on the Contract Drawings.

B.BID ITEM NO. 2 - "REPLACE EXISTING VFD WITH NEW VFD FOR 40 HP PUMP"

1. **METHOD OF MEASUREMENT** "Replace Existing VFD with New VFD for 40 HP Pump" shall not be measured, but shall be paid for on a lump sum basis for the construction of a new VFD, including all of the work shown and specified on the Contract Drawings and in the Specifications. Bid amount shall be either an additive or deductive value that will be added to or subtracted from Base Bid Item #23.
2. **BASIS OF PAYMENT** Payment for "Replace Existing VFD with New VFD for 40 HP Pump" shall be paid for at the contract lump sum bid price listed in the bidder's proposal and shall be considered complete compensation for all labor, equipment, and materials necessary to make functional 40 HP VFD, including but not limited to furnishing a new replacement VFD including, but not limited to, new enclosure, VFD, harmonic filters, capacitors, fuses, fans, wiring, and all other and materials required to complete this portion of the Work as herein described and as shown on the Contract Drawings for a complete and operable VFD.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, Submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.

C. After OWNER occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of OWNER's activities.

D. UDOT, OWNER, and/or utility owners may be working within the project area while this contract is in progress. If so, CONTRACTOR shall schedule Work in conjunction with these other organizations to minimize mutual interference.

E. All existing Springville City waterlines and service connections shall remain active during the construction of this project. All connections to the existing waterlines, except those being hot-tapped, shall only be done upon successful completion of mainline installation and testing.

F. Water service to this area can be interrupted for a maximum of 4hours. CONTRACTOR shall provide a minimum notice of 48 hours to each home or business affected. A copy of CONTRACTOR'S notification letter shall be reviewed and approved by OWNER prior to distribution.

G. If required to work in City Streets or Utah Department of Transportation (UDOT) right-of-way, CONTRACTOR shall notify UDOT 72 hours prior to work being performed therein. Work within the City Streets or UDOT right-of-way shall be in accordance with their required permit and their license agreement with OWNER. CONTRACTOR shall obtain and comply with all required permits.

H. Coordination with Adjacent Property Owner

1. Once each week, CONTRACTOR shall hand deliver or mail a written **"Construction Status Update Notice"** to all residents, businesses, schools and property owners adjacent to and affected by the Work. Notice shall be on CONTRACTOR's company letterhead paper and be secured to doorknob should occupants not be home. Obtain ENGINEER's review of notice prior to distribution. As a minimum the notice shall contain the following:

    a. name and phone number of CONTRACTOR's representative for the project
    b. work anticipated for the next 7 days including work locations and work by subcontractors and utility companies
    c. rough estimate of construction schedule through end of project
    d. anticipated driveway approach closures

e. anticipated water, sewer or power outages
f. anticipated vehicular traffic impacts, rerouting or lane closures
g. anticipated pedestrian impacts and sidewalk closures
h. changes to public transportation bus routes
i. any other construction or work items which will impact or restrict the normal use of streets and amenities

2. Failure to comply with this contract provision is considered grounds for project suspension per Article 16.01 of the General Conditions (EJCDC 00 72 00).

1.2 FIELD ENGINEERING

A. ENGINEER shall provide the following construction staking at no cost to CONTRACTOR.

1. Benchmark network throughout the construction zone

B. Construction staking and surveying shall be performed by a registered Land Surveyor in the State of Utah.

C. CONTRACTOR shall provide all other survey construction staking as necessary to complete the required work according to the Contract Documents.

D. ENGINEER shall not be responsible for stakes, etc. removed through negligence of CONTRACTOR and in that event shall be compensated by CONTRACTOR for re-staking efforts.

E. CONTRACTOR shall locate and protect survey control and reference points. Promptly notify ENGINEER of discrepancies discovered.

F. Control datum for survey is that shown on Contract Drawings.

G. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

H. Promptly report to ENGINEER loss or destruction of reference point or relocation required because of changes in grades or other reasons.

I. CONTRACTOR shall be responsible to coordinate with all property owners to determine the location of existing sewer and water service laterals. CONTRACTOR shall be responsible to coordinate with all property owners during installation or relocation of existing service laterals.

J. All service laterals shall be verified and indicated on the Record Drawings supplied by CONTRACTOR to ENGINEER.

1.3 PRECONSTRUCTION MEETING

A. Prior to the commencement of work at the site, a preconstruction conference will be held at a mutually agreed time and place which shall be attended by CONTRACTOR's Project Manager, its superintendent, and its subcontractors as appropriate. Other attendees will be:

1. ENGINEER and the Resident Project Representative (RPR)
2. Representatives of OWNER
3. Governmental representatives as appropriate
4. Others as requested by CONTRACTOR, OWNER, or ENGINEER.

B. Unless previously submitted to ENGINEER, CONTRACTOR shall bring to the conference one copy of each of the following:

1. Progress schedule
2. Procurement schedule of major equipment and materials and items requiring long lead time
3. Shop Drawings/Sample/Substitute or "Or Equal" submittal schedule.

C. 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 agenda may include the following:

1. CONTRACTOR's tentative schedules
2. Transmittal, review, and distribution of CONTRACTOR's submittals
3. Processing applications for payment
4. Maintaining record documents
5. Critical work sequencing
6. Field decisions and Change Orders
7. Use of project site, office and storage areas, security, housekeeping, and OWNER's needs
8. Major equipment deliveries and priorities
9. CONTRACTOR's assignments for safety and first aid

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

E. CONTRACTOR should plan on the conference taking no less than 2 hours.

1.4 PROGRESS MEETINGS

A. CONTRACTOR shall schedule and hold regular on-site progress meetings at least bi-weekly and at other times as required by ENGINEER or as required by progress of the work. CONTRACTOR, ENGINEER, and all subcontractors active on the site shall be represented at each meeting. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers', and other subcontractors.

B. ENGINEER shall preside at the meetings and provide for keeping and distribution of the minutes. The purpose of the meetings will be to review the progress of the work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

C. At each construction progress meeting a progress report shall be presented by CONTRACTOR containing an updated Progress Schedule. Where the delayed completion date of a project phase is noted, CONTRACTOR shall describe the anticipated delays or problems and outline the action plan being taken to resolve the issues.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUBMITTAL PROCEDURES

A. General

1. This Section outlines the general terms that CONTRACTOR must follow for preparing and providing Submittals to ENGINEER for review.
2. CONTRACTOR shall anticipate resubmitting Submittals for major equipment or complex systems.
3. If CONTRACTOR has questions about Submittal requirements, CONTRACTOR is encouraged to communicate with ENGINEER to discuss requirements prior to submittal the Submittal.
4. Substitutions shall be clearly identified on the Submittal transmittal form and shall include all the information required per Section 01 60 00 – Product Requirements.

B. Wherever Submittals are required by the Contract Documents, transmit 5 copies of each Submittal or a single electronic PDF file to ENGINEER with a Submittal transmittal form which is acceptable to ENGINEER.

C. Sequentially number transmittal forms. Mark revised Submittals with original number and sequential alphabetic or numeric suffix, i.e., Submittal 1, Submittal 1.A, Submittal 1.1, etc.

D. Identify Project, Contractor, subcontractor and/or supplier, pertinent drawing and detail number, and Specification section number, appropriate to Submittal.

E. Each Submittal shall contain material pertaining to no more than one equipment or material item.

F. Each Submittal shall have the Specification section and applicable paragraph number clearly identified on the front of the Submittal transmittal form. A copy of the Specification section and applicable paragraph shall be included with the Submittal and items included shall be clearly mark as either in compliance or not in compliance. For items not in compliance a description shall be provided explaining the reason for non-compliance.

G. CONTRACTOR shall review Submittals prior to submission to ENGINEER. Apply Contractor's stamp, signed and dated, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents. Identify any deviations from the Contract Documents on the Submittal transmittal form.

H. Schedule Submittals to expedite Project and deliver to ENGINEER at their business address. Coordinate submission of related items.

I. Submittals shall be submitted sufficiently in advance to allow ENGINEER not less than ten regular working days for examining the drawings. These drawings shall be accurate, distinct, and complete and shall contain all required information, including satisfactory

identification of items and unit assemblies in relation to the contract drawings and/or specifications.

J. Identify variations from Contract Documents and product or system limitations which may adversely affect successful performance of completed Work.

K. If a Submittal is returned to CONTRACTOR marked “APPROVED”, or similar notification, formal revision and resubmission will not be required.

L. If a Submittal is returned marked “APPROVED – MAKE CORRECTIONS NOTED”, or similar notification, CONTRACTOR shall make the corrections on the Submittal, however, formal revision and resubmission will not be required.

M. Resubmittals

1. If a Submittal is returned marked “AMEND AND RESUBMIT”, or similar notification, CONTRACTOR shall revise the Submittal and resubmit the required number of copies.
2. Identify changes made since the previous submission.

N. Rejected Submittals

1. If a Submittal is returned marked “REJECTED – RESUBMIT”, or similar notification, it shall mean either that the proposed material or product does not satisfy the specification, the Submittal is so incomplete that is cannot be reviewed or is a substitution request not submitted in accordance with Section 01 60 00 – Product Requirements.
2. CONTRACTOR shall prepare a new Submittal or submit a substitution request according to Section 01 60 00 – Product Requirements and shall submit the required number of copies.

O. Distribute copies of reviewed Submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

P. Submittals not requested will not be recognized or processed.

Q. Unless noted otherwise, corrections indicated on Submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as changes to the contract requirements.

R. Fabrication or purchase of an item may only commence after ENGINEER has reviewed the pertinent Submittals and returned copies to CONTRACTOR marked either “APPROVED” or “APPROVED – MAKE CORRECTIONS NOTED”.

S. ENGINEER's review of CONTRACTOR Submittals shall not relieve CONTRACTOR of the entire responsibility for the corrections of details and dimensions. CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR Submittals. CONTRACTOR shall be responsible for dimensions and quantities, coordinating with all trades, the design of adequate connections and details, and satisfactory and safe performance of the work.

1.2 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedules within 15 days after date of Owner-Contractor Agreement. After review comments on the initial schedule are received from ENGINEER and OWNER, CONTRACTOR shall resubmit required revised data within ten days.

B. Submit revised Progress Schedules with each Application for Payment.

C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

D. Submit computer generated horizontal bar chart with separate line for each major portion of Work or operation, identifying first work day of each week.

E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.

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

G. Submit separate schedule of submittal dates for shop drawings, product data, and samples.

1.3 PRODUCT DATA

A. Product Data: Submit to ENGINEER for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 78 50 - Project Closeout.

1.4 SHOP DRAWINGS

A. Shop Drawings: Submit to ENGINEER for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Fabrication of an item may be commenced only after ENGINEER has reviewed the pertinent submittals and returned copies to CONTRACTOR marked either "APPROVED", or "APPROVED - 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 of claims for extra work.

C. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.

1. Include signed and sealed calculations to support design.
2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 78 50 - Project Closeout.

1.5 SAMPLES

A. Whenever indicated in the Specifications or requested by ENGINEER, CONTRACTOR shall submit at least 1 sample of each item or material to ENGINEER for acceptance at no additional cost to OWNER.

B. Samples, as required herein, shall be submitted for acceptance prior to ordering such material for delivery to the jobsite, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delay in the Work.

C. Unless otherwise specified, all colors and textures of specified items will be selected by ENGINEER from the manufacturer's standard colors and standard materials, products, or equipment lines.

1.6 CERTIFICATES

A. When specified in individual Specification sections, submit certification by manufacturer, installation/application subcontractor, or CONTRACTOR to ENGINEER, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to ENGINEER.

1.7 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual Specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to ENGINEER for delivery to Owner in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.8 MANUFACTURER'S FIELD REPORTS

A. When required in individual sections, have Manufacturer or Supplier provide qualified representative to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable and to make written report of observations and recommendations to ENGINEER.

1.9 OPERATIONS AND MAINTENANCE MANUAL SUBMITTAL

A. CONTRACTOR shall furnish to ENGINEER two (2) identical sets of Operations and Maintenance Manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl, hard-cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A Table of Contents shall be provided which indicates all equipment and suppliers in the Operations and Maintenance Manuals.

B. CONTRACTOR shall also furnish ENGINEER one copy of the Operations and Maintenance Manuals in PDF electronic format.

C. CONTRACTOR shall include in the Operations and Maintenance manuals full details for care and maintenance for all visible surfaces as well as the following for each item of mechanical, electrical, and instrumentation equipment (except for equipment furnished by the Owner):

1. Complete operating instructions, including location of controls, special tools or other equipment required, related instrumentation, and other equipment needed for operation.
2. Preventative maintenance procedures and schedules
3. A description of proper maintenance activities
4. Complete parts lists, by generic title, identification number, and catalog number, complete with exploded views of each assembly.
5. Disassembly and reassembly instruction
6. Name and location of nearest supplier and spare parts warehouse
7. Name and location of manufacturer
8. Recommended troubleshooting and start-up procedures
9. Prints of the record drawings, including diagrams and schematics, as required under the electrical and instrumentation portions of these specifications.

D. All Operations and Maintenance manuals shall be submitted in final form to ENGINEER not later than the 75 percent of construction completion date. All discrepancies found by ENGINEER in the Operations and Maintenance manuals shall be corrected by CONTRACTOR prior to final acceptance of the project.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

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SECTION 01 42 13
ABBREVIATIONS

PART 1 GENERAL

1.1 DESCRIPTION

A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various 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 AND ACRONYMS

AASHTO	American Association of the State Highway and Transportation Officials
ABMA	American Bearing Manufacturers Association (formerly AFBMA)
ACI	American Concrete Institute
AGA	American Gas Association
AGC	American General Contractors
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American Nation Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASOC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
AWPB	American Wood Preservers Bureau
BBC	Basic Building Code, Building Officials and Code Administrators International
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DIPRA	Ductile Iron Pipe Research Association
DWQ	Department of Water Quality
DWR	Drinking Water Regulations
ECTC	Erosion Control Technology Council
EIA	Electronic Industries Association
EPA	Environmental Protection Agency
ETL	Electrical Test Laboratories

FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FM	Factory Mutual System
HI	Hydraulic Institute
IBC	International Building Code
ICBO	International Conference of Building Officials
ICC	International Code Council
ICC-ES	International Code Council Evaluation Service
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IFC	International Fire Code
IMC	International Mechanical Code
IPC	International Plumbing Code
ISA	Instrument Society of America
ISO	International Organization of Standardization
ITE	Institute of Traffic Engineers
LPI	Lightning Protection Institute
LRQA	Lloyd’s Register Quality Assurance
MBMA	Metal Building Manufacturer's Association
MSS	Manufacturers Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NISO	National Information Standards Organization
NSF	NSF International (formerly National Sanitation Foundation)
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
RMA	Rubber Manufacturers Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SSPC	Society for Protective Coating (formerly Steel Structure Painting Council)
SSPWC	Standard Specification for Public Works Construction
TPI	Truss Plate Institute
UDOT	Utah Department of Transportation
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCRSI	Western Concrete Reinforcing Steel Institute
WI	Woodwork Institute
WRI	Wire Reinforcements Institute, Inc.
WWPA	Western Wood Products Association

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 GENERAL

1.1 QUALITY ASSURANCE

A. TITLES OF SECTIONS AND PARAGRAPHS. Captions accompanying Specifications sections and paragraphs are for convenience of reference only, and do not form a part of the Specification.

B. APPLICABLE PUBLICATIONS. Whenever in these Specifications 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; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. 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, specifications test requires (or implies) that specific work is to 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 and shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the work; also they 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 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 all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications nor the applicable codes.

B. Reference herein to "Building Code" or “Uniform Building Code” shall mean the International Building Code of the International Code Council. The latest edition of the code as approved and used by the local agency as of the date of award, as adopted by the agency having jurisdiction, shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, drawings and the other Contract Document, the most stringent requirements shall govern. All conflicts shall be brought to the attention of ENGINEER for clarification and directions prior to ordering or providing any materials or labor. CONTRACTOR shall bid the most stringent requirements.

D. APPLICABLE STANDARD SPECIFICATIONS. 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; except, that wherever references to "Standard Specifications" are made, the provisions therein for measurement and payment shall not apply.

E. References in the Contract Documents to "Standard Specifications" shall mean the Contract Documents including all current supplements, addenda, and revisions thereof.

F. 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.

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

H. UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY. Wells, tanks, pumping stations and culinary water pipelines shall conform to the requirements of Utah Administrative Code Rule R 309. Water and sewer pipeline installation shall conform to the requirements of Utah Administrative Code Rule R 317-3-2.9 “Protection of Water Supplies” for horizontal and vertical separation.

I. UTAH DEPARTMENT OF TRANSPORTATION (UDOT) REQUIREMENTS. CONTRACTOR's work on UDOT property or right-of-way shall conform to UDOT’s latest edition of Standard Specifications For Road and Bridge Construction.

J. U.S. ARMY CORPS OF ENGINEERS (COE) REQUIREMENTS. CONTRACTOR's work shall conform to COE Specifications in accordance with Section 404 of the Clean Water Act for excavation in wetlands.

K. Reference herein to APWA shall mean the latest edition of the “Manual of Standard Specifications” and “Manual of Standard Plans” as prepared by the American Public Works Association and the Associated General Contractors of America.

L. All provisions of the Manual of Standard Specifications, Latest Edition and Manual of Standard Plans, Latest Edition both published by the Utah Chapter of the American Public Works Association are hereby made a part of the Contract Documents by reference. The publications may be purchased separately from the Utah Technology Transfer Center, Utah State University, 4111 Old Main Hill, Logan, UT 84322-4111. Any conflicts, between the technical specifications, drawings, and other provisions or documents contained in the Contract Form or Contract Documents versus provisions contained in the Manual of Standard Specifications, Latest Edition and Manual of Standard Plans, Latest Edition published by the Utah Chapter of the American Public Works Association, shall be resolved in favor of the technical specifications, drawing, and provisions contained in the Contract form or Contract Documents.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

SECTION 01 45 00
QUALITY CONTROL AND MATERIALS TESTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section outlines responsibilities for controlling quality of materials, products, and workmanship.

1.2 MATERIALS

A. All materials incorporated in the project shall be new and shall fully comply with the Specifications. Unless otherwise clearly provided in the Specifications, all workmanship, equipment, materials, and articles incorporated in the Work covered by the Contract are to be of the best available grade of their respective kinds. Whenever, in the specifications, any material, article, device, product, fixture, form, type of construction, or process indicated or specified by patent or proprietary name, by name of manufacturer, or by catalog number, such specifications shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the material or process desired and shall be deemed to be followed by the words "or approved equal" and CONTRACTOR may in such case, upon receiving ENGINEER's approval, purchase and use any item, type, or process which shall be substantially equal in every respect to that indicated or specified.

B. Materials and equipment may be used in the Work based upon receipt of a Supplier's certificate of compliance. Certificate must be in possession of CONTRACTOR and reviewed by ENGINEER prior to use.

C. Quality Assurance Testing by OWNER and/or ENGINEER shall not relieve CONTRACTOR of responsibility to furnish materials and work in full compliance with Contract Documents.

1.3 MANUFACTURER'S INSTRUCTIONS

A. Should instructions conflict with Contract Documents, request clarification before proceeding.

B. When required in individual sections, submit manufacturer's instructions in the quantity required for product data, delivery, handling, storage, assembly, installation, start-up, adjusting, balancing, and finishing, as appropriate.

1.4 WORKMANSHIP

A. Maintain performance control and supervision over Subcontractors, Suppliers, manufacturers, products, services, workmanship, and site conditions, to produce work in accordance with Contract Documents.

B. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

C. Provide suitable qualified personnel to produce specified quality.

D. Ensure finishes match approved samples.

1.5 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from ENGINEER before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.6 TESTING AND INSPECTION SERVICES

A. Testing agency and testing for quality control and material testing shall be furnished by CONTRACTOR as part of the project. Results of testing shall be reported to CONTRACTOR and ENGINEER on site. Reports of the testing shall be transmitted directly to ENGINEER.

B. Materials to be supplied under this contract will be tested and/or inspected either at their place of origin or at the site of the work by the testing agency. CONTRACTOR shall give ENGINEER written notification well in advance of actual readiness of materials to be tested and/or inspected at point of origin so ENGINEER may witness testing by the testing agency. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the material nor shall it preclude retesting or reinspection at the site of the work.

C. CONTRACTOR shall furnish such samples of materials as are requested by the ENGINEER, without charge. No material shall be used until reports from the testing agency have been reviewed and accepted by ENGINEER. See Section 01 33 00 - Submittal Procedures.

1.7 UNSATISFACTORY CONDITIONS

A. Examine areas and conditions under which materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

1.8 AUTHORITY AND DUTIES OF PROJECT REPRESENTATIVE

A. Refer to Section 00 73 00 "Supplementary Conditions" sub-section SC 10.03 "Resident Project Representative".

1.9 QUALITY CONTROL TESTING

A. ENGINEER’s failure to detect any defective Work or materials does not prevent later rejection when such defect is discovered, nor does it obligate ENGINEER for acceptance.

B. CONTRACTOR shall provide 24-hours minimum notice to ENGINEER for all testing required by these specifications so ENGINEER may coordinate or be present during testing.

1.10 TESTING ACCEPTANCE AND FREQUENCY

A. Minimum Quality Control Testing Frequency: As defined in Table 01 45 00-1, CONTRACTOR shall be responsible to ensure that all testing is performed at the frequencies shown. CONTRACTOR shall uncover any work at no cost to OWNER to allow the testing agency to perform required testing at the frequency shown.

B. Acceptance of Defective Work: As defined in Article 14.04 of the General Conditions.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

TABLE 01 45 00-1: QUALITY CONTROL TESTING FREQUENCY

SYSTEM or MATERIAL	TESTS	MINIMUM REQUIRED FREQUENCY
SUBGRADE AND BACKFILL MATERIALS		
Section 31 23 15 Excavation and Backfill for Buried Pipelines	Field Density	1 test per 200 linear feet per 1.5 feet of backfill thickness placed.
	Laboratory	1 test for each material type which includes proctor, classification, and gradation.
Section 31 23 23 Excavation and Backfill for Structures	Field Density	1 test per 200 linear feet per 1.5 feet of backfill thickness placed.
	Laboratory	1 test for each material type which includes proctor, classification, and gradation.
Section 32 11 23 Road Base - Untreated Base Course	Field Density	Base course subgrade: 1 test per 2,000 square feet of area. Base course: 1 test per 2,000 square feet of area.
	Laboratory	Base course: 1 test for each material type which includes proctor, classification, and gradation.
ASPHALT		
Section 32 12 16 Hot-Mix Asphalt Concrete Paving	Mix Design	Marshall Test Method: 1 test initially per each type of material and each change in target, and for each day of production thereafter. Specific Gravity: 1 per each Marshall Test Extraction: 1 test per each Marshall Test
	Field Density	Bituminous surfaces: 1 test per 2,000 square feet placed or part thereof.
	Asphalt Thickness and Core Density	Bituminous surfaces: 1 test sample every 300 linear feet of completed roadway.
PORTLAND CEMENT CONCRETE		
Section 3 30 00 Cast-in-Place Concrete	Slump	1 test every day of placement (if less than 100 cubic yards in a day), 1 test for every 100 cubic yards, or 1 test for each 3,000 square feet of surface area for slabs and more frequently if batching appears inconsistent.
	Entrained air	1 test with slump test.
	Ambient and concrete temperatures	1 test with slump test.
	Water cement ratio.	to be verified and provided with batch tickets.

SYSTEM or MATERIAL	TESTS	MINIMUM REQUIRED FREQUENCY
	Compressive strength	1 set of 5 cylinders. 1 test every day of placement (if less than 100 cubic yards in a day), 1 test for every 100 cubic yards, or 1 test for each 3,000 square feet of surface area for slabs, and more frequently if batching appears inconsistent.

NOTES:

1 Additional tests shall be conducted when variations occur due to CONTRACTOR's operations, weather conditions, site conditions, etc.
2 Classification, moisture content, Atterberg limits and specific gravity tests shall be conducted for each compaction test, if applicable.
3 Tests can substitute for same tests required under "Aggregates" (from bins or source), although gradations will be required when blending aggregates.
4 Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for water/cement calculations.

- END OF SECTION –

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SECTION 01 45 23

TESTING AGENCY SERVICES

PART 1 GENERAL

1.1 SUMMARY

A. CONTRACTOR shall be responsible for providing Construction Quality Control Testing of all soils, concrete, etc. as required by the various sections of these Specifications. This section includes the following:

1. Use of independent testing agency
2. Control testing report submittal requirements
3. Responsibilities of testing agency

1.2 RELATED WORK

A. Related work specified in other sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 22 00 Measurement and Payment

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D 3740 Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
2. ASTM D 4561 Standard Practice for Quality Control Systems for Organizations Producing and Applying Bituminous Paving Materials
3. ASTM E 329 Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.4 DEFINITIONS

A. Independent Testing Agency: A testing agency NOT owned by CONTRACTOR, and an agency that does not have any preferential affiliation or association with CONTRACTOR, or any of CONTRACTOR's Subcontractors and Suppliers other than entering into a contract with CONTRACTOR to perform the duties defined in these Specifications.

B. Professional Engineer: An engineer who complies with Utah licensing law and is acceptable to the authority having jurisdiction.

1.5 QUALITY ASSURANCE

A. CONTRACTOR shall employ and pay for services of an independent testing agency which complies with ASTM D 3740, ASTM D 4561, and ASTM E 329 to test materials for contract compliance.

1.6 CONTRACTOR SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures

B. If CONTRACTOR is employing and paying for an independent testing agency, prior to start of Work, submit testing agency's name, address, telephone number and the following:

1. Concrete Technician: Approved by ENGINEER or ACI certified.
2. Person charged with engineering managerial responsibility
3. Professional engineer on staff to review services
4. Level of certification of technicians

1.7 TESTING AGENCY SUBMITTALS

A. Field Test Report: Submit report no later than the end of the current day.

B. Laboratory Test Report: Submit original report within 48 hours after test results are determined.

C. Final Summary Report: Submit prior to final payment

D. On all reports include:

1. Project title, number and date of the report
2. Date, time and location of test
3. Name and address of material Supplier
4. Identification of product being tested and type of test performed
5. Identify whether test is initial test or retest
6. Results of testing and interpretation of results
7. Name of technician who performed the testing

1.8 RESPONSIBILITIES OF TESTING AGENCY

A. Calibrate testing equipment at least annually with devices with an accuracy traceable to either National Bureau of Standards or acceptable values of natural physical constraints.

B. Provide sufficient personnel at site and cooperate with CONTRACTOR, ENGINEER and OWNER's Representative in performance of testing service.

C. Secure samples using procedures specified in the applicable testing code.

D. Perform testing of products in accordance with applicable sections of the Contract Documents.

E. Immediately report any compliance or noncompliance of materials and mixes to CONTRACTOR, ENGINEER, and OWNER's Representative.

F. When an out-of-tolerance condition exists, perform additional inspections and testing until the specified tolerance is attained, and identify retesting on test reports.

1.9 LIMITS ON TESTING AGENCY AUTHORITY

A. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Agency may not suspend Work.

C. Agency has no authority to accept Work for OWNER.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

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SECTION 01 50 00
TEMPORARY CONSTRUCTION UTILITIES AND ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers temporary utilities, including electricity, lighting, telephone service, water, and sanitary facilities; temporary controls, including barriers, protection of work, and water control; and construction facilities, including parking, progress cleaning, and temporary buildings.

1.2 TEMPORARY UTILITIES

A. Temporary Electricity: CONTRACTOR shall provide, maintain, and pay for all power required by CONTRACTOR, including electrical service to CONTRACTORS field office.

B. Temporary Lighting: CONTRACTOR shall provide all temporary lighting required for execution of his work and for employee and public safety. As a minimum, lighting levels during working hours shall meet the requirements of OSHA Subsection 1926.56 illumination.

C. Temporary Heating and Cooling

1. Provide heating and cooling devices as needed to maintain specified conditions for construction operations.

D. Temporary Ventilation

1. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Telephone Service: CONTRACTOR shall provide, maintain and pay for telephone service to the field office at time of project mobilization.

F. Temporary Water Service

1. CONTRACTOR shall provide for all his workers on the project, adequate and reasonably convenient uncontaminated drinking water supply. All facilities shall comply with the regulations of the local and State Departments of Health.
2. CONTRACTOR shall be responsible to arrange for water, both potable and non-potable water.
3. When water is taken from a city water system or any other potable water supply source for construction purposes, suitable precautions shall be taken to prevent cross connections and contamination of water supply.

G. Temporary Sanitary Facilities: CONTRACTOR shall provide and maintain sanitary facilities for his employees and his subcontractors' employees that will comply with the regulations of the local and State Departments of Health.

1.3 TEMPORARY CONTROLS

A. Barriers: Provide barriers as necessary to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

B. Project Security

1. CONTRACTOR shall make all necessary provisions to protect the project and CONTRACTOR's facilities from fire, theft, and vandalism, and the public from unnecessary exposure to injury.
2. Entry Control:
   a. Restrict entrance of persons and vehicles into Project site.
   b. Allow entrance only to authorized persons.

C. Dust Control: Execute Work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into the atmosphere. Give all unpaved streets, roads, detours, or haul roads used in the construction area an approved dust-preventive treatment or periodically water to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.

D. Pest Control: Provide methods, means, and facilities to prevent rodents, pests and insects from damaging the Work.

E. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. All chemicals used during construction or furnished for project operation whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instruction of the manufacturer.

F. Protection of Work: CONTRACTOR shall protect installed work and provide special protection where specified in individual specifications sections. CONTRACTOR shall provide temporary and removable protection for installed products and shall control activity in immediate work area to minimize damage.

G. Open Burning: No open burning of waste materials will be allowed.

H. Explosives and Blasting: The use of explosives on the work will not be permitted.

I. Noise Abatement: In inhabited areas, particularly residential, operations shall be performed in a manner to minimize unnecessary noise generation.

J. STORM AND GROUND WATER

1. CONTRACTOR shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water entering the excavation or other parts of the work, whether the water be from surface or underground water sources.

2. In excavation, fill, and grading operations, care shall be taken to disturb the pre-existing drainage pattern as little as possible. Particular care shall be taken not to direct drainage water into private property or into streets or drainage ways inadequate for the increased flow.
3. CONTRACTOR shall maintain effective means to minimize the quantity of sediments leaving the work area either by storm water or CONTRACTOR's own dewatering operations. CONTRACTOR shall be responsible for obtaining required permits and complying with all City, State, and Federal storm water management regulations and requirements, including preparing and implementing a Storm Water Pollution Prevention Plan (SWPPP) for Construction Activities. If required, CONTRACTOR shall submit a copy of the Notice of Intent and the SWPPP to the OWNER for review and approval.

1.4 CONSTRUCTION FACILITIES

A. VEHICULAR ACCESS

1. Construct temporary access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.
2. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.
3. Location of temporary access roads and detours shall be approved by ENGINEER.
4. Provide unimpeded access for emergency vehicles.
5. Provide and maintain access to fire hydrants and control valves free of obstructions.
6. Provide means of removing mud from vehicle wheels before entering streets.
7. When possible, use existing on-site roads for construction traffic.

B. Parking: CONTRACTOR shall provide temporary parking areas to accommodate use of construction personnel. Parking shall be located in an area approved by ENGINEER.

C. Progress Cleaning

1. CONTRACTOR shall maintain areas free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition. Upon completion of work, repair all damage caused by equipment and leave the project site free of rubbish or excess materials of any kind.
2. Thoroughly clean all spilled dirt, gravel, or other foreign materials caused by the construction operations from all streets and roads at the conclusion of each day's operation.
3. It shall be the responsibility of CONTRACTOR to promptly clean up and remove any oil and/or fuel spills caused by CONTRACTOR or his Sub-contractors during the course of the project. Contaminated soil shall be properly disposed of by CONTRACTOR in accordance with all applicable laws. CONTRACTOR shall be responsible for any damages to OWNER resulting from CONTRACTOR's negligence in promptly cleaning up said spills.

1.5 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Prior to Final Application for Payment, CONTRACTOR shall remove temporary above grade or buried utilities, equipment, facilities, and materials; clean and repair damage

caused by installation or use of temporary work; and restore existing facilities used during construction to original condition.

1.6 CULTURAL RESOURCES

A. 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, archeological, or cultural resources (hereinafter called "cultural resources").

B. 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. If a suspected or unsuspected historical, archaeological, or paleontological item, feature, or site or other cultural resource is encountered during subsurface excavations at the site of construction, the following procedures shall be instituted:

1. Construction operations shall be immediately stopped in the vicinity of the discovery and ENGINEER and OWNER shall be notified of the nature and exact location of the finding. CONTRACTOR shall not damage the discovered objects and shall provide written confirmation of the discovery to ENGINEER within two (2) calendar days.
2. OWNER and ENGINEER will then immediately notify the State Historical Preservation Office (SHPO) and the Utah Geological Survey (UGS).
3. SHPO and UGS will investigate the finding and determine if the resource requires protection and the disposition of the said resource.

D. If SHPO and UGS determine that the potential find is a bona fide cultural resource, CONTRACTOR shall suspend work at the location of the find under the provisions for changes contained in Articles 11, 12, and 13 of the General Conditions, Section 00 70 00 – General Conditions.

PART 2 PRODUCTS

2.1 TEMPORARY EROSION CONTROL MATERIALS

A. EROSION CONTROL BLANKETS

1. Erosion control blankets shall meet the requirements of the Erosion Control Technology Council (ECTC) and the FHWA Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-03 Section 713.17 as a Type 3.B Extended Term Double Net Erosion Control Blanket. The erosion control blanket shall be fabricated from UV-stabilized polypropylene and a straw/coconut blend. The blanket shall be **Model SC150 by Tensar North American Green, Excel CS-3 by Western Excelsior**, or approved equal. The functional longevity shall be 24 months minimum.

B. SILT FENCE

1. Use woven fabric meeting the following properties.

Table 1 - Silt Fence Geotextile			
Property	**ASTM**	**MARV's**	
		Standard	**High Performance**
Grab Tensile Strength, lbs.	D 4632	90[(a)]	120[(a)]
Grab Elongation, %	D 4632	< 40	< 40
Flux, gal/min/ft^2	D 4491	15	90
Apparent Opening Size, (AOS-US sieve)	D 4751	> 20	> 30
Ultraviolet Degradation, %	D 4355	70	90
NOTES (a) Percent of tensile strength retained determined after weathering per ASTM D 4355 for 500-hours			

2. High performance fence to have tape yarns in one principle direction only.
3. Add stabilizers or inhibitors to make the filaments resistant to sunlight or heat deterioration.
4. Finish edges to prevent outer yarn from pulling away from the fabric.
5. Sheets of fabric may be sewn or bonded together. Provide minimum width recommended by manufacturer.
6. No deviation from any requirement in Table 2 due to the presence of seams.
7. Manufactured with pockets for posts, hems with cord, or with posts pre-attached using staples or button head nails.

C. POSTS

1. Minimum length: 4-feet.
2. Steel: Round, U shaped, T shaped, or C shaped with a minimum weight of 1.3-pounds per foot, and have projections for fastening wire.
3. Wood as follows:
   a. Soft wood posts at least 3-inches in diameter, or nominal 2 x 4-inches and straight to provide a fence without noticeable misalignment.
   b. Hard wood post providing a minimum cross-sectional area of 2.25 square-inches.
4. Fasteners for Wooden Posts:
   a. Wire staples No. 17 gage minimum with a crown at least 3/4-inches wide and legs at least 1/2-inch long.
   b. Nails 14 gage minimum, 1-inch long with 3/4-inch button.

PART 3 EXECUTION

3.1 SILT FENCE

A. Beginning work means acceptance of existing conditions.

B. Maintain the silt fence until revegetation is complete (defined as when cover reaches a density of at least 70% of pre-disturbance levels.

C. Clear area of any debris and obstructions that may damage geotextile.

D. Place post in all low points.

E. Install posts a maximum of 8-feet apart with at least 18-inches in the ground. If not possible to achieve depth, secure posts to prevent overturning.

F. Attach filter fabric by wire, cord, pockets, staples, nails, or other effective means.

1. When using a wire support fence, provide at least 6 horizontal wires with a minimum of 12 gage wire. Space vertical wires 6-inches maximum. Secure geotextile to the up slope side of the post. Extend wire into the trench a minimum of 2-inches and extend a maximum or 36-inches above the ground surface.

G. Install fabric so 6 to 8-inches of fabric remain at the bottom to be buried. Splice together only at support posts with at least a minimum overlap of 18-inches. Extend buried portion 6-inches deep and the rest upstream of the fabric fence.

H. Sediment Removal: Remove sediment before deposit reaches 1/2 of the height of the silt fence or raise the height of silt fence. After removal of sediment, dress landscape.

I. Schedule of Locations: Typical locations include the toe of fill slopes, the downhill side of fill slopes, the downhill side of large cut areas, and at natural drainage areas. Limit geotextile materials to handle an area equivalent to 1,000 square feet per 10-feet of fence. Use caution should site slope be steeper than 1:1 (horizontal:vertical), and water flow rates exceed 1 cubic foot per second per 10-feet of fence face.

- END OF SECTION –

SECTION 01 50 30
PROTECTION OF EXISTING FACILITIES

PART 1 GENERAL

1.1 DESCRIPTION

A. Any existing facilities, disturbed which are located in or adjacent to the line of work such as curbs, gutters, drive approaches, sidewalks, driveways, fences, underground pipes, conduits, or utilities, shall be cleaned up and restored in kind by CONTRACTOR and in accordance with the Specifications contained herein governing the various types of services involved.

B. CONTRACTOR shall not perform work that would affect any oil, gas, sewer, or water pipeline; any telephone, fiber optic, television cable, or electric transmission line; any fence; or any structure, until authorization has been obtained from owner of the improvement. Provide owner of the improvement due notice of the beginning of the work, and remove, shore, support, or otherwise protect such improvement or replace the same.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

Section 01 78 50 Project Closeout

1.3 RESTORATION OF FENCES

A. Where it is necessary to remove any fence to facilitate CONTRACTOR's operation, CONTRACTOR shall obtain prior agreement with owner of the fence for removal of the fence and shall be responsible for any damage due to negligence of CONTRACTOR. As soon as practical, the fence shall be restored substantially to the same or improved condition as it was prior to the commencement of the work. Where livestock is present CONTRACTOR shall provide temporary fencing to keep livestock away from the construction area.

1.4 UNDERGROUND SERVICE ALERT

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, CONTRACTOR shall notify the regional notification center (Blue Stakes of Utah) at 1-800-662-4111 or 811 or submit an on-line request at www.bluestakes.org at least 2 days, but no more than 7 days, prior to such excavation.

1.5 INTERFERING STRUCTURES AND UTILITIES

A. CONTRACTOR shall exercise all possible caution to prevent damage to existing structures and utilities, whether above ground or underground. Prior to submittal of Shop Drawings, and prior to commencing any excavations for new pipelines or structures, conduct investigations, including exploratory excavations and borings, to

determine the location and type of underground utilities and services connections that could result in damage to such utilities. It shall be the responsibility of CONTRACTOR to locate and expose all existing underground and overhead structures and utilities in such a manner as to prevent damage to same. CONTRACTOR shall notify all utility offices concerned at least 48 hours in advance of construction operations in which a utility agency's facilities may be involved. This shall include, but not be limited to, irrigation water, culinary water, telephone, television cables, fiber optic communication, gas, and electric. CONTRACTOR shall be responsible for any and all changes to, reconnections to public utility facilities encountered or interrupted during prosecution of the work, and all costs relating hereto shall be at CONTRACTOR's expense. CONTRACTOR shall contract with and pay Public Utility Agencies for work required in connection with all utility interferences and handle all necessary notifications, scheduling, coordination, and details. The cost of public utility interferences shall be included in CONTRACTOR's lump sum or unit price bid covering the major contract facility to which interference or changes are attributable.

B. All exploratory excavations shall be performed as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of the construction to avoid possible delays to CONTRACTOR's progress. Prepare a report identifying each utility by its size, elevation, station and material of construction. Immediately notify ENGINEER and the utility in writing as to any utility discovered in a different position than as marked in the field or shown on the Drawings, or any utility which is not marked in the field or not shown on the Drawings.

C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility. Conform to local agency requirements for backfill and pavement repair subsequent to performing exploratory excavations.

D. Any damages to private property, either inside or outside the limits of the easements provided by OWNER, shall be the responsibility of CONTRACTOR. Any roads, structures, or utilities damaged by the work shall be repaired or replaced in a condition equal to or better than the condition prior to the damage. Such repair or replacement shall be accomplished at CONTRACTOR's expense without additional compensation from OWNER.

E. CONTRACTOR shall remove and replace small miscellaneous structures such as fences and culverts which are damaged by the construction activity at his own expense without additional compensation from OWNER. CONTRACTOR shall replace these structures in a condition as good as or better than their original condition.

F. At points where CONTRACTOR's operations are adjacent to or across properties of railway, telegraph, telephone, irrigation canal, power, gas, water, or adjacent to other property (damage to which might result in considerable expense, loss, and inconvenience), no work shall be started until all arrangements necessary for the protection thereof have been made.

G. The locations of the major existing culinary water lines, gas pipes, underground electric, cable television, and telephone lines that are shown on the plans were taken from city maps, and maps supplied by the utility owner. No excavations were made to verify the locations shown for underground utilities, unless specifically stated on the Drawings. It should be expected that some location discrepancies will occur. Neither OWNER nor its

officers or agents shall be responsible for damages to CONTRACTOR as a result of the locations of the utilities being other than those shown on the plans or for the existence of utilities not shown on the plans.

H. CONTRACTOR shall be solely and directly responsible to owners and operators of such properties for any damage, injury, expense, loss or inconvenience, delay, suits, actions, or claims of any character brought because of an injury or damage which may result from the carrying out of the work to be done under the contract.

I. All utilities 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 encountered along the line of the work shall remain continuously in service during all operations under the Contract, unless other arrangements satisfactory to ENGINEER are made with owner of said utility.

J. In the event of interruption to either domestic or irrigation water, or to other utility services as a result of accidental breakage, or as a result of being exposed or unsupported, CONTRACTOR shall promptly notify the proper authority. CONTRACTOR shall cooperate with the authority in restoration of service as soon as possible and shall not allow interruption of any water or utility service outside working hours unless prior approval is received.

K. In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of CONTRACTOR, be notified by OWNER to move such property within a specified reasonable time. When utility lines that are to be moved are encountered within the area of operations, CONTRACTOR shall notify ENGINEER a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.

L. 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 indicated, CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such Utility or improvement in a manner satisfactory to ENGINEER and OWNER of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished by 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.

1.6 RIGHTS-OF-WAY

A. CONTRACTOR shall be required to confine construction operations within the dedicated rights-of-way for public thorough fares, or within areas for which construction easements have been obtained, unless they have made special arrangements with the affected property owners in advance. CONTRACTOR shall be required to protect stored materials, cultivated trees and crops, and other items adjacent to the proposed construction site.

B. CONTRACTOR shall submit for approval by ENGINEER the type and size of equipment used, and the methods for work performed on the rights-of-way across private properties, to avoid or minimize injury to trees, shrubs, gardens, lawns, fences, driveways, retaining walls, or other improvements within the rights-of-way.

C. The construction easement widths and access to private properties are as shown on the Drawings and as described in the easement documents; however, CONTRACTOR is to minimize impacts to surface improvements within the right-of-way. CONTRACTOR shall obtain a signed release from the property owner, approving restoration of work in the construction easements across or bordering private properties. See Project Closeout Section 01 78 50, 1.4.D.

D. Property owners affected by the construction shall be notified by CONTRACTOR at least 48 hours in advance of the time the construction begins. During all construction operations, CONTRACTOR shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to his property for a period exceeding 8 hours unless CONTRACTOR has made special arrangements with the affected persons. CONTRACTOR shall, daily or more frequently, if necessary, grade all disturbed areas to be smooth for motor vehicle traffic.

1.7 PROTECTION OF SURVEY, STREET OR ROADWAY MARKERS

A. CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced. Survey markers or points disturbed by CONTRACTOR shall be accurately restored after street or roadway resurfacing has been completed.

1.8 TREES OR SHRUBS WITHIN PROJECT LIMITS

A. Except where trees or shrubs are indicated to be removed, CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or OWNER. Existing trees and shrubs which are damaged during construction shall be trimmed or replaced by CONTRACTOR or a certified tree company under permit from the jurisdictional agency and/or OWNER. Tree trimming and replacement shall be accomplished in accordance with the following paragraphs.

1. Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. Cuts over 1-1/2 inches in diameter shall be coated with a tree paint product that is waterproof, adhesive, and elastic, and free from kerosenes, coal tar, creosote, or other material injurious to the life of the tree.
2. CONTRACTOR shall immediately notify the jurisdictional agency and/or OWNER if any tree or shrub is damaged by CONTRACTOR's operations. If, in the opinion of said agency or OWNER, the damage is such that replacement is necessary, CONTRACTOR shall replace the tree or shrub at its own expense. The tree or shrub shall be of a like size and variety as the one damaged, or, if of a smaller size, CONTRACTOR shall pay to OWNER of said tree a compensatory payment acceptable to the tree or shrub owner, subject to the approval of the jurisdictional agency or OWNER. The size of the tree or shrub shall be not less than 1-inch diameter nor less than 6 feet in height.

1.9 RESTORATION OF PAVEMENT

A. Pavement work shall meet the specifications for installation as noted in APWA Section 33 12 16.

B. All paved areas damaged during construction shall be replaced with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract or in the requirements of the agency issuing the permit. The pavement restoration requirement to match existing sections shall apply to all components of existing sections, including sub-base, base, and pavement. Pavements which are subject to partial removal shall be neatly sawcut in straight lines.

C. Wherever required by the local agency having jurisdiction, CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.

1.10 CONCRETE WORK

A. Concrete work shall meet the specifications for installation as noted in APWA Section 32 16 13 Driveway, Sidewalk, Curb and Gutter.

B. All flat work in streets tying into existing flatwork shall be doweled into the existing concrete. Dowels to be spaced at 12" O.C. and be No. 5 rebar x 14" for slabs up to 8 inches in thickness and No. 8 rebar x 18" for slabs over 8 inches.

1.11 LAWNS

A. Lawns that are damaged or destroyed during performance of the work shall be repaired or replaced with turf sod according to APWA Section 32 92 00 - Turf and Grass.

1.12 FENCES

A. Fences that are damaged or destroyed during performance of the work shall be repaired or replaced back to the original condition or better to the satisfaction of the landowner and OWNER.

1.13 LANDSCAPING

A. All landscaping on private property that is damaged or destroyed during performance of the work shall be repaired or replaced back to the original condition or better to the satisfaction of the landowner and OWNER.

1.14 OTHER SURFACE IMPROVEMENTS

A. All other surface improvements not explicitly mentioned herein that are damaged or destroyed during performance of the work shall be repaired or replaced back to original condition or better.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

SECTION 01 55 26
TRAFFIC CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall comply with all rules and regulations of the City, County, and State authorities regarding the closing of public streets or highways. If conditions justify, ENGINEER may authorize CONTRACTOR to conduct his work in specific areas and to specific tasks to avoid sporadic and unorganized work efforts.

B. All work performed on or within the right-of-way of state roads shall have traffic control devices in place before work begins that meet the requirements of Utah Department of Transportation's "Specifications for Excavation on State Highways".

C. No road shall be closed by CONTRACTOR to the public except by express permission of ENGINEER and after obtaining the required permits. Where it is necessary to close a county or city road to thru traffic, the road shall be closed to thru traffic only - not local traffic. The road shall be closed for one block only, not over 700 feet. The road shall be barricaded at each point of public access with barricades meeting the Utah Department of Transportation's specifications.

D. Traffic must be kept open on those roads and streets where no detour is possible. CONTRACTOR shall, at all times, conduct his work so as to ensure the least possible obstruction to traffic and normal commercial pursuits. All obstructions within traveled roadways shall be protected by approved signs, barricades, and lights where necessary for the safety of the traveling public. The convenience of the general public and residents, and the protection of persons and property are of prime importance and shall be provided for by CONTRACTOR in an adequate and satisfactory manner.

E. Excavations on project sites from which the public is excluded shall be marked or guarded in a manner appropriate for the hazard.

1.2 TRAFFIC CONTROL

A. For the protection of traffic in public or private streets and ways, CONTRACTOR shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the "Manual on Uniform Traffic Control Devices for Streets and Highways, Part VI - Temporary Traffic Control," published by U.S. Department of Transportation, Federal Highway Administration. CONTRACTOR shall take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. CONTRACTOR shall station such guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.

B. If at any time the conditions indicate that CONTRACTOR's protective facilities and service are inadequate to assure the safety of the public or CONTRACTOR's workers, CONTRACTOR shall provide additional facilities or services as may be necessary to assure protection at no additional cost to OWNER.

C. Where required, CONTRACTOR shall obtain a traffic control permit from the governing agency prior to beginning work and shall comply with all requirements of the permit.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

SECTION 00 56 00
DUST CONTROL

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials and equipment as required to provide dust control for the project.

B. All materials and services shall comply with the requirements of the State of Utah, Department of Environmental Quality, Division of Air Quality and the City's Municipal Code.

PART 2 PRODUCTS

2.1 MATERIALS

A. Water. CONTRACTOR shall be responsible to arrange and pay for water for dust control.

B. Calcium chloride shall be added to the water used to provide dust control, if required by the City.

PART 3 EXECUTION

3.1 DUST CONTROL

A. CONTRACTOR shall comply with the requirements of the State of Utah Department of Environmental Quality, Air Quality Regulations (including R301-205 Emission Standards: Fugitive Emissions and Fugitive Dust, and R307-309 Fugitive Emissions and Fugitive Dust, of the Utah Air Conservation Rules (UACR). CONTRACTOR shall submit a Fugitive Dust Control Plan to the Utah Division of Air Quality, which meets the requirements of R307-309-4. CONTRACTOR shall obtain a permit from the Division of Air Quality.

B. CONTRACTOR shall execute Work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into the atmosphere. Give all unpaved streets, roads, detours, or haul roads used in the construction area an approved dust-preventive treatment or periodically water to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.

3.2 WATER PLACEMENT FOR DUST CONTROL

A. CONTRACTOR is responsible for placement of sufficient water to control dust on the project. Dust control is defined by the permit requirements of the State of Utah, Division of Environmental Quality, Division of Air Quality. Permit shall be obtained by CONTRACTOR.

3.3 WATER AND CALCIUM CHLORIDE MIXTURE FOR DUST CONTROL

A. CONTRACTOR may also use a water and calcium chloride solution to abate the dust for the project. The mixture of calcium chloride per 10,000-gallon truck shall be 10 pounds. The calcium chloride shall be added to the water truck container as the water is being put into the water truck in order to provide sufficient mixing.

B. In the absence of providing the water and calcium chloride mixture, CONTRACTOR shall meet the requirements of Subsection 3.2 of this document, or shall use other approved methods by OWNER that will allow CONTRACTOR to meet permit requirements.

- END OF SECTION -

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

C. Furnish interchangeable components from same manufacturer for components being replaced.

1.2 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.3 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.4 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.5 PRODUCT SUBSTITUTION PROCEDURES

A. ENGINEER will consider requests for Substitutions only after Notice of Award.

B. Substitutions may be considered when a product becomes unavailable through no fault of CONTRACTOR.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that CONTRACTOR:

1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
2. Will provide same warranty for Substitution as for specified product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to OWNER.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse OWNER for review or redesign services associated with re-approval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:

1. Submit four copies of request for Substitution for consideration to ENGINEER.
2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
3. ENGINEER may require CONTRACTOR to provide additional data about the proposed substitution.
4. ENGINEER will be the sole judge as to the type, function, and quality of any such substitution and ENGINEER’s decision shall be final.
5. ENGINEER will notify CONTRACTOR in writing of decision to accept or reject request.
6. Acceptance by ENGINEER of a substitution proposed by CONTRACTOR shall not relieve CONTRACTOR of the responsibility for full compliance with the Contract Documents and for the adequacy of the substitution.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

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SECTION 01 71 13
MOBILIZATION

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section is provided to cover CONTRACTOR's cost of general and miscellaneous responsibilities and operations not normally attributed to, or included in, any other single bid item. This shall include, but not necessarily be limited to, work described or enumerated in this section under the following subsections.

1.2 MOVING TO AND FROM THE JOB SITE

A. This shall include CONTRACTOR's preliminary arrangement for starting and stopping construction operations, work schedules, and transportation of equipment and personnel to and from the project.

1.3 CLEAN-UP

A. The cost of all clean-up work as specified and not covered under other items shall be included in the Bid. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

1.4 TEMPORARY UTILITIES

A. The cost of water, power, etc. required by CONTRACTOR in performing the Work specified in the Contract shall be included in the Bid. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

1.5 PERFORMANCE BOND, PAYMENT BOND, AND INSURANCE

A. The cost of the Performance Bond, Payment Bond, and any required insurance and/or other miscellaneous cost associated with this Project shall be included with the Bid. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

1.6 PERMITS

A. CONTRACTOR shall provide all necessary permits for completion of the Work. Values shall be included in the Bid Schedule, lump-sum price, for "Mobilization/Demobilization".

1.7 PRE-CONSTRUCTION VIDEO RECORDS

A. CONTRACTOR is required to produce a preconstruction video recording of areas where Work is to be performed. The video record shall be of professional quality and the coverage shall be such as to allow accurate determination of location, size, and conditions, etc. of existing features and improvements within the rights-of-way. CONTRACTOR shall provide OWNER with a copy of the rights-of-way video in electronic format on a digital video disc (DVD) or solid-state drive (USB or Thumb Drive) before construction begins.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION –

SECTION 01 78 50
PROJECT CLOSEOUT

PART 1 GENERAL

1.1 FINAL CLEANUP

A. 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 OWNER will be withheld until CONTRACTOR has satisfactorily complied with the foregoing requirements for final cleanup of the Project Site.

1.2 TOUCH-UP AND REPAIR

A. CONTRACTOR shall touch up or repair all finished surfaces on structures, equipment, fixtures, etc., that have been damaged prior to final acceptance. Surface on which such touch-up or repair cannot be successfully accomplished shall be completely refinished or in the case of hardware and similar small items, the item shall be replaced.

1.3 CLOSEOUT TIMETABLE

A. CONTRACTOR shall establish dates for equipment testing, acceptance periods and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow OWNER, ENGINEER, and their authorized representatives sufficient time to schedule attendance at such activities.

1.4 MAINTENANCE AND GUARANTEE

A. CONTRACTOR shall comply with the maintenance and guarantee requirements contained in Article 7 of the General Conditions, Section 00 70 00.

B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as part of such required repair work, and any repair or resurfacing which becomes necessary by reason of such required repair work shall be completed by CONTRACTOR at no cost to OWNER.

C. CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from OWNER. If CONTRACTOR fails to make such repairs or replacement promptly, OWNER reserves the right to do the work and CONTRACTOR and his surety shall be liable to OWNER for the cost thereof.

D. CONTRACTOR shall obtain a signed release from the property owner approving restoration of work in the construction easements across or bordering private property.

1.5 BOND

A. CONTRACTOR shall provide a bond to guarantee performance of the provisions contained in Paragraph "Maintenance and Guarantee" above, and Article 6 of the General Conditions, Section 00 70 00.

1.6 FINAL ACCEPTANCE

A. Final acceptance and final payment shall not be made until all provisions of the General Conditions Section 00 70 00 Article 15 have been satisfied.

1.7 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed Shop Drawings, Product Data, and Samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by OWNER.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work
3. Field changes of dimension and detail
4. Details not on original Contract drawings

G. Submit documents to ENGINEER with claim for final Application for Payment.

1.8 CONTRACT CLOSEOUT

A. As a condition precedent to final acceptance of the project, CONTRACTOR shall complete the following forms and submit the original and two copies of each form to the Project Representative.

1. Contractor’s Certificate of Substantial Completion
2. Contractor’s Certificate of Final Completion
3. Contractor’s Final Waiver of Lien
4. Consent of Surety for Final Payment
5. Affidavit of Payment
6. Affidavit of Release of Liens by the Contractor

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

CONTRACTOR'S CERTIFICATE OF SUBSTANTIAL COMPLETION

OWNER

TO: Name
Address
City, State, Zip Code

PROJECT: _____

ATTENTION: _____

FROM: _____
Firm or Corporation

This is to certify that I, _____ am an authorized official of _____ working in the capacity of _____ and have been properly authorized by said form or corporation to sign the following statements pertaining to the subject contract.

I know of my own personal knowledge, and do hereby certify, that the work of the Contract described above has been substantially performed, and materials used and installed to date in accordance with, and in conformity to, the Contract drawings and specifications. A list of all incomplete work is attached.

The Contractor hereby releases the Owner and its agents from all claims and liability to the Contractor for anything done or finished for or relating to the Work, as specified in the Project Manual, except demands against the Owner for the remainder of progress payments retained to date, and unresolved written claims prior to this date.

The Contract Work is now substantially complete, ready for its intended use, and ready for your inspection. You are requested to issue a Certificate of Substantial Completion.

Signature: _____

Date: _____

CONTRACTOR'S CERTIFICATE OF FINAL COMPLETION

OWNER

TO:
Name
Address
City, State, Zip Code

PROJECT: _____

ATTENTION: _____

FROM: _____
Firm or Corporation

This is to certify that I, _____ am an authorized official of _____ _____ working in the capacity of _____ _____ and have been properly authorized by said form or corporation to sign the following statements pertaining to the subject contract.

I know of my own personal knowledge, and do hereby certify, that the work of the Contract described above has been substantially performed, and materials used and installed to date in accordance with, and in conformity to, the Contract drawings and specifications.

The Contractor hereby releases the Owner and its agents from all claims and liability to the Contractor for anything done or finished for or relating to the Work. The Contract Work is now complete in all parts and requirements, ready for its intended use, excepting the attached list of minor deficiencies and the reason for each being incomplete to date, for which exemption from final payment requirements is requested (if no exemptions requested, write "none") _____. The Work is now ready for your final inspection. The following items are required from the Contractor prior to application for final payment and are submitted herewith, if any:

_____

_____

I understand that neither the issuance, by the Owner, or a Certificate of Final Completion, nor the acceptance thereof by the Owner, shall operate as a bar claim against the Contractor under the terms of the guarantee provisions of the Contract Documents.

Signature: _____
Date: _____

CONTRACTORS FINAL WAIVER OF LIEN

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has furnished labor and materials for (A) _____

_____

in the City of _____, County of _____, State of Utah, of which City of _____ is the Owner.

NOW THEREFOR, this _____ day of _____, 20_____, for and in consideration of the sum of (B) _____ dollars paid simultaneously herewith, the receipt whereof is hereby acknowledged by the undersigned, the undersigned does hereby waive and release any lien* right to, or claim of lien with respect to and on said above described premises, and the improvements thereon, and on the monies or other consideration due or to become due from the Owner, on account of labor, services, materials, fixtures, apparatus or machinery heretofore or which may hereafter be furnished by the undersigned to or for the above described premises by virtue of said contract.

(C) _____ (SEAL)
(Name of sole ownership, corporation or partnership)

(C) _____ (SEAL)
(Signature of Authorized Representative)

Title: _____

INSTRUCTION FOR FINAL WAIVER:

A. Project name.

B. Final Contract amount received (total amount of Contract as adjusted).

C. If the waiver is for a corporation, corporate name should be used, corporate seal affixed, and title of officer signing waiver should be set forth; if waiver is for a partnership, the partnership name should be used, partner should sign and designate himself/herself as partner.

* The word Lien as used herein shall include Stop Orders, Stop Notices, or Freeze Orders on monies or other consideration of the Owner which are due or are to become due on the Contract referenced above.

CONSENT OF SURETY FOR FINAL PAYMENT

Project Name: _____

Location: _____

Type of Contract: _____

Amount of Contract: _____

In accordance with the provisions of the above named contract between the Owner and the Contractor, the following named surety:

_____

_____

_____

on the Payment Bond of the following named Contractor:

_____

_____

_____

hereby approves of final payment to the Contractor, and further agrees that said final payment to the Contractor shall not relieve the Surety Company named herein of any of its obligations to the following named Owner (as set forth in said Surety Company's bond):

Owners Name
Owners Address
City, State, Zip Code

IN WITNESS WHEREOF, the Surety Company has hereunto set its hand and seal this _ day of _____, 20___.

_____
(Name of Surety Company)

_____
(Signature of Authorized Representative)

Title: _____

AFFIDAVIT OF PAYMENT

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by Springville City to furnish labor and materials under a contract dated _____ for the project named _____ _____ in the City of _____County of _____, State of Utah.

NOW THEREFORE, this _____ day of _____ , 20____, the undersigned, as the Contractor for the above named Contract pursuant to the conditions of the Contract, hereby certifies that, except as listed below, he has paid in full or has otherwise satisfied all obligations for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or its property might in any way be held responsible.

EXCEPTIONS: (If none, write “none”. If required by the Owner, the Contractor furnish bond satisfactory to the Owner for each exception).

{AFFIX CORPORATE}
{SEAL HERE}

_____
Contractor (Name of sole ownership, Corporation or partnership)

_____
(Signature of Authorized Representative)

Title: _____

AFFIDAVIT OF RELEASE OF LIENS BY THE CONTRACTOR

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by Springville City to furnish labor and materials under a contract dated _____ for the project named _____ _____ in the City of _____County of , State of Utah.

NOW THEREFOR, this _____ day of _____ , 20_____, the undersigned, as the Contractor for the above named Contract pursuant to the conditions of the Contract, hereby certifies that to the best of his/her knowledge, information and belief, except as listed below, the Releases or Waivers of Lien* attached hereto include the Contractor, all subcontractors, all suppliers of material and equipment, and all performers of work, labor or services, who have or may have liens against any property of the Owner and on the monies or other consideration due to becomes due from the Owner arising in any manner in connection with the performance of the Contract referenced above.

EXCEPTIONS: (If none, write "none". If required by the Owner, the Contractor furnish bond satisfactory to the Owner for each exception).

ATTACHMENTS:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Release or Waiver of Liens from subcontractors and material suppliers.

{AFFIX CORPORATE}
{SEAL HERE}

_____
Contractor (Name of sole ownership, Corporation or partnership)

_____
(Signature of Authorized Representative)

Title: _____

* The word Lien as used herein shall include Stop Orders, Stop Notices, or Freeze Orders on monies or other consideration of the Owner which are due or are to become due on the Contract referenced above.

- END OF SECTION -

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SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolishing designated structures and piping
2. Demolishing designated foundations
3. Disconnecting and capping designated utilities
4. Removing demolished materials

B. See Electrical Specifications for required demolition of electrical equipment.

1.2 RELATED WORK

A. Related Work in other sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 31 23 23 Excavation and Backfill for Structures

1.3 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings and Schedule: Describe demolition, removal procedures, sequence, and schedule.

C. Locations to be used for disposing of demolished materials. Location can be either an landfill or recycling facility.

D. Submit existing structure monitoring procedures.

E. Design Data: Submit calculations for bracing, shoring, and underpinning to protect structures indicated to remain signed and sealed by professional engineer.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of capped utilities and any changes to the design.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fill materials shall be in accordance with DIVISION 31 – EARTHWORK or as noted on the Contract Drawings.

B. Structural and piping modifications shall include the materials noted in the specific Sections related to the changes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Document condition of adjacent structures and buildings indicated to remain.

B. Monitor buildings for movement during demolition operations. Notify ENGINEER of measured movement.

3.2 PREPARATION

A. Contact OWNER not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Provide, erect, and maintain temporary barriers and security devices.

C. Notify adjacent owners of work which may affect their property, potential noise, utility outage, or disruption seven days prior to the start of Work. Coordinate with Owner.

D. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.

E. Protect existing structures indicated to remain.

3.3 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent structures.

B. Conduct operations with minimum interference to public or private accesses.

C. Maintain egress and access at all times. Do not close or obstruct roadways without permits.

D. Water sprinkling, temporary enclosures, chutes, and other suitable methods shall be used to limit dust and debris rising and scattering in the area. CONTRACTOR shall comply with local, State, and Federal environmental regulations pertaining to environmental protection. Water shall not be used if it creates hazardous or objectionable conditions such as ice, flooding, or pollution.

E. Cease operations immediately when adjacent structures appear to be in danger. Notify OWNER and ENGINEER.

3.4 STRUCTURE DEMOLITION

A. Disconnect, remove as required, and cap designated utilities. Identify utilities at termination of demolition. Record termination or capped location on Record Documents.

B. Remove the existing piping as noted on the drawing. Remove the existing concrete floor in areas that require new equipment or conduits.

C. Demolish and remove components in an orderly and careful manner.

D. Backfill all excavated areas and open pits or holes resulting from demolition with structural fill materials in accordance with Section 31 23 23 Excavation and Backfill for Structures.

E. Grade and compact areas affected by demolition to required finished grades.

F. Protect all existing structures not to be removed.

3.5 CLEAN UP

A. Remove demolished materials from site as work progresses and dispose of off-site at an approved landfill or recycling facility.

B. Leave areas of work in clean condition.

C. Adjacent structures shall be cleaned of dust, dirt, and debris caused by the demolition, as requested by ENGINEER, or directed by governing authorities, and adjacent areas shall be returned to pre-demolition conditions.

- END OF SECTION –

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SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the work necessary to furnish, install, and complete, the concrete formwork.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 03 30 00 Cast-in-Place Concrete

1.3 MEASUREMENT AND PAYMENT

A. Concrete formwork shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

1.4 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Concrete Institute (ACI) -ACI 347R- Guide to Formwork for Concrete
2. American Hardboard Association (AHA) -AHA A135.4- Basic Hardboard
3. Department of Commerce (DOC) -DOC PS 1- Structural Plywood
4. ACI 350R-01 – Code Requirements for Environmental Engineering Concrete Structures and Commentary
5. NSF International (NSF) 61 - Drinking Water System Components - Health Effects

1.5 DESIGN

A. Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the finish specified in Section 03 30 00 Cast-in-Place Concrete. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

1.6 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. The following shall be submitted:

1. Drawings showing details of forming, shoring and bracing for footings, walls, and floors shall be submitted to ENGINEER at least 3 weeks prior to their use. Drawings showing details of formwork shall include joints, supports, studding and shoring, and sequence of form and shoring removal.

2. If requested by ENGINEER, design analysis and calculations shall be submitted for form design and methodology used in the design. The analysis and calculations shall verify the selection of form ties, horizontal and vertical stiff-backs or braces for wall panels, forming and form openings, or any other part of forming, shoring or bracing which may be considered critical by ENGINEER.
3. Manufacturer's data including literature describing form materials, accessories, and form releasing agents.
4. Manufacturer's recommendation on method and rate of application of form releasing agent.

C. ENGINEER's review will not relieve CONTRACTOR from any responsibility as to the adequacy of the forming, shoring and bracing design. Any formwork installed by CONTRACTOR shall be solely at CONTRACTOR's risk. ENGINEER's review will not lessen or diminish CONTRACTOR's liability.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Form surfaces shall be in "new and undamaged" condition and may be plywood, hard plastic finished plywood, overlaid waterproof particle board, and steel of sufficient strength and surface smoothness to produce the specified finish. CONTRACTOR shall verify that his types of form surfaces and panel sizes satisfy all requirements of these specifications.

B. 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 the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

2.2 FORM TIES

A. Form ties on exposed surfaces shall be located in a uniform pattern. Snap ties shall not be broken until the concrete has reached the design concrete strength. The use of tie wires as form ties will not be permitted. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used. Form ties shall be **Plastic Cone Snap Tie by Dayton-Superior, Wrench Head Snap Tie by MASCO Mason Supply,** or approved equal.

B. 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 therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess. Taper ties shall be **Taper Tie by Dayton-Superior, Taper-Tie by MASCO Mason Supply**, or approved equal.

2.3 FORM RELEASING AGENTS

A. Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

B. Any agents used inside of the Spring Box of Junction Box shall consist of products which are certified by laboratories approved by ANSI and shall comply with be NSF Standard 61 for approved use in potable water systems.

PART 3 EXECUTION

3.1 INSTALLATION

A. Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03 30 00 Cast-in-Place Concrete. Forms shall be used, whenever necessary, to confine the concrete, to shape the concrete to the required lines and grades, and to obtain a thoroughly compacted dense concrete through proper vibrating. The forms shall have sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure, tamping and vibration, without deflection from the prescribed lines. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar.

B. The surfaces of all forms in contact with the concrete shall be clean, rigid, tight and smooth. All dirt, chips, sawdust, mud, water and other foreign matter shall be removed from within the forms or within the excavated areas, before any concrete is deposited therein.

C. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be thoroughly cleaned of mortar from previous concreting and of all other dirt and foreign matter before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

D. Bulkheads to form vertical wall joints shall be strong enough to withstand concrete pressures during pouring and vibrating, and shall be properly placed between the forms to avoid mortar seepage. Holes shall be provided in the bulkheads to permit passage of horizontal mild steel reinforcing where required by the Contract Drawings. Unless these are specifically called for on the Contract Drawings, no chamfer strips shall be placed in the corners of vertical construction joints.

3.2 COATING

A. Form inside surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.3 ALIGNMENT AND TOLERANCES

Forms shall be properly aligned and adequately supported to produce concrete surfaces conforming to construction tolerance given in Table 03 10 00-1, Tolerances for Formed Surfaces.

TABLE 03 10 00-1
TOLERANCES FOR FORMED SURFACES

Condition	Measurement	Tolerance
1. Variations from the plumb:	In any 10 feet of length	1/4-inch
a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length	1 inch
b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 20 feet of length Maximum for entire length	1/4-inch 1/2-inch
2. Variation from the level or from the grades indicated on the drawings	In any 10 feet of length In any bay or in any 20 feet of length	1/4-inch 3/8-inch
3. Variation of the linear building lines from established position in plan	In any 20 feet Maximum	1/2-inch 1-inch
4. Variation of distance between walls, columns, partitions	1/4-inch per 10 feet of distance, but not more than 1/2-inch in any one bay, and not more than 1-inch total variation	
5. Variation in the thickness of slabs and walls	Minus Plus	1/4-inch 1/2-inch

3.4 FORM REMOVAL

A. Forms shall be removed in a manner that will prevent injury to the concrete and ensure the complete safety of the structure. Forms shall not be removed until approval is given by ENGINEER. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement.

B. CONTRACTOR shall remove all wood splinters on concrete surfaces after stripping of wood forms.

- END OF SECTION -

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the reinforcing steel bars, wire fabric or rod mats for cast-in-place concrete.

1.2 RELATED WORK

A. Related Work in other sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

1.	ACI 301	Specifications for Structural Concrete
2.	ACI 315	Details and Detailing of Concrete Reinforcement
3.	ACI 318	Building Code Requirements for Structural Concrete and Commentary
4.	ACI 350R	Code Requirements for Environmental Engineering Concrete Structures and Commentary

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1.	ASTM A 184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
2.	ASTM A 615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3.	ASTM A 767	Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
4.	ASTM A 775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
5.	ASTM A 1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

D. CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

1.	CRSI (DA4)	Manual of Standard Practice (MSP-1)

1.4 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 - Submittal Procedures:

1. Drawings of Concrete Reinforcement System with details showing reinforcing steel schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.
2. Reinforcing Steel with certified copies of mill reports attesting that the reinforcing steel furnished meets the requirements specified, prior to the installation of reinforcing steel.

1.5 DELIVERY AND STORAGE

A. Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

1.6 MEASUREMENT AND PAYMENT

A. Concrete reinforcement shall not be measured or paid as a separate item but shall be included as part of the various items to which it relates.

PART 2 PRODUCTS

2.1 DOWELS

A. Dowels shall conform to ASTM A 615, Grade 60.

2.2 FABRICATED BAR MATS

A. Fabricated bar mats shall conform to ASTM A 184.

2.3 REINFORCING STEEL

A. Reinforcing steel shall be deformed bars conforming to ASTM A 615 grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 1064. When no grade is indicated use 60 ksi grade steel. Special coated bars (epoxy and zinc) may be specified for use in a highly corrosive atmosphere where concrete cover is not considered sufficient. In which case reference to ASTM A 767 and A 775 will be included.

2.4 WELDED WIRE FABRIC

A. Welded wire fabric shall conform to ASTM A 1064.

2.5 WIRE TIES

A. Wire ties shall be 16-gauge or heavier black annealed steel wire.

2.6 SUPPORTS

A. Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI (DA4) MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete.

B. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within ½ inch of concrete surface shall be plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 EXECUTION

3.1 REINFORCEMENT

A. Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete.

B. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety.

C. Placement:

1. Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete.
2. Reinforcement shall be placed in accordance with ACI 318 at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

D. Splicing:

1. Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6-inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2 WELDED-WIRE FABRIC

A. Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Lap

splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.3 DOWELS

A. Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately aligned parallel to the finished concrete surface and rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

- END OF SECTION -

SECTION 03 25 00

EXPANSION JOINTS, CONSTRUCTION JOINTS AND WATERSTOPS

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers the work necessary to furnish, install and complete expansion and construction joints, including waterstops.

B. All waterstops and sealants in contact with potable water including waterstops embedded in concrete floors and walls of the Spring Box and Junction Box shall be NSF 61 certified.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 03 33 00 Cast-in-Place Concrete

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

1. ACI 318 Building Code Requirements for Reinforced Concrete

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
2. ASTM D 412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
3. ASTM C 920 Standard Specification for Elastomeric Joint Sealants
4. ASTM D 570 Standard Test Method for Water Absorption of Plastics
5. ASTM D 624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
6. ASTM D 638 Standard Test Method for Tensile Properties of Plastics
7. ASTM D 746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
8. ASTM D 747 Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
9. ASTM D 792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
10. ASTM D 1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

11. ASTM D 1752 Standard Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
12. ASTM D 2240 Standard Test Method for Rubber Property-Durometer Hardness

D. FEDERAL SPECIFICATIONS (FS)

1. FS-TT-S-00227E Sealing Compound: Elastomeric Type, Multi-Component (For Calking, Sealing, and Glazing in Buildings and Other Structures)

E. NSF International (NSF)

1. NSF/ANSI 61 Drinking Water System Components – Health Effects

1.4 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 – Submittal Procedures:

1. Submit certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified. ENGINEER may take samples of any materials and have them tested by an independent testing laboratory to verify their compliance with these Specifications. All such costs shall be borne by OWNER. If any materials should fail to meet these Specifications, all costs for further testing of the replacement material shall be borne by CONTRACTOR.
2. Samples of factory fabricated waterstop joints representing in all respects the material and workmanship of the material that will be furnished under this contract. Samples will be submitted and approved by ENGINEER prior to use of the factory joints in the field.
3. Manufacturer's catalog data and manufacturer's recommended instructions for splicing of waterstops.

1.5 OBSTRUCTIONS

A. CONTRACTOR shall pay particular attention to removing all obstructions such as concrete, nails, etc., from joints when movements of floor or wall sections can be expected under temperature and other conditions.

1.6 QUALITY ASSURANCE

A. Waterstop manufacturer shall demonstrate five years (minimum) continuous, successful experience in production of waterstops.

1.7 DELIVERY AND STORAGE

A. Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 HORIZONTAL JOINT SEALANT

A. Horizontal joints not requiring waterstops or when so indicated on the Contract Drawings, shall be sealed using **Sikaflex-2c NS**, or approved equal, and shall meet the requirements of ASTM C-920, Type M, Grade NS, Class 25 and FS-TT-S-00227E, Type II, Class A, and shall be NSF 61 certified (Sikaflex 2c NS EZ) if in contact with potable water. Color shall match color of concrete.

2.2 VERTICAL JOINT SEALANT

A. Vertical joints not requiring waterstops or when so indicated on the Contract Drawings, shall be sealed using **Sikaflex-2c NS,** or approved equal, and shall meet the requirements of ASTM C-920, Type M, Grade NS, Class 25 and FS-TT-S-00227E, Type II, Class A, and shall be NSF 61 (Sikaflex 2c NS EZ) certified if in contact with potable water. Color shall match color of concrete.

2.3 JOINT PRIMER

A. All joints receiving a joint sealant shall be primed using **Sikaflex Primers 429/202**, or approved equal.

2.4 EXPANSION JOINTS

A. Expansion joints shall be composed of cellular fibers securely bonded together and uniformly saturated with asphalt. Joint shall be resilient, flexible, and non-extruding. Expansion joints shall meet the requirements of ASTM D 1751. Manufacturer shall be **Fibre Expansion Joint by W.R. Meadows, Fiberflex by JD Russel Company**, or approved equal.

2.5 PVC WATERSTOPS

A. Waterstops shall be of an approved type, supplied by an approved manufacturer and shall be plastic made of virgin polyvinylchloride (PVC) compound, shall be ribbed, uniform in dimensions, dense, homogeneous, free from porosity, and as detailed on the Contract Drawings. No reclaimed PVC shall be used in the compound. Waterstop in contact with potable water shall be NSF 61 certified.

B. The finished waterstop material shall meet the following minimum requirements:

Tensile strength	2,000 psi min.	(ASTM D 638)
Ultimate elongation	300% min.	(ASTM D 638)
Shore A hardness	75 ± 5	(ASTM D 2240)
Specific gravity	1.38 max	(ASTM D 792)
Stiffness in flexure	600 psi min.	(ASTM D 747)
Cold brittleness	No Failure at -35°F	(ASTM D 746)
Water absorption: 48 hours	0.15% max	(ASTM D 570)
Tear Resistance	290 lb./in. min.	(ASTM D 624)

C. Manufacturer, or approved equal:

1. Vinylex Waterstop & Accessories
2. Greenstreak, Inc. (Sika Corporation)
3. Durajoint Concrete Accessories

D. Factory made waterstop joints shall have a tensile strength across the joint equal to at least 600 psi. Field splices and joints shall be made in accordance with the waterstop manufacturer's instructions using a thermostatically controlled heating iron.

2.6 HYDROPHILIC WATERSTOP

A. Non-bentonite rubber hydrophilic waterstop shall only be used where shown on the Contract Drawings or when approved by ENGINEER. Hydrophilic waterstop in contact with potable water including in potable water tank floor slabs and walls shall be NSF 61 certified. Size shall be as indicated on the Contract Drawings.

B. The hydrophilic waterstop shall meet the following physical properties:

Physical Property	Test Method	Result
Tensile Strength (Minimum)	ASTM D412	350 psi
Elongation (minimum)	ASTM D412	600 %
Hardness	ASTM D2240	52 +/-5 Shore A
Tear Resistance	ASTM D624	50 lb/in
Specific Gravity	ASTM D792	1.35 +/-5

C. Manufacturer, or approved equal:

1. Conseal CS-231
2. Sika Hydrotite CJ-1020-2K

PART 3 EXECUTION

3.1 WATERSTOPS

A. Waterstops shall be of the type indicated and shall be installed at the locations shown to form a continuous water-tight diaphragm. The waterstop shall be correctly positioned in the forms so that the center of the waterstop is centered on the joint. Waterstop shall be held in place in the forms by use of a split form or other approved method that will positively hold the waterstop in the correct position and to the correct alignment. Vibrate concrete to obtain impervious concrete in the vicinity of all joints. In horizontal joints, ensure that the areas below the water stop are completely filled with concrete.

B. Horizontal plastic waterstops shall be bent up during placing of concrete until the concrete has been brought to the level of the waterstop; additional concrete shall then be placed over the waterstop, after which the concrete shall be thoroughly vibrated. All horizontal and vertical waterstops, which are not accessible during pouring, shall be tied off in two directions every 12 inches in such a manner that bending over one way or another is prevented. A hog-ring or nail may be driven through both ends of the waterstop to facilitate placing and tying of waterstops to reinforcing steel forms or form-ties.

C. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. All waterstops shall be properly spliced and joints shall be checked for strength and pinholes after splicing. Splices shall be strong enough to develop a pulling force of 75 percent of the strength of the waterstop and shall be watertight. Splices in waterstop shall be made in conformance with the recommendations of the waterstop manufacturer. Continuity of cross-sectional features shall be maintained across the splice. Splices showing evidence of separation after bending shall be remade.

D. Install hydrophilic waterstop in accordance with the manufacturer's written instructions. Adhesives used on hydrophilic waterstop shall be NSF 61 certified. Adhesives shall meet the requirements of ASTM C 920 and shall be **Manus Bond 75-AM Lot NSF61**, **DAP Premium Polyurethane Construction Adhesive**, or approved equal.

3.2 JOINTS

A. Joints shall be installed at locations indicated and as authorized. Joints shall be constructed so as to produce straight joints, and shall be vertical or horizontal, except where walls intersect sloping floors.

B. Construction Joints

1. Prior to placing the abutting concrete for all construction joints, the contact surface shall be cleaned by approved means to remove all laitance and expose the aggregate. The exposed portion of the reinforcing steel shall be cleaned of all concrete. The cleaning method shall be conducted so as to not damage waterstop, if waterstop is present. Where the joint is to receive a sealant, a recess 3/4-inch deep shall be formed along the joint using a dressed-and-oiled wood strip or other method approved by ENGINEER. The wood strip shall be removed after the concrete has set.

C. Expansion Joints

1. Expansion joint filler shall be used where required on the Contract Drawings. The edges of the joint shall be neatly finished with an edging tool of 1/8-inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed-and-oiled wood strip temporarily secured to the top thereof to form a recess 3/4-inch deep to be filled with sealant. The wood strip shall be removed after the concrete has set. In lieu of the wood strip a removable expansion filler cap designed and fabricated for this purpose may be used.

D. Joint Sealant

1. The joint cavity shall be cleaned by sandblasting or power wire brushing and shall be blown clean of dust and sand with compressed air before the joint sealant may be applied. Joints must be frost-free, free of oils, grease, curing compound residues, and any other foreign matter that might prevent bond. A bond breaker tape shall be installed over the joint per manufacturer's instructions. After the joints have been prepared as described above, the joints shall be primed, and the sealant shall be applied in accordance with the manufacturer's recommendations.

- END OF SECTION -

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers cast-in-place concrete mix design and placement.

B. CONTRACTOR shall provide cast-in-place concrete as indicated in the Specifications and the Contract Drawings.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 45 00 Quality Control and Material Testing
3. Section 03 10 00 Concrete Forming and Accessories
4. Section 03 20 00 Concrete Reinforcement
5. Section 03 25 00 Expansion Joints, Construction Joints, and Waterstops
6. Section 09 90 00 Painting and Finishes
7. Section 31 23 23 Excavation and Backfill for Structures

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

1. ACI 117 Specifications for Tolerances for Concrete Construction and Materials and Commentary
2. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
3. ACI 301 Structural Concrete for Buildings
4. ACI 304 Guide for Measuring, Mixing, Transporting, and Placing Concrete
5. ACI 305R Hot Weather Concreting
6. ACI 306R Cold Weather Concreting
7. ACI 318 Building Code Requirements for Structural Concrete and Commentary
8. ACI 350R Code Requirements for Environmental Engineering Concrete Structures and Commentary

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM C 31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
2. ASTM C 33 Standard Specification for Concrete Aggregates
3. ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
4. ASTM C 42 Standard Test Method for Obtaining and Testing Drilled Cores and

Sawed Beams of Concrete

5. ASTM C 78 Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
6. ASTM C 94 Standard Specification for Ready-Mixed Concrete
7. ASTM C 109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
8. ASTM C 143 Standard Test Method for Slump of Hydraulic-Cement Concrete
9. ASTM C 150 Standard Specification for Portland Cement
10. ASTM C 171 Standard Specification for Sheet Materials for Curing Concrete
11. ASTM C 172 Standard Specification for Sampling Freshly Mixed Concrete
12. ASTM C 173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
13. ASTM C 192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
14. ASTM C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
15. ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete
16. ASTM C 309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
17. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete
18. ASTM C 618 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

D. NSF INTERNATIONAL (NSF)

1. NSF/ANSI 61 Drinking Water System Components - Health Effects.

1.4 DEFINITIONS

A. Average Strength (f_{cr}): The required average strength for 30 consecutive strength tests which statistically assures not more than the permissible proportions of tests will fall below Specified Strength.

B. Specified Strength (f_c'): The indicated strength.

1.5 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 – Submittal Procedures.

B. Provide catalog information for all products to be used as part of the submitted mix design.

C. The results of trial mix designs along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of each strength of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the concrete is satisfactory. Indicate whether mixes have been designed for pumping. Include in the

report the following information:

1. Water-cement ratio.
2. Proportion of materials in the mix.
3. Source and type of cement.
4. Analysis of water to be used unless potable.
5. Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times.
6. Slump, air content and temperature of samples.
7. Unit weight of fresh and dry light weight concrete.

D. Preapproved Mix Design Data: If supplier has on record, an OWNER approved mix design, submit name and address of supplier for each mix design 1 day prior to using concrete mix.

E. Certified copies of laboratory test reports, including all test data, for aggregate, admixtures, and curing compound. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials. Test reports shall meet the following requirements:

1. Date of mix design: No older than 365 days from the date of submission.
2. Physical properties of the aggregate: Test results shall not be older than 455 days from the date of submission. A new report will be required if aggregate source is changed.

F. Cementitious Materials showing Manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished, for cement and pozzolan.

G. Submit catalog information on the curing compound and the proposed location to be used.

1.6 QUALITY ASSURANCE

A. Do not change material sources, type of cement, air-entraining agent, water reducing agent, other admixtures, or aggregate without ENGINEER'S approval.

B. In proportioning materials for mixing, use scales certified by the State of Utah. Do not use volume measurement except for water and liquid admixtures.

C. Do not change the quantity of cement per cubic yard for approved mix design without written approval of ENGINEER.

D. Use of admixtures will not relax hot or cold weather placement requirements.

E. Ready-mixed concrete to be in accordance with Alternate No. 3 of ASTM C-94 and the requirements in this Section.

F. Tolerances for concrete construction and materials shall be in accordance with ACI 117.

1.7 PRODUCT STORAGE AND HANDLING

A. Store bagged and bulk cement in weatherproof enclosures to exclude moisture and

contaminants.

B. Stockpile aggregate to avoid segregation and prevent contamination.

C. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.

PART 2 PRODUCTS

2.1 ADMIXTURES

A. Admixtures shall be approved by ENGINEER prior to use. Any admixtures to be used shall be included in proposed concrete mix designs.

B. Air Entrainment: ASTM C 260.

C. Later Reducing and Set Retarding Agents: ASTM C494.

1. Type A: Set water reducing.
2. Type B: Set retarding.
3. Type C: Set accelerating.
4. Type D: Water reducing and set retarding.
5. Type E: Water reducing and set accelerating.
6. Type F: High range water reducing (super plasticizer) *
7. Type G: High range water reducing and set retarding *

* The relative durability factor of water reducing admixtures shall not be less than 80 and the chlorides content (as Cl^-) expressed as a percent of the cement shall not exceed 0.1 percent by weight.

D. Calcium Chloride: None allowed.

E. Pozzolan: Pozzolan conforming to the requirements of ASTM C 618, Class F, is allowed as a Portland cement replacing agent under the following conditions:

1. The maximum percentage of Portland cement replacement is:
   a. 15 percent, for concrete exposed to weather.
   b. 20 percent, for interior concrete.
2. Pozzolan should not exceed 25% by weight of the cement plus pozzolans.
3. The minimum cement content shall be used in the design formulas before replacement is made.
4. Loss of ignition of pozzolan is less than 3 percent and the water requirement does not exceed 100 percent.
5. All other requirements of this section still apply.
6. Mix designs including trial batches are required for each aggregate source and for each concrete class.

F. Cementitious Materials showing Manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished, for cement and pozzolan.

2.2 CEMENTITIOUS MATERIALS

A. Cementitious materials shall each be of one type and from one source when used in concrete which will have surfaces exposed in the finished structure. Cementitious materials shall each be of one type and from one source when used in concrete which will have surfaces exposed in the finished structure. Cementitious materials shall conform to one of the following:

1. Cement: Use Portland cement, ASTM C 150, Type II, Type IIA, or Type V, low alkali, unless noted otherwise.
2. Portland - Pozzolan Cement: ASTM C-595, Type IP-A(MS). Do not use Pozzolan cement unless approved by ENGINEER

B. Only one brand of cement from one manufacturing plant may be used.

2.3 AGGREGATES

A. Aggregates shall be natural aggregates, free from deleterious coatings, and shall conform to the requirements of ASTM C 33, except as modified herein. Aggregates shall not be potentially reactive as defined in Appendix XI of ASTM C 33. CONTRACTOR shall import nonreactive aggregates if local aggregates are reactive.

B. Fine Aggregates

1. Fine aggregate shall consist of clean, sharp, natural sand and shall conform to the requirements of ASTM C 33. Fine aggregate shall be graded as follows:

FINE AGGREGATES	
Sieve Size	Percent Passing by Weight
3/8 inch	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10

2. Fine aggregates shall have no more than two percent by weight passing #200 sieve.

C. Coarse Aggregate

1. Coarse aggregate shall be washed gravel or crushed stone, or a combination of these materials, consisting of hard, tough, durable particles free from adherent coatings. It shall contain no more than 15 percent flat or elongated particles. A thin, flat or elongated particle is defined as a particle having a maximum dimension in excess of five times its minimum dimension. Aggregate which has disintegrated or weathered badly under exposure conditions similar to those which will be encountered in the work under consideration shall not be used. Coarse aggregate shall be graded as follows (ASTM C 33):

COARSE AGGREGATES	
Sieve Size	Percent Passing by Weight
1-1/2 inch	100
1 inch	95-100
½ inch	25-60
#4	0-10
#8	0-5

2. Coarse aggregates shall have no more than 1.75 percent by weight passing #200 sieve. Proof of gradation will be provided to ENGINEER by CONTRACTOR.

2.4 ACI MIX DESIGN

A. The amount by which the average strength (f_{cr}) of a concrete mix exceeds the specified compressive strength (f'_c) shall be based upon no more than 1 in 100 random individual strength tests falling more than 500 psi below the specific strength.

B. Proportion the materials in accordance with ACI 211.1, 211.2 or 211.3 as applicable to produce concrete having the properties or limitations of Table No. 03 30 00-A.

2.5 HAND MIXING

A. Do not hand mix batches exceeding 0.5 cubic yards.

B. Hand mix only on watertight platform. Mix cement and aggregate prior to adding water.

C. Ensure all stones are thoroughly covered with mortar and mixture is of uniform color and consistency.

2.6 HEATING, WATER AND AGGREGATE

A. Do not allow products of fuel combustion to contact the aggregate.

B. Heat mixing water to maximum temperature of 150 degrees F. Heat aggregates uniformly.

C. Do not mix cement with water and aggregate at a mix temperature greater than 100 degrees F.

2.7 WATER

A. Water shall be potable, except that non-potable water may be used if it produces mortar cubes having 7- and 28-day strengths at least 90 percent of the strength of similar specimens made with water from a municipal supply. The strength comparison shall be made on mortars, identical except for mixing water, prepared and tested in accordance with ASTM C 109. Water for curing shall not contain any substance injurious to concrete, or which causes staining.

2.8 PROPORTIONS OF MIX

A. Mixture Proportioning, Normal Weight Concrete: All concrete that must be watertight and resistant to freeze-thaw cycles and to naturally occurring or commonly used

chemicals should be air entrained. All materials should be proportioned to produce a well-graded mixture of high density and maximum workability with a minimum specified 28-day compressive strength of concrete classification. Trial batches shall contain materials proposed to be used in the project. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios. Trial mixes shall be proportioned to produce concrete strengths specified. In the case where ground iron blast-furnace slag is used, the weight of the slag will be substituted in the equations for the term P which is used to denote the weight of pozzolan. Trial mixtures shall be designed for maximum permitted slump and air content. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results a curve shall be plotted showing the relationship between water-cement ratio and strength. Maximum water-cement or water-cement plus pozzolan Ratio: 0.45.

B. Average Strength: In meeting the strength requirements specified, the selected mixture proportion shall produce an average compressive strength exceeding the specified strength by the amount indicated below. Where a concrete production facility has test records, a standard deviation shall be established. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at other test age designated for determination of the specified strength.

TABLE NO. 03 30 00-A

CONCRETE MIX PROPERTIES (e)			
CONCRETE PROPERTIES	CONCRETE CLASSIFICATION(S)		
	Class 4000	Class 3500	Class 3000
Specified Compressive Strength $f_{c'}$ at 28 days, min., psi	4,000	3,500 (d)	3,000 (d)
Compressive Strength at 7 days, min., psi (a)	2,680	2,345	2,010
Cement content (94 lb. sacks of cement per cubic yard of concrete), min. (b)	6.0	5.75	5.5
Entrained air content, (% by volume).	6±1	6±1	6±1
Slump Range, in. (c)	1 - 4 (f)	2 - 4	2 - 4
Maximum Water Cement Ratio	0.45	0.45	0.45

(a) Used for monitoring purposes only.

(b) May include pozzolan replacements if approved by ENGINEER.
(c) Not more than 8 inches after adding high range water reducing admixture (super-plasticizer) at site.
(d) Not allowed if concrete is exposed to freezing and thawing temperatures. Use Class 4000 or higher compressive strength and 6±1.0 percent air entrainment.
(e) All mix designs must be approved by ENGINEER.
(f) 1-3" for footings, sub-structural walls and 1-4" for slabs, beams, reinforced walls and columns.

2.9 CURING MATERIALS

A. General: Curing compounds in contact with potable water shall be NSF 61 certified.

B. Normal Curing Compound

1. Curing compound shall be white pigmented and shall conform to ASTM C 309, Type 2 Class B.
2. Sodium silicate compounds cannot be used.
3. Manufacturer, or approved equal:
   a. 1200-White by W.R. Meadows
   b. White Resin Cure J10W by Dayton Superior
   c. Safe-Cure 2000 by ChemMasters
   d. Aqua Kure White by Lambert Corporation

C. Dissipating Curing Compound

1. When the curing compound must be removed for finishes or grouting, compounds shall be of a dissipating type, conforming to the requirements of ASTM C 309, Type 1 or Type 2, Class B
2. Manufacturer, or approved equal:
   a. 1100-Clear by W.R. Meadows
   b. Kurez DR VOX by Euclid Chemical Company
   c. Clear Cure VOC J7WB by Dayton Superior
   d. Safe-Cure Clear DR by ChemMasters

PART 3 EXECUTION

3.1 GENERAL

A. CONTRACTOR shall inform ENGINEER at least 72 hours in advance of time and places at which CONTRACTOR intends to place concrete. All preparation work for concrete placements shall be substantially completed at least 2 workdays prior to the scheduled start of concrete placement to allow for ENGINEER's review and any necessary corrections.

3.2 PREPARATION OF SURFACES

A. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Conduit and other similar items shall be in place and clean of any deleterious substance.

B. Foundations: Earthwork shall be as specified. Flowing water shall be diverted without washing over freshly deposited concrete. Rock foundations shall be cleaned by high

velocity air-water jets, sandblasting, or other approved methods. Debris and loose, semi-detached or unsound fragments shall be removed. Rock surfaces shall be moist but without free water when concrete is placed. Semi porous subgrades for foundations and footings shall be damp when concrete is placed. Pervious subgrades shall be sealed by blending impervious material with the top 6 inches of the in-place pervious material or by covering with an impervious membrane.

C. Preparation of Previously Placed Concrete: Concrete surfaces to which other concrete is to be bonded shall be roughened in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be moist but without free water when concrete is placed.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Embedded items shall be free from oil, loose scale or rust, and paint. Embedded items shall be installed at the locations indicated and required to serve the intended purpose. Voids in sleeves, slots and inserts shall be filled with readily removable material to prevent the entry of concrete.

B. Reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms at locations as indicated or shown on the Contract Drawings. Proper placement and locations shall be the responsibility of CONTRACTOR.

3.4 BATCHING, MIXING AND TRANSPORTING CONCRETE

A. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and non-agitating units shall comply with NRMCA TMMB-1. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA-QC 3.

B. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quantity and quality of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by ENGINEER.

C. Truck mixers and their operation must be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 1 inch when the specified slump is 3 inches or less, or more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

D. Admixtures: Admixtures shall be batched within an accuracy of 3 percent. Where two or more admixtures are used in the same batch, they shall be batched separately and must be compatible. Retarding admixture shall be added within one minute after addition of water is complete or in the first quarter of the required mixing time, whichever

is first. Superplasticizing admixtures shall be added at the project site, and the concrete with the admixture shall be mixed 4 to 5 minutes before placing as recommended by manufacturer. Concrete that shows evidence of total collapse or segregation caused by the use of admixture shall be removed from the site.

E. Control of Mixing Water: No water from the truck system or elsewhere shall be added after the initial introduction of mixing water for the batch. No water shall be added at the jobsite without the approval of ENGINEER.

3.5 SAMPLING AND TESTING

A. Sampling and Testing of the concrete will be as defined in Section 01 45 00 – Quality Control and Material Testing. If there are discrepancies between this Section and Section 01 45 00, the more stringent requirement shall apply.

1. Aggregates: Aggregates for normal weight concrete shall be sampled and tested in accordance with ASTM C 33.
2. Sampling of Concrete: Samples of concrete for air, slump, unit weight, and strength tests shall be taken in accordance with ASTM C 172.
    a. Air Content: Test for air content shall be performed in accordance with ASTM C 173 or ASTM C 231. A minimum of 1 test shall be conducted each time a slump test is made.
    b. Slump: At least 1 slump test shall be made on randomly selected batches of each mixture of concrete for every 100 cubic yards of ready-mixed concrete delivered to the job site. Also note the time batched at the plant and the starting time when unloading began at the site. Tests shall be performed in accordance with ASTM C 143.
    c. Temperature: Concrete and air temperatures shall be measured and recorded with each slump test or with each set of cylinders and the air temperature shall also be recorded when the air temperature at the site is 40 degrees F or below and/or 90 degrees F or above.
3. Evaluation and Acceptance of Concrete
    a. Frequency of Testing: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yards of concrete, nor less than once for each 3,000 square feet of surface area for slabs or walls. If this sampling frequency results in less than 5 strength tests for a given class of concrete, tests shall be made from at least 5 randomly selected trucks or from each truck if fewer than 5 truck loads are used. Field cured specimens for determining form removal time or when a structure may be put in service shall be made in numbers directed to check the adequacy of curing and protection of concrete in the structure. The specimens shall be removed from the molds at the age of 24 hours and shall be cured and protected, insofar as practicable, in the same manner as that given to the portion of the structure the samples represent.
    b. Testing Procedures: Cylinders for acceptance tests shall be molded and cured in accordance with ASTM C 31. Cylinders shall be tested in accordance with ASTM C 39. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at another specified test age.

c. Evaluation of Results: Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength and no individual strength test result falls below the required strength by more than 500 pounds per square inch.
d. Unless noted otherwise, make a minimum of five (5) concrete cylinders each time a test is required. When concrete is being placed in suspended slabs, beams and retaining walls make two (2) extra cylinders which must be cured on site. The extra cylinders will be used to determine when to remove forms and/or when to backfill.

B. Investigation of Low-Strength Test Results: When any strength test of standard-cured test cylinder falls below the specified strength requirement by more than 500 pounds per square inch, or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized. Nondestructive testing in accordance with ASTM C 597, ASTM C 803 or ASTM C 805 may be permitted by ENGINEER to determine the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection. When strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by ENGINEER to least impair the strength of the structure. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for seven days before testing and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C 42. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to or at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. If the core tests are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be directed by ENGINEER in accordance with the requirements of ACI 318. Concrete work evaluated by structural analysis or by results of a load test and found deficient shall be corrected in a manner satisfactory to ENGINEER. All investigations, testing, load tests, and correction of deficiencies shall be performed, and approved by ENGINEER, at the expense of CONTRACTOR.

3.6 CONVEYING CONCRETE

A. Concrete shall be conveyed from mixer to forms as rapidly as possible and within the time interval specified in paragraph 3.6 CONCRETE PLACEMENT by methods which will prevent segregation or loss of ingredients. Conveying concrete shall be in accordance with the requirements of ACI 304.

1. Chutes: When concrete can be placed directly from a truck mixer or other transporting equipment, chutes attached to this equipment may be used. Separate chutes will not be permitted except when specifically approved.
   a. Use metal or metal lined chutes with a maximum length of 20-feet.

b. The minimum slopes of chutes shall be such that concrete of the indicated consistency will readily flow in them.

2. Buckets: Bucket design shall be such that concrete of the required slump can be readily discharged. Bucket gates shall be essentially grout tight when closed. The bucket shall provide means for positive regulations of the amount and rate of deposit of concrete in each dumping position.

3. Pumps: Concrete may be conveyed by positive displacement pumps when approved. Pump shall be the piston or squeeze pressure type. Pipeline shall be steel pipe or heavy duty flexible hose. Inside diameter of the pipe shall be at least three times the maximum size of the coarse aggregate. Distance to be pumped shall not exceed the limits recommended by the pump manufacturer. Concrete shall be supplied to the pump continuously. When pumping is completed, the concrete remaining in the pipeline shall be ejected without contaminating the concrete in place. After each use, the equipment shall be thoroughly cleaned. Flushing water shall be wasted outside the forms.

3.7 CONCRETE PLACEMENT

A. Mixed concrete which is transported in truck mixers or agitators or concrete which is truck mixed, shall be discharged within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. These limitations may be waived by ENGINEER if the concrete is of such slump after the 1-1/2 hour time or 300 revolution limit has been reached that it can be placed, without the addition of water to the batch. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the truck.

1. Placing Operation: Concrete shall be handled from mixer to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by CONTRACTOR prevent proper consolidation, finishing and curing. Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 4 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Concrete should not be allowed to drop through a cage of reinforcing steel. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screened to the proper level to avoid excessive shimming or grouting.
   a. Additional requirements for depositing concrete in walls include, but are not limited to:
      1) Deposit concrete in a continuous operation until section is completed.
      2) Place concrete in approximately horizontal layers 2 ft maximum thickness.
      3) Each layer of concrete shall be plastic when covered with following layer.
      4) Rate of vertical rise not more than 4 ft per hour.
      5) Pump concrete or use a tremie having varying lengths for placing concrete in columns and walls to prevent free fall of more than 4 ft.

6) Allow concrete to thoroughly settle before top is finished. Remove all laitance, debris, and surplus water from surfaces at tops of forms by screeding, scraping, or other effective means.

b. Additional requirements for depositing concrete in slabs include, but are not limited to:
   1) Deposit concrete in a continuous operation until section is completed.
   2) Concrete shall be deposited as nearly as practicable to its final position to avoid segregation due to rehandling or flowing.
   3) In sloping slabs, proceed uniformly from the bottom of the slab to the top for the full width of the placement.

2. Consolidation: Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 8,000 vibrations per minute, and the head diameter and amplitude shall be appropriate for the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then withdrawn slowly. The use of form vibrators must be specifically approved. Vibrators shall not be used to transport concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique.

B. Cold Weather Requirements: Cold weather requirements shall conform to ACI 306 and this Specification. Special protection measures, approved by ENGINEER, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. Provisions should be made to keep the concrete at a minimum temperature of 50 degrees F for 7 days. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 32 degrees F. No concrete shall be placed on frozen ground. The temperature of the concrete when placed shall be not less than 55 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Calcium chloride shall not be used.

C. Hot Weather Requirements: Hot weather requirements shall conform to ACI 305 and this Specification. The temperature of the concrete placed during hot weather shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 95 degrees F.

3.8 CONSTRUCTION JOINTS

A. Construction joints shall be located as indicated on the Contract Drawings. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of ENGINEER.

Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete is no longer plastic, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints are required, a strip of 1-inch square-edge lumber, beveled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph 3.1, PREPARATION OF SURFACES.

3.9 FINISHING CONCRETE

A. Formed Surfaces

1. Repair of Surface Defects: Surface defects shall be repaired within 24 hours after the removal of forms. Honeycombed and other defective areas shall be cut back to solid concrete or to a depth of not less than 1 inch, whichever is greater. Edges shall be cut perpendicular to the surface of the concrete. The prepared areas shall be dampened and brush-coated with neat cement grout. The repair shall be made using mortar consisting of not more than 1 part cement to 2-1/2 parts sand. The mixed mortar shall be allowed to stand to stiffen (approximately 45 minutes), during which time the mortar shall be intermittently remixed without the addition of water. After the mortar has attained the stiffest consistency that will permit placing, the patching mix shall be thoroughly tamped into place by means approved by ENGINEER and finished slightly higher than the surrounding surface. For Class A and Class B finished surfaces the cement used in the patching mortar shall be a blend of job cement and white cement proportioned to produce a finished repair surface matching, after curing, the color of adjacent surfaces. Holes left after the removal of form ties shall be cleaned and filled with patching mortar. Holes left by the removal of tie rods shall be reamed and filled by dry-packing. Repaired surfaces shall be cured as required for adjacent surfaces. The temperature of concrete, mortar patching material, and ambient air shall be above 50 degrees F while making repairs and during the curing period. Concrete with defects which affect the strength of the member or with excessive honeycombs will be rejected, or the defects shall be corrected as directed by ENGINEER.
2. Class A Finish: Where a Class A finish is indicated, fins shall be removed. A mortar mix consisting of one-part Portland cement and two parts well-graded sand passing a No. 30 sieve, with water added to give the consistency of thick paint, shall be prepared. White cement shall be used to replace part of the job cement. After the surface has been thoroughly wetted and allowed to approach surface dryness, the mortar shall be vigorously applied to the area by clean burlap pads or by cork or wood-floating, to completely fill all surface voids. Excess grout shall be scraped off with a trowel. As soon as it can be accomplished without pulling the mortar from the voids, the area shall be rubbed with burlap pads until all visible grout film is removed. The rubbing pads shall have on their surfaces the same sand-cement mix specified above but without any mixing water. The finish of any area shall be completed in the

same day, and the limits of a finished area shall be made at natural breaks in the surface. The surface shall be continuously moist cured for 48 hours. The temperature of the air adjacent to the surface shall be not less than 50 degrees F for 24 hours prior to, and 48 hours after, the application. In hot, dry weather the smooth finish shall be applied in shaded areas.

3. Class B Finish: Where a Class B finish is indicated, fins shall be removed. Concrete surface shall be smooth with a texture at least equal to that obtained through the use of Grade B-B plywood forms.
4. Class C Finish: Where a Class C finish is indicated, fins shall be removed. Concrete surfaces shall be relatively smooth with a texture imparted by the forms used.
5. Class D Finish: Where a Class D finish is indicated, fins exceeding 1/4 inch in height shall be chipped or rubbed off. Concrete surfaces shall be left with the texture imparted by the forms used.
6. See Specification Section 09 90 00 Painting and Finishes for required finishes.

B. Unformed Surfaces: In cold weather, the air temperature in areas where concrete is being finished shall not be less than 50 degrees F in accordance with ACI 306R. In hot windy weather when the rate of evaporation of surface moisture, as determined by methodology presented in ACI 305R, may reasonably be expected to exceed 0.2 pounds per square foot per hour; coverings, windbreaks, or fog sprays shall be provided as necessary to prevent premature setting and drying of the surface. The dusting of surfaces with dry materials or the addition of water during finishing will not be permitted. Finished surfaces shall be plane, with no deviation greater than 5/16-inch when tested with a 10-foot straightedge. Surfaces shall be pitched to drains.

1. Rough-Slab Finish: Slabs to receive fill or mortar setting beds shall be screened with straightedges immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible.
2. Float Finish: Slabs to receive a steel trowel finish and slabs where indicated shall be given a float finish. Screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. After the concrete has stiffened to permit the operation and the water sheen has disappeared, it shall be wood floated. Concrete that portrays stickiness shall be finished with a magnesium float in lieu of a wood float, and left free of ridges and other projections. Float finish is normally specified for surfaces that will receive other treatment such as built-up roofing, nonslip surfacing material. Float Finish shall not be used on wearing surfaces.
3. Trowel Finish: Slabs where indicated, shall be given a trowel finish immediately following floating. Surfaces shall be trowelled to produce smooth, dense slabs free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. A final hard steel troweling shall be done by hand. Trowel finish shall be used on wearing surfaces and where a smooth finish is required.
4. Broom Finish: After floating, slabs where indicated, shall be lightly troweled, and then broomed with a fiber-bristle brush in a direction transverse to that of the main traffic.
5. See Specification Section 09 90 00 Painting and Finishes for required finishes.

3.10 CURING AND PROTECTION

A. General: All concrete shall be cured by an approved method for the period of time given

below:

Concrete with Type III cement	3 days
Concrete with Type II or IIA, or V, low alkali cement	7 days
Concrete with Type IP-A(MS) cement blended with pozzolan	10 days

B. Immediately after placement, concrete shall be protected from premature drying extremes in temperatures, rapid temperature change, mechanical injury and injury from rain and flowing water. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. All materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat shall be permitted near or in direct contact with the concrete at any time. Curing shall be accomplished by any of the following methods, or combination thereof, as approved.

C. Moist Curing: Concrete to be moist-cured shall be maintained continuously wet for the entire curing period. If water or curing materials used stains or discolors concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by covering with a 2-inch minimum thickness of continuously saturated sand, or by covering with waterproof paper, polyethylene sheet, polyethylene-coated burlap or saturated burlap. Once the moist curing has started the concrete surface must not be allowed to become surface dry for the entire curing period.

D. Membrane Curing:

1. Normal membrane curing compound shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete. Use a Dissipating curing compound for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring.
2. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam.
3. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface.
4. Surfaces shall be thoroughly moistened with water and the curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period.
5. Compound shall be applied in a one-coat continuous operation by mechanical spraying equipment, at a uniform coverage in accordance with the manufacturer's printed instructions.

6. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified.
7. On surfaces permanently exposed to view, the surface shall be shaded from direct rays of the sun for the duration of the curing period.
8. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.11 QUALITY CONTROL TESTING

A. Quality Control Testing shall be in accordance with Section 01 45 00 – Quality Control and Material Testing.

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SECTION 03 31 05

CONTROLLED LOW STRENGTH MATERIAL

PART 1 GENERAL

1.1 REQUIREMENTS

A. CONTRACTOR shall provide Controlled Low Strength Material (CLSM), complete and in place, in accordance with the Contract Documents.

B. CLSM shall be placed where indicated and may be used, if ENGINEER approves, for the following purposes:

1. Normal CLSM with high slump, non-segregating consistency that readily flows and fills voids and difficult to reach places: pipe zone fill, trench zone fill, pipe abandonment, structure backfill, and structure cavity fill.
2. Foundation CLSM is used where higher early strengths are required and future excavation is not likely to be required.

1.2 RELATED WORK

A. Related Work in other Sections includes but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 31 23 15 Excavation and Backfill for Buried Pipelines

1.3 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM C 33 Standard Specification for Concrete Aggregates
2. ASTM C 94 Standard Specification for Ready-Mixed Concrete
3. ASTM C 138 Standard Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete
4. ASTM C 150 Standard Specification for Portland Cement
5. ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete.
6. ASTM C 403 Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
7. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete
8. ASTM C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
9. ASTM C 803 Standard Test Method for Penetration Resistance of Hardened Concrete
10. ASTM D 4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
11. ASTM D 4832 Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

1.4 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings:

1. CLSM mix designs which show the proportions and gradations of all materials proposed for each type of CLSM indicated. Each mix design shall be accompanied by independent laboratory test results of the indicated properties.
2. If Contractor proposes to provide lower strength CLSM with aggregates that do not conform to ASTM C 33, Shop Drawings shall include a testing program that will be used to control the variability of the aggregates. The testing program shall be acceptable to ENGINEER.

1.5 QUALITY ASSURANCE:

A. All testing will be done by a testing laboratory at CONTRACTOR'S expense, except as otherwise indicated.

B. If tests of the CLSM show non-compliance with the specifications, CONTRACTOR shall make changes as may be required to achieve compliance. Performing and paying for subsequent testing to show compliance shall be CONTRACTOR's responsibility.

C. Correlation Tests

1. CONTRACTOR shall perform a field correlation test for each mix of CLSM used in pipe zone, trench zone, or backfill used in amounts greater than 100 cubic yards or when CLSM is required to support traffic or other live loads on the fill less than 7 days.
2. Field correlation tests shall be performed in a test pit similar in cross section to the WORK and at least 10-feet long at a location near the WORK. The proposed location shall be acceptable to ENGINEER.
3. Laboratory and field tests shall be performed on samples taken from the same CLSM batch mix. All tests shall be performed by a laboratory at CONTRACTOR's expense.
4. Testing shall be performed once each 2-hours during the first 8 hours, once each 8-hours during the first week, and once each 24-hours until the CLSM mix reaches the maximum design strength.
    a. Compression testing shall be in accordance with ASTM D 4832.
    b. Setting test shall be in accordance with ASTM C 403.
    c. Density tests shall be in accordance with ASTM C 138.

PART 2 PRODUCTS

2.1 CONTROLLED LOW STRENGTH MATERIAL

A. CLSM shall be a mixture of cement, pozzolan, coarse and fine aggregate, admixtures, and water, mixed in accordance with ASTM C 94.

B. Composition: The following parameters shall be within the indicated limits and as necessary to produce the indicated compressive strengths.

1. The actual mix proportions and flow characteristics shall be determined by the producer of the CLSM to meet requirements for compressive strength as specified for Normal CLSM or Foundation CLSM.
2. Entrained air content shall be between 15 percent minimum and 30 percent maximum.
3. Water reducing agent content as necessary.

C. Properties

1. Density shall be between 120 PCF minimum and 145 PCF maximum.
2. Slump shall be as required by CONTRACTOR methods, but shall not promote segregation, nor shall slump exceed 10 inches.
3. Compressive strength at 28 days:
   a. Normal CLSM: Between 100 psi minimum and 300 psi maximum. Unless specifically indicated otherwise, all CLSM shall be Normal CLSM.
   b. Foundation CLSM: 500 psi to 1,000 psi.

2.2 CEMENT

A. Cement shall be Type ll in accordance with ASTM C 150.

2.3 POZZOLAN

A. Pozzolan shall be Type F or C in accordance with ASTM C 618. Pozzolan content, by weight, in Normal CLSM, shall not be greater than 90 percent.

2.4 AGGREGATE

A. Aggregate shall consist of a well graded mixture of crushed rock, soil, or sand, with a nominal maximum size of 3/8-inch. One hundred percent shall pass the 1 inch sieve; no more than 30 percent shall be retained on the 3/8-inch sieve; and no more than 12 percent shall pass the number 200 sieve. If more than 5 percent of the aggregate passes the number 200 sieve, the material passing the number 200 sieve shall have a plasticity index of less than 0.73(liquid limit-20), when tested in accordance with ASTM D 4318. All aggregate shall be free from organic matter and shall not contain more alkali, sulfates, or salts than the native materials at the Site.

2.5 ADMIXTURES

A. Air entraining admixtures shall be in accordance with ASTM C 260.

B. Water reducing admixtures shall be in accordance with ASTM C 494.

2.6 WATER

A. Water shall be potable, clean, and free from objectionable quantities of silt, organic matter, alkali, salt, and other impurities.

PART 3 EXECUTION

3.1 PREPARATION

A. Subgrade and compacted fill to receive CLSM shall be prepared according to Section 31 23 15 Excavation and Backfill for Buried Pipelines.

3.2 BATCHING, MIXING AND DELIVERY

A. Batching, mixing, and delivery of CLSM shall conform to ASTM C 94. CLSM shall be mixed at a batch plant acceptable to the ENGINEER and shall be delivered in standard transit mix trucks.

3.3 PLACEMENT

A. CLSM shall be placed by tailgate discharge, conveyor belts, pumped, or other means acceptable to the ENGINEER. CLSM shall be directed in place by vibrator, shovel, or rod to fill all crevices and pockets. Avoid over-consolidation which causes separation of aggregate sizes.

B. CLSM shall be continuously placed against fresh material unless otherwise approved by ENGINEER. When new material is placed against existing CLSM, the placement area shall be free from all loose and foreign material. The surface of the existing material shall be soaked a minimum of one hour before placement of fresh material but no standing water shall be allowed when placement begins.

C. CLSM placement for piping. Pipe shall be placed on soil pads and bedding placed under the pipe from one side and vibrated, as necessary, so that the CLSM flows to the opposite side. CLSM shall then be added to both sides of the pipe and vibrated until it fills the space between the pipe and the excavated trench bottom. CLSM shall be deposited in such a manner as to avoid uplift and deposited in its final position to avoid disturbing the pipe trench causing foreign material to mix with the cement slurry.

D. Pipe zone backfill shall not be placed or compacted until the CLSM has reached initial set. Pipes placed on steep slopes may require a stiffer mix to prevent CLSM from flowing down the trench. Vibration may be required to ensure that the CLSM fills all voids.

E. Temperature of the CLSM shall be between 50 and 90 degrees F, when placed. CLSM shall not be placed when the air temperature is below 40 degrees F. No CLSM shall be placed against frozen subgrade or other materials having temperature less than 32 degrees F.

3.4 FINISHING

A. The finish surface shall be smooth and to the grade indicated or directed by the ENGINEER. Surfaces shall be free from fins, bulges, ridges, offsets, and honeycombing. Finishing by wood float, steel trowel, or similar methods is not required.

3.5 CURING

A. CLSM shall be kept damp for a minimum of 7 days or until final backfill is placed.

3.6 PROTECTION

A. CLSM shall be protected from freezing for 72 hours after placement.

B. No fill or loading shall be placed on CLSM until probe penetration resistance, as measured in accordance with ASTM C 803 exceeds 650 psi.

C. CLSM shall be protected from running water, rain, and other damage until the Material has been accepted and final fill completed.

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SECTION 03 60 00
GROUT

PART 1 GENERAL

1.1 REQUIREMENTS

A. CONTRACTOR shall provide grout, complete and in place, in accordance with the Contract Documents.

B. Unless indicated otherwise, grouts shall be provided as listed in this Section whether indicated on the Contract Drawings or not.

C. The following types of grouts 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. Non-Shrink Epoxy Grout
5. Epoxy Anchor Grout for Adhesive Anchors
6. Topping Grout and Concrete/Grout Fill

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 60 00 Product Requirements
3. Section 03 30 00 Cast-in-Place Concrete

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. American Society for Testing Materials (ASTM)

1. ASTM C 33 Standard Specification for Concrete Aggregates
2. ASTM C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
3. ASTM C 150 Standard Specification for Portland Cement
4. ASTM C 307 Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings
5. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete
6. ASTM C 496 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
7. ASTM C 531 Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
8. ASTM C 579 Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

9. ASTM C 580 Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
10. ASTM C 827 Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
11. ASTM C 881 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
12. ASTM C 882 Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear
13. ASTM C 939 Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
14. ASTM C 942 Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory
15. ASTM C 1090 Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout
16. ASTM C 1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
17. ASTM C 1339 Standard Test Method for Flowability and Bearing Area of Chemical-Resistant Polymer Machinery Grouts
18. ASTM D 648 Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
19. ASTM D 695 Standard Test Method for Compressive Properties of Rigid Plastics

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01 33 00 – Submittal Procedures.

B. Provide the following submittals for each type of grout used on the project:

1. Test reports accompanied by a manufacturer’s statement that previously tested material is of similar type, quality, and manufacture as that which is proposed for use on this project shall be submitted for:

    a. Cement
    b. Aggregates
    c. Retardants
    d. Bonding compounds
    e. Epoxy Resin
2. Certifications 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 location of use. ICBO/ES report shall be submitted for epoxy anchor grout for adhesive anchors.
4. Manufacturer’s certification that non-shrink grout does not contain aluminum, zinc, or magnesium powders as a method of expansion.
5. Submit manufacturer's written warranty as indicated herein.

6. Name and telephone number of grout manufacturer's representative who will give on-Site service. The representative shall have at least one year of experience with the indicated grouts.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Grout and grout materials shall be stored in a dry shelter, protected from moisture, and for prepackaged grout, maintained in accordance with the manufacturer's recommendations.

1.6 QUALITY ASSURANCE

A. The work shall be subject to inspection at all times by OWNER and ENGINEER for the purpose of determining that the work is properly executed in accordance with this specification. Failure to detect defective workmanship or material during any interim inspection shall not constitute acceptance of workmanship and materials.

B. All testing will be done by a testing laboratory at CONTRACTOR'S expense, except as otherwise indicated.

C. Field Tests

1. Compression test specimens will be taken from the first placement of each type of grout, and at intervals thereafter selected by ENGINEER.
2. Compression tests and fabrication of specimens for cement grout and cement based non-shrink grout will be performed in accordance with ASTM C 1107, at intervals during construction selected by 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 31 00 - Cast-in-Place Concrete, at intervals during construction selected by ENGINEER.
4. Compression tests and fabrication of specimens for epoxy grouts will be performed in accordance with ASTM C 579, Method B, at intervals during construction selected by ENGINEER. A set of 3 specimens will be made for testing at 7 Days and each earlier time period as appropriate.

D. Construction tolerances shall be as indicated in Section 03 30 00 Cast-in-Place Concrete unless noted otherwise.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement: Portland cement shall be ASTM C 150 Type II of Type V.

B. Aggregate:

1. General: Aggregate shall be non-reactive and shall be washed before use. When sources of aggregate are changed, test reports shall be provided for the material from the new source prior to commencing grout work.

2. Fine Aggregate: Fine aggregate shall be sand or crush stone conforming to ASTM C 33 as modified herein. When tested in accordance with ASTM C 136, gradation shall be such that 100 percent by weight passes a No. 8 sieve and not less than 45 percent by weight passes a standard No. 40 sieve. Variation from the specified gradation in individual tests will be accepted if the average of three consecutive tests is within the following variation:

Standard Sieve	Permissible Variation in Individual Test
No. 30 or coarser	2% by weight
No. 50 or finer	0.5% by weight

C. Admixtures

1. General: Admixtures shall be compatible with the grout and shall comply with the manufacturer's recommendations. Admixtures shall be added to the grout mix separately.
2. Water Reducing Retarder: Water reducing retarder shall comply with ASTM C 494, Type D and shall be **Master Builders (BASF) MasterSet R 300, Sika Corporation Plastiment**, or approved equal.
3. Lubricant: Lubricant additive for cement pressure grouting shall be **Sika Intraplast**, or approved equal.

D. Water:

1. Water for washing aggregate, for mixing and for curing shall be potable, shall not contain more than 1,000 mg/L of chlorides as Cl, nor more than 1,300 mg/L of sulfates as SO_4, and shall not contain impurities which may change the setting time by more than 25 percent or a reduction of more than 5 percent of the compressive strength of the grout at 14 days when compared to the results for grout made with distilled water.

2.2 CEMENT GROUT

A. Application: Surface repairs of concrete.

B. Cement grout shall be composed of one 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 4000 psi.

C. Cement grout materials shall be as indicated in Section 03 30 00 Cast-in-Place Concrete.

2.3 NON-SHRINK GROUT

A. General

1. Non-shrink cementitious grout shall be a flowable, prepackaged, inorganic, non-metallic, cement type grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used. The manufacturer shall have at least 10 years' experience in the manufacture of cement based grouts. The

manufacturer shall provide technical services and provide a representative at the jobsite for product training prior to product installation.

2. 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 shall be as recommended by the manufacturer for the particular application.
3. Grout shall not contain chlorides or additives that may contribute to corrosion.
4. Grout shall be formulated to be used at any consistency from fluid to plastic.
5. Cement-based non-shrink grout shall have the following minimum properties when tested at a fluid consistency, at 28 Days:
   a. Minimum tensile splitting strength of 500 psi per ASTM C 496.
   b. Minimum flexural strength of 1,000 psi per ASTM C 580.
   c. Minimum bond strength (concrete to grout) of 1,900 psi per modified ASTM C 882.
   d. Grout shall be certified for use in freeze/thaw environments.

B. Class I Non-Shrink Grout

1. Application: Anchor bolts and reinforcing steel required to be set in grout in which the average working or operating temperature will be over 100 degrees F or in high fire risk areas; Beam and column (1 or 2 story) base plates less than 16-inches in the least dimension; Storage tanks and other non-motorized equipment and machinery under 30 horsepower; Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc.; Repair of holes and defects in concrete members which are not water bearing and not in contact with soil or other fill material; and any other location not specifically listed in this Section or on the Contract Drawings.
2. Class I non-shrink grout shall have a minimum 28 Day compressive strength of 5,000 psi when mixed at a fluid consistency.
3. Class I non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C, when mixed to fluid, flowable, and plastic consistencies.
4. Grout shall have a maximum early age height change of 4.0% expansion, and shall have no shrinkage (0.0%) in accordance with ASTM C 827. The grout when tested shall not bleed or segregate at maximum allowed water.
5. Grout shall have no shrinkage (0.0%) and a maximum of 0.3% expansion in the hardened state when tested in accordance with ASTM C 1090.
6. Furnish certification that the non-shrink property of grout is not based on gas production or gypsum expansion.
7. Class I Non-Shrink Grout shall be **Five Star Grout by Five Star Products, Sikagrout 212 by Sika Corporation, CB-G PG by Hilti**, or equal.

C. Class II Non-Shrink Grout

1. Application: Column base plates (greater than 2 story or larger than 16-inches in the least dimension); under precast concrete elements; and repair of holes and defects in concrete members which are water bearing or in contact with soil or other fill materials.
2. Class II non-shrink grout shall be a high precision, fluid, extended working time, grout. The minimum 28-Day compressive strength shall be 7,500 psi, when mixed at a fluid consistency.
3. Grout shall have a maximum early age height change of 4.0% expansion, and shall have no shrinkage (0.0%) in accordance with ASTM C 827.

4. Grout shall have no shrinkage (0.0%) and a maximum of 0.3% expansion in the hardened state when tested in accordance with ASTM C 1090.
5. 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 C 827 at temperature extremes of 45 to 90 degrees F in accordance with ASTM C 1107.
6. Class II non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C when tested using the amount of water needed to achieve fluid consistency per ASTM C 939.
7. The grout when tested shall not bleed or segregate at maximum allowed water content.
8. Provide certification that its non-shrink property is not based on gas production or gypsum expansion.
9. Class II non-shrink grout shall be **Five Star Fluid Grout 100 by Five Star Products**, **Crystex by L&M Construction Chemicals**, or equal.

2.4 NON-SHRINK EPOXY GROUT

A. Application: Pumps over 1,000 horsepower, unless indicated otherwise.

B. Non-shrink epoxy grout shall be a flowable, non-shrink, 100 percent solids system. The epoxy grout system shall have 3 components: resin, hardener, and specially blended aggregate, each premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

C. Epoxy grout shall have a maximum early age height change of 4.0% expansion, and shall have no shrinkage (0.0%) in accordance with ASTM C 827, (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1).

D. Epoxy grout shall have a negligible (less than 0.0006 in/in) length change after hardening, and a coefficient of thermal expansion less than $18x10^{-6}$ in/in F when tested according to ASTM C 531.

E. The epoxy grout shall develop a minimum compressive strength of 9,000 psi in 24 hours and 13,000 psi in seven days when tested in accordance with ASTM C 579, method B.

F. The mixed epoxy grout shall have a minimum working life of 90 to 120 minutes at 70 degrees F.

G. The effective bearing area shall be a minimum of 95 percent EBA in accordance with ASTM C 1339.

H. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application. Do not reduce aggregate loading or add solvents to increase flowability.

I. Non-shrink epoxy grout shall have the following minimum properties when tested at 7 Days:

1. Minimum bond strength to concrete of 3,000 psi per ASTM C 882 modified.
2. Minimum bond strength to steel of 1,700 psi per ASTM C 882 modified.
3. Minimum flexural strength of 2,500 psi per ASTM C 580.
4. Minimum tensile strength of 2,000 psi per ASTM C 307.

J. Non-shrink epoxy grout shall be **Five Star DP Epoxy Grout by Five Star Products, Inc., Sikadur 42 Grout-Pak by Sika Corporation**, or equal.

2.5 EPOXY ANCHOR GROUT

A. Application: Anchor bolts and reinforcing steel required to be set in grout that is not in high temperature or high fire risk areas.

B. Epoxy anchor grout shall conform to ASTM C 881, Type IV, Class A, B, and C, Grade 3 with the exception of gel time.

C. Heat deflection temperature shall be a minimum of 139 °F per ASTM D 648.

D. Manufacturer shall certify that the epoxy anchor grout will maintain 90 percent of its strength up to a temperature of 125 °F.

E. 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.

F. Epoxy anchor grout shall be capable of being used in submersed applications once cured.

G. Minimum compressive strength shall be 12,000 psi per ASTM D 695.

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 **Epcon C6+ by ITW Ramset/Red Head, Power-Fast Epoxy Injection Gel by Powers Fasteners, RE 500 by Hilti**, or equal.

2.6 TOPPING GROUT AND CONCRETE/GROUT FILL

A. Where fill is thicker than 3-inches, structural concrete as indicated in Section 03 31 00 - Cast-in-Place Concrete, may be used when accepted by 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. Materials and procedures indicated for normal concrete in Section 03 31 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. Topping grout in clarifiers shall contain between 750 and 800 pounds of cement per cubic yard with a maximum water cement ratio of 0.42.

D. Coarse aggregate shall be graded as follows:

U.S. Standard Sieve Size	Percent By Weight Passing
1/2 in	100
3/8 in	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 Section 03 30 00 - Cast-in-Place Concrete.

F. Topping grout and concrete grout/fill shall contain air-entraining agent per Section 03 30 00 – Cast-in-Place Concrete.

G. **Strength:** Minimum compressive strength of topping grout and concrete/grout fill at 28 Days shall be 4,000 psi.

2.7 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 defined 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.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

B. Rough concrete lightly, but not enough to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level, and maintain final positioning of components to be grouted.

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 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. 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. Shade the WORK from sunlight for at least 24 hours before and 48 hours after grouting.

G. Contact the grout manufacturer's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

3.3 GROUTING PROCEDURES

A. **General:** 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 other thickness if 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 ENGINEER, alternate grouting methods shall be submitted for acceptance by ENGINEER.
3. Concrete equipment pads for equipment bases that will be epoxy-grouted shall be sized so that, when the equipment base is fully grouted, the epoxy grout is stopped not less than 4-inches from the edge of the pad.

C. Drilled Anchors and Reinforcing Bars

1. General
   a. 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.

b. 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 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.

2. Epoxy Adhesive Anchors
   a. Grout shall be proportioned and mixed with automatic equipment.
   b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO/ES report, but shall not be less than 8 diameters for threaded rod or 12 diameters for reinforcing or smooth bars.
   c. Holes required for grouting shall be blown or vacuumed clean and are to be free of dust and standing water. Horizontal holes for grouting are to be drilled at a slight downward angle and with the inserted dowel or bolt bent to match.
3. Cement Based Non-Shrink Grout
   a. In places of high temperature or fire hazard, anchor bolts shall be grouted in using cement based non-shrink grout, Class I.
   b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO/ES report, but shall not be less than 16 diameters for threaded rod or 24 diameters for reinforcing or smooth bars.
   c. When the bolt diameter is one-inch or less, the hole diameter should be a minimum of 2-inches. When the bolt diameter is greater than one-inch, the hole diameter should be at least twice the bolt diameter.
   d. Drilled holes shall be saturated with water for not less than 24 hours before installation of anchor/rod/rebar.
   e. 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.

D. Topping Grout and Concrete/Grout Fill

1. 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 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.
2. The minimum thickness of grout topping and concrete/grout fill shall be one-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.
3. 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.

4. 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.
5. The surface shall be tested with a straight edge to detect high and low spots that 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.
6. 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 ENGINEER, the tank shall be filled with sufficient water to cover the entire floor for 14 days.

3.4 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.

3.5 CURING

A. Cement based grouts shall be cured per 03 30 00 – Cast-in-Place Concrete and per the manufacturer's recommendations.

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SECTION 04 22 00
REINFORCED UNIT MASONRY

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers reinforced unit masonry and appurtenant work.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 03 20 00 Concrete Reinforcement
3. Section 03 30 00 Cast-in-place Concrete
4. Section 07 21 00 Insulation
5. Section 07 92 00 Joint Sealants
6. Section 09 90 00 Painting and Finishes

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICA CONCRETE INSTITUTE (ACI)

1. ACI SP-66 ACI Detailing Manual
2. ACI 530 Building Code Requirements for Masonry Structures
3. ACI 530.1 Specifications for Masonry Structures

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
2. ASTM A 951 Standard Specification for Steel Wire for Masonry Joint Reinforcement
3. ASTM A 1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
4. ASTM C 90 Standard Specification for Load-Bearing Concrete Masonry Units
5. ASTMC 140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
6. ASTM C 144 Standard Specification for Aggregate for Masonry Mortar
7. ASTM C 150 Standard Specification for Portland Cement
8. ASTM C 207 Standard Specification for Hydrated Lime for Masonry Purposes
9. ASTM C 270 Standard Specification for Mortar for Unit Masonry
10. ASTM C 404 Standard Specification for Aggregates for Masonry Grout
11. ASTM C 476 Standard Specification for Grout for Masonry
12. ASTM C 578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
13. ASTM C 652 Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale)

14. ASTM C 1019 Standard Test Method for Sampling and Testing Grout
15. ASTM C 1314 Standard Test Method for Compressive Strength of Masonry Prisms
16. ASTM C 1384 Standard Specification for Admixtures for Masonry Mortars
17. ASTM D 226 Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
18. ASTM D 2000 Standard Classification System for Rubber Products in Automotive Applications
19. ASTM D 2287 Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
20. ASTM E 514 Standard Test Method for Water Penetration and Leakage Through Masonry
21. ASTM E 518 Standard Test Methods for Flexural Bond Strength of Masonry

D. NATIONAL CONCRETE MASONRY ASSOCIATION (NCMA)

1. NCMA-TEK 45 Removal of Stains from Concrete Masonry Walls

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements and color samples. Include in the submittal dimensioned drawings for each type of block to be used on the project including, but not limited to, standard field block, lintel block, end block, caps, etc. Submit certificates showing compliance to the specifications for reinforcing steel, manufacturer’s literature for anchor ties and any other accessories used, grout and mortar mix design, samples for mortar color selection, and manufacturer’s literature for mortar and grout admixtures used along with CONTRACTOR’s proposed usage details.

C. Three sample specimens of the masonry units proposed for incorporation into the project shall be submitted to ENGINEER.

D. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars, complying with ACI SP-66. Show bar schedules, diagrams of bent bars, stirrup, spacing, lateral ties, and other components required for fabrication and placement of masonry reinforcement.

E. Submit product data for premolded control joint strips and joint sealant.

F. A minimum 4-ft square free-standing sample panel shall be prepared for approval before starting masonry work. The panel shall remain at the site for reference until masonry work is completed.

1.5 QUALITY ASSURANCE

A. Masonry units shall be sampled and tested in accordance with ASTM C 140.

B. CONTRACTOR shall have mortar and grout tested to assure compliance with the Specifications and the governing codes by a testing laboratory approved by ENGINEER. The test reports shall be submitted to ENGINEER.

1. Tests shall be taken at the following times:
   a. At commencement of masonry work, at least 2 samples each of mortar and grout shall be taken on 3 successive days.
   b. At any change in materials or job conditions, at least 2 samples of each modified material, grout and mortar shall be tested.
   c. Make four (4) random tests each of mortar and grout. The random test samples shall be taken when requested by ENGINEER.
   d. The costs of tests shall be paid by CONTRACTOR as part of the work. The costs of additional tests, when required to verify compliance when requested by OWNER or ENGINEER, will be paid by OWNER. When tests do no verify compliance, the cost of additional tests shall be paid by CONTRACTOR.
2. Samples shall be stored in a moist environment until tested, unless directed otherwise by ENGINEER or the testing laboratory. Testing for mortar shall be in accordance with ASTM C 270. Testing for grout shall be in accordance with ASTM C 1019.

C. CONTRACTOR shall test the masonry units to assure compliance with the specifications and governing codes. Testing will be by a laboratory approved by ENGINEER.

1. Testing will be made of the following items:
   a. At the time of the construction of the sample panel, at least 3 masonry units shall be tested for each type of block, except separate tests are not required for block which only varies by texture.
   b. At any change in materials during construction, at least 3 masonry units shall be tested.
   c. Additional sets of at least 3 masonry units shall be tested whenever, in the judgment of ENGINEER, additional tests are necessary to determine the quality of the material.
   d. CONTRACTOR shall submit a letter of certification from the masonry unit supplier at the time of, or prior to, delivery of the materials to the site that the materials used in construction are representative of the materials used to construct the prisms.
2. The masonry units shall be sampled and tested in accordance with ASTM C 140.

D. Whenever required under the provisions of the Building Code, the work shall be subject to inspection by a Special Inspector selected by ENGINEER and approved by the local building code representative having jurisdiction. Costs of such inspections will be paid by OWNER. The Special Inspector will work under the supervision of ENGINEER. Special Inspection will be in accordance to Drawing S-2 – General Special Inspections.

E. Cold weather construction shall be per ACI 530.1, IBC Section 2104.3, and the local code requirements, whichever is more stringent.

1.6 DELIVERY, STORAGE, AND HANDLING

A. CONTRACTOR shall be responsible to deliver, handle, and store masonry units by means which will prevent mechanical damage and deterioration due to moisture, temperature changes, and corrosion. CONTRACTOR shall provide protection which will

limit moisture absorption of concrete masonry units to the maximum percentage specified for Type I units for the average relative humidity at the project site, as reported by the nearest National Weather Service station.

B. Cementitious materials shall be stored off the ground and protected from moisture.

C. Aggregates shall be stored in a manner which will preserve grading characteristics.

D. Masonry accessories shall be stored to prevent corrosion, dirt accumulation, and other deterioration.

1.7 PROJECT CONDITIONS

A. Cold Weather Protection: Do no lay masonry units when outside air temperature is below 40 degrees F.

1. Grouted construction: On any day when the minimum anticipated nighttime temperature is 32 degrees F or less, in addition to complying with general procedures above, grout materials shall be heated to 90 degrees F to produce an in-place grout temperature of not less than 70 degrees F at end of workday. Protective blankets or enclosures shall remain in place for not less than 48 hours after placement of masonry units.
2. Water: Water for mortar or grout shall not be heated to more than 160 degrees F.

B. Hot-Weather Protection: Cover or shade masonry units and mortar materials and use cool water for mortar whenever ambient air temperature is 90 degrees F or greater. At air temperatures of 85 degrees F or above, if relative humidity is less than 30 percent or wind is in excess of 15 miles per hour, provide protection by immediately covering newly constructed walls by providing windbreaks, or by using fog spray to reduce rate of evaporation.

1.8 MEASUREMENT AND PAYMENT

A. There shall be no separate measurement and payment for reinforced unit masonry. Full compensation for all reinforced unit masonry shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which reinforced unit masonry relates.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards for types required, and as follows:

1. Unit, Grade and Type: Masonry units shall conform to the requirements of the following table:

Unit	ASTM	Grade	Type	Minimum Net Area[1] Compressive Strength (psi)
Concrete Masonry Unit (CMU)	C 90	Normal Weight	Hollow	2,000
Note: (1) Average of 3 units				

2. Size: The size of masonry units shall be as indicated on the Contract Drawings. Special shapes and sizes shall be provided as required, whether or not specifically indicated on the Contract Drawings as special.
3. Surfaces: Special surface texture or architectural faces shall be provided where indicated on the Contract Drawings.
4. Color: Where the finished surface will be visible, masonry units shall have colors as indicated on the Contract Drawings. Where colors are not specified, OWNER shall determine colors to be provided.

2.2 MATERIALS

A. Portland Cement: ASTM C 150, Type II or IIA.

1. Type III may be substituted during cold-weather construction.

B. Hydrated Lime: ASTM C 207, Type S.

C. Aggregate for Mortar: Sand conforming to ASTM C 144.

D. Aggregate for Grout: ASTM C 404.

E. Admixture for grout, if used, shall be **Sika Grout Aid by Sika Corp.**,or approved equal.

F. Water: Clean and potable.

G. Masonry cleaner shall be a non-acidic cleaner, **SafEtch by Prosoco, Inc.**, or approved equal.

H. Accelerating Admixture: Non-chloride admixture for use in mortar mixes during cold weather, proportioned and mixed to comply with directions of manufacturer.

1. Products: The following products, provided they comply with requirements of ASTM C 1384 and the contract documents, will be among those considered acceptable.
   a. MORSET by Grace Construction Products
   b. or approved equal

I. Water-repellant and efflorescence control admixture.

1. All exterior masonry units shall utilize a water-repellant and efflorescence control admixture as recommended by the manufacturer to obtain ASTM E 514 test extended to 72 hours, class E rating.

2. Admixtures shall be MasterPel 240 (Rheopel Plus) by BASF, Eucon Blocktite by Euclid Chemical Company, or approved equal.

J. Integral water repellant admixture is required for mortar for exterior masonry units and shall be **MasterPel 240MA** (**Rheopel Plus Mortar Admixture) by BASF, Blocktite Mortar Admixture by Euclid Chemical Company,** or approved equal.

2.3 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Bars shall be in accordance with Section 03 20 00 – Concrete Reinforcement.

B. Joint Reinforcement and Anchorage Materials: shall comply with ASTM A 951 and the following general requirements for materials required in joint reinforcement and anchorage devices.

1. Steel wire: ASTM A 1064.
   a. Zinc coating: ASTM A 641 Class 1.
   b. Application: Use at interior locations.

C. Joint Reinforcement: Provide welded-wire units prefabricated into straight lengths of not less than 10 feet, with deformed continuous side rods and plain cross rods, and as follows:

1. Width: Approximately 1-1/2 inches less than nominal wall width, providing not less than 1/2 inch mortar coverage on each exposure.
2. Wire sizes:
   a. Side rod diameter: 0.1483 inch.
   b. Cross rod diameter: 0.1483 inch.
3. Configuration:
   a. Applications of single unit width: Ladder design, cross rods at not more than 16 inches on center.
   b. Corners: Provide prefabricated L- and T-shaped units.

2.4 MISCELLANEOUS MASONRY ACCESSORIES

A. Premolded Control Joints Strips: Joints designed to fit standard sash block and to maintain lateral stability in masonry wall, of size and configuration indicated or as required for conditions, and as follows:

1. Styrene-butadiene rubber compound complying with ASTM D 2000, 2AA-805, or
2. Polyvinyl chloride complying with ASTM D 2287, Type PVC 654-4.

B. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type 1 (No. 15 asphalt).

C. Joint Sealant: Provide joint sealants in accordance with Section 07 92 00.

2.5 MORTAR AND GROUT MIXES

A. General: Do not use admixtures unless indicated and approved by ENGINEER. Do not use calcium chloride in mortar or grout mixture.

B. Mixing: Combine and thoroughly mix ingredients in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.

C. Mortar for Unit Masonry: Comply with ASTM C 270 and IBC Section 2103.7, Proportion Specification, for types of mortar required, unless otherwise indicated.

1. Limit cementitious materials in mortar to Portland cement and lime.
2. Use Type S mortar for reinforced masonry. Compressive strength: 1800 psi @ 28 days.
3. Mortar for use with colored masonry units shall have the integral color as approved by OWNER.

D. Grout: Comply with ASTM C 476 and IBC 2103.10 for grout used in construction of unit masonry elements. Use grout of consistency indicated or as required at time of placement to fill completely all spaces intended to receive grout. Compressive strength: 2000 psi @ 28 days.

1. Use fine grout in spaces less than 2 inches in least horizontal dimension, unless otherwise indicated.
2. Use coarse grout in spaces 2 inches or more in least horizontal dimension, unless otherwise indicated.

2.6 MASONRY SEALERS

A. Sealers shall be as noted in Section 09 90 00 - Painting and Finishes.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION PROCEDURES

A. Concrete Masonry Units: Do not wet concrete masonry units prior to laying.

B. Measurements for mortar and grout shall be accurately made. Shovel measurements are not acceptable. Mortar proportions shall be accurately controlled and maintained.

C. Reinforcing: Before placing masonry reinforcing, remove loose rust, dirt, and other coatings.

D. Masonry Thickness: Build masonry elements to full thickness shown.

1. Build single-wythe walls to actual thickness of masonry units, using units of size indicated.

E. Chases and Recesses: Build masonry to accommodate the work of other trades, including chases and recesses as shown or required. Provide not less than 8 inches of masonry between jambs of openings and chases and recesses.

F. Leave openings for equipment to be installed in masonry. After installation of equipment, complete masonry work to match work immediately adjacent to opening.

G. Cutting Masonry Units: Use motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use dry cutting saws to cut concrete masonry units.

H. Add insulation to open cells if required on the Contract Drawings. See Section 07 21 00 - Insulation.

I. Work shall be performed in accordance with ACI 530 and ACI 530.1, the latest edition of the IBC, and local governing codes for reinforced concrete hollow-unit masonry.

J. CONTRACTOR shall set or embed anchors, bolts, reglets, sleeves, conduits, and other items as required.

3.2 CONSTRUCTION TOLERANCES

A. Variation from Plumb: Do not exceed the following construction tolerances in vertical elements, including surfaces of walls, columns, and arises:

1. 1/4 inch to 10 feet
2. 3/8 inch to one story height, or 20 feet, whichever is less, except 1/4 inch for external corners, expansion joints, and other highly conspicuous vertical elements
3. 1/2 inch for 40 feet or more
4. Plus or minus 1/4 inch in 10 feet, 1/2 inch maximum, for vertical alignment of head joints.

B. Variation from Level: Do not exceed the following construction tolerances for bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous horizontal elements:

1. 1/4 inch in one bay or in 20 feet maximum
2. 1/2 inch in 40 feet or more

C. Variation from Plan Lines: Do not exceed the following horizontal construction tolerances for related portions of columns, walls, and partitions:

1. 3/8 inch in any bay of 16 feet maximum
2. 1/2 inch in 32 feet or more

D. Variation in Cross Section: Do not exceed the following masonry elements:

1. Minus 1/4 inch
2. Plus 1/2 inch

E. Variation in Mortar Joint Thickness: Do not exceed the following construction tolerances for thickness of mortar joints:

1. Bed joints: Plus or minus 1/8 inch
2. Head joints: Plus or minus 1/8 inch

3.3 MASONRY CONSTRUCTION - GENERAL

A. Layout: Lay out masonry for accurate pattern bond, for uniform joint widths, and for accurate location of specific features before beginning actual construction. Avoid use of masonry units of less than 1/2 size. Do not use units with less than nominal 4-inch horizontal face dimensions at corners and jambs.

B. Pattern Bond: Lay exposed masonry in 1/2 running bond with vertical joints in each course centered on units in course above and below except where other bonds are indicated at special features.

1. Lay concealed masonry with all units in a wythe in running bond.
2. Bond and interlock each course of each wythe at corners.

C. Reinforced Concrete Unit Masonry: Maintain vertical continuity of core or cell cavities. Keep cavities clear of mortar, including bed area of first course, to provide minimum clear dimension indicated, to provide minimum clearance and grout coverage for vertical reinforcement bars, and to provide direct grout contact with supporting surfaces.

D. Stopping and Resuming Work: Lay masonry in proper sequence to avoid toothing. Rack walls back in each course at end of each day. Before resuming, clean exposed surfaces and remove loose masonry units and mortar.

E. Built-in Work: As work progresses, build in items indicated for installation in masonry, filling around built-in items solidly with masonry.

1. Fill spaces between metal frames and masonry elements solidly with mortar, unless otherwise indicated.

F. Install lintels of types indicated at all openings.

1. Bearing: Provide not less than 8 inches of bearing at each jamb unless otherwise indicated.
2. Reinforcement: At masonry openings greater than one foot in width, install horizontal joint reinforcement in 2 horizontal joints approximately 8 inches apart immediately above lintel and immediately below sill. Extend reinforcement which is in addition to required continuous joint reinforcement not less than 24 inches beyond jambs of the opening, except at control joints.

G. Formwork: Provide temporary formwork and shores as required for temporary support of reinforced masonry elements. Construct formwork to shape line, and dimensions shown. Make sufficiently tight to avoid leakage of mortar and grout.

1. Brace, tie, and support as required to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other reasonable temporary loads that may be placed on them during construction.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be grouted or filled with concrete.

B. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. Except as otherwise indicated, maintain joint widths of 3/8 inch.

C. Cut joints flush for masonry walls which are concealed or covered by other materials, unless otherwise indicated.

D. Tool exposed joints slightly concave, using a jointer larger than joint thickness unless otherwise indicated.

E. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners of jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.5 HORIZONTAL JOINT REINFORCEMENT OF SINGLE-WYTHE WALLS

A. General: Provide continuous horizontal joint reinforcement for all single-wythe masonry walls, unless otherwise indicated. Lap reinforcing a minimum of 6 inches.

B. Install joint reinforcing in mortar joints at not more than 16 inches on center vertically.

C. Cut or interrupt joint reinforcement at control and expansion joints.

D. Provide continuity at corners and wall intersections by means of prefabricated L- and T-shaped sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.6 INSTALLATION OF REINFORCEMENT

A. Preparation: Do not use reinforcement bars with kinks or bends not shown on Contract Drawings or final shop drawings. Do not use bars with cross section reduced due to excessive rusting and other causes.

B. Placement: Position reinforcement bars accurately at spacings indicated. Support and secure vertical bars against displacement. Horizontal bars may be placed as the work progresses. Provide not less than the greater of either the bar diameter or 1 inch clear between bars. For columns, piers, and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1-1/2 times the nominal bar diameter or 1-1/2 inches, whichever is greater.

C. Splicing: Provide lapped splices at locations shown; do not splice at other points or by other methods, unless approved by ENGINEER. Provide not less than minimum lap indicated, or as required by governing code.

3.7 GROUTING

A. Grouting Technique:

1. Provide minimum clear dimension of 2 inches and minimum clear area of 8 square inches in vertical cores to be grouted. Place vertical reinforcement prior to laying concrete masonry units, extending above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters or 10 feet, whichever is less.
2. Grout shall be placed in all open areas of the masonry block as specified herein.
3. Lay masonry units to maximum pour height, not to exceed 4 feet.

4. Pour grout using chute or container with spout. Vibrate grout during placement. Place grout continuously; do not interrupt pouring operation for more than 1 hour. Terminate pour 1-1/2 inches below top of highest course in pour, except at tops of walls.
5. Stop grout in vertical cells 1-1/2 inches below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beams.

3.8 REPAIR AND POINTING

A. Repair: Remove and replace masonry units which are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units, and install in fresh mortar or grout pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of mortar joints, enlarge any holes or voids except weep holes and completely fill with mortar. Point up all joints, including corners, openings, and adjacent work, to provide a neat and uniform appearance.

3.9 CLEANING AND PROTECTION

A. Clean masonry as follows after mortar is thoroughly set and cured:

1. Remove large mortar particles by hand, using wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel, leaving half of panel uncleaned for comparison.
3. Clean concrete unit masonry to comply with directions of masonry manufacturer and as recommended by NCMA in Tek Bulletin No. 45.

B. Protection: CONTRACTOR shall protect all masonry until such time as the Work is completed and accepted by ENGINEER.

3.10 FINISH

A. Block shall be finished as per Section 09 90 00 - Painting and Finishes.

- END OF SECTION –

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SECTION 05 45 00
MECHANICAL METAL SUPPORTS (PIPE SUPPORTS)

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers materials and installation of mechanical metal supports, pipe supports, hangers, guides, anchors and appurtenances as specified and indicated.

B. CONTRACTOR shall provide mechanical metal supports in accordance with this Section whether shown on the Contract Drawings or not.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 05 50 00 Miscellaneous Specialties
3. Section 09 90 00 Painting and Finishes
4. Section 33 05 03 Copper Pipe
5. Section 33 05 05 Ductile Iron Pipe
6. Section 33 05 07.1 PVC Pressure Pipe (ASMT 1785)
7. Section 33 12 00 Mechanical Appurtenances
8. Section 40 05 13.13 Steel Process Piping
9. Section 40 05 13.19 Stainless Steel Process Piping
10. Section 40 05 13.33 Brass Process Piping

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTING INDUSTRY (MSS)

1. MSS SP-58 Pipe Hangers and Supports – Materials Design and Manufacture
2. MSS SP-69 Pipe Hangers and Supports – Selection and Application
3. MSS SP-89 Pipe Hangers and Supports – Fabrication and Installation Practices
4. MSS SP-127 Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application

C. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

1. ASME B 31.1 Power Piping

D. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 36 Standard Specification for Carbon Structural Steel
2. ASTM A 47 Standard Specification for Ferritic Malleable Iron Castings
3. ASTM A 48 Standard Specification for Gray Iron Castings
4. ASTM A 123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on

Iron and Steel Products.

5. ASTM A 153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6. ASTM A 575 Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
7. ASTM A 576 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. CONTRACTOR shall submit complete shop drawings of mechanical supports, pipe supports, hangers and guides. Provide scaled shop drawings showing locations of the supports and detailed drawings for each support. Identify each type of hanger or support by the manufacturer's part number of figure on the drawing.

C. Provide installation drawings and manufacturer's catalog information on each type of hanger and support.

D. Provide structural calculations for special supports and anchors, stamped, and signed by a professional engineer registered in the State of Utah.

PART 2 MATERIALS

2.1 GENERAL

A. All pipe hanger and supports shall be manufactured to comply with MSS-SP-58, MSS-SP-569, MSS-SP-89 except as modified herein. Where applicable, design and manufacture must also conform to ANSI/ASME B31.1. Supports for plumbing or fire piping shall be in accordance with the latest edition of the applicable plumbing or fire code and the requirements of the local jurisdiction.

B. Hangers, supports, anchors and restraints must be designed in accordance with MSS-SP-127 to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment. Piping supports and equipment must be considered as a total system and appropriate balance calculations made to determine load forces at critical stress points. Loading conditions to be considered may include, but are not limited to:

1. The total load of pipe, fittings, valves, insulation, and any expected contents of the pipe.
2. Thermal expansion and contraction
3. Stress from cycling of equipment or process.
4. Vibration transmitted to or from equipment or terminal connection.
5. Wind, snow, or ice loading on outdoor piping
6. Loading due to seismic forces

C. Static and dynamic forces at points of attachments must be considered to help ensure structural integrity of buildings or equipment. Hanger and supports must be selected to minimize the effect of piping system loading on the structure.

D. In general, piping shall be supported from structural members, such as walls, beams, columns, and slabs, using approved structural attachments. In situations where approved attachments cannot be used, alternative attachments or substructure assemblies must receive approval by ENGINEER prior to installation. Prior approval by ENGINEER must be given before any cutting or drilling of building structural steel. Damage to the structure through welding, cutting or drilling will not be permitted if it reduces the structures strength below the established safety factor for the structure. Any additional structural steel required to properly support piping or equipment shall be furnished and installed by CONTRACTOR at no additional cost to OWNER.

2.2 SUPPORT MATERIALS

A. Pipe supports, hangers, guides, etc. shall be hot-dip galvanized carbon steel, unless noted otherwise on the Contract Drawings. Steel shall be in accordance with ASTM A 36, ASTM A 575, or ASTM A 576. Hot-dip galvanizing shall be in accordance with ASTM A 123 or ASTM A 153. Bases, rollers, and anchors shall be steel as described above or may be cast iron conforming to ASTM A 48. Pipe clamps shall be steel as described above or may be malleable iron conforming to ASTM A 47.

B. Submerged supports, as well as piping in hydraulic structures within 24 inches of the high water level, shall have supports, including hardware and anchors constructed of Type 316 stainless steel, unless noted otherwise on the Contract Drawings.

C. Piping in chemical or corrosive areas shall have supports, including hardware and anchors constructed of Type 316 stainless steel or fiberglass reinforced plastic (FRP), unless noted otherwise on the Contract Drawings.

D. Supports fabricated from other materials specified on the Contract Drawings shall have a protective coating in accordance with the requirements of Section 09 90 00 – Painting and Coatings.

2.3 FLOOR MOUNTED SUPPORTS

A. Floor mounted pipe supports shall be the adjustable saddle support with stanchion, base and U-bolt or adjustable flange support type with stanchion and base. Pipe supports with stanchion and base plate shall be sized for the pipe or mechanical appurtenance it supports. All pipe supports shall have a 1-inch-high grouted pad to be used as a leveling base. Pipe supports shall be secured to the floor. A 1/4-inch-thick EPDM Rubber insulation pad shall be provided between the pipe and the U-Bolt.

2.4 SPRING-TYPE HANGERS

A. Spring-type hangers shall be provided for piping subject to vibration or vertical expansion/contraction such as engine exhaust piping. Design the spring-type hangers per the manufacturer’s recommendations.

2.5 CONCENTRATED LOADS

A. Concentrated loads, such as meters, valves, and equipment, on PVC piping systems shall have supports on each side of the concentrated load.

2.6 CONCRETE ANCHORS

A. Anchors shall be in accordance with Section 05 50 00 – Miscellaneous Specialties.

2.7 MANUFACTURERS

A. Mechanical Metal Support (pipe support) manufacturers shall be **Anvil International Inc., B-Line by Eaton (Cooper Industries), Utility Coatings & Fabrication, Piping Technology & Products, Inc. (PT&P),** or approved equal. To be considered an approved equal, materials must be of similar diameter, thickness, and strength to the product specified.

PART 3 EXECUTION

3.1 GENERAL

A. Mechanical metal supports, pipe supports, hangers, guides, etc. shall be installed per the manufacturer's instructions and ASME B31.1 – Power Piping.

B. Pipe supports shall be positioned in order to produce an orderly, neat piping system. Hanger rods shall be vertical without offsets.

C. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting as close to ceilings or roods as possible and without interference with other work.

D. Hangers shall be installed in a manner to prevent obstructing ladders, manhole covers, and access hatches.

E. Set embedded inserts accurately in position and support them rigidly before concrete is placed and prevent displacement during and after placement of concrete.

F. Provide separate hangers or supports at valves, meters, elbows, tees, and other equipment. Provide separate hangers on each both sides of each non-rigid joint or flexible coupling.

G. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps, or other pipe to which the pipe is connected.

H. Hangers and supports for rigid plastic pipe shall be provided with a support shield to spread the load bearing surface.

I. Use of wire hangers, perforated strap, hanging from unreinforced metal deck and cellular roof deck are not permitted.

J. Repair or replace metal items damaged during installation. Follow the manufacturer's procedures for repairing damaged surfaces.

K. Galvanizing Field Repairs

1. Surface preparation shall consist of removing oil, grease, soil, and soluble material by cleaning with water and detergent (SSPC SP1) followed by brush-off blast cleaning (SSPC SP7) over an area extending at least 4 inches into the undamaged

area.

2. The coating shall be applied to at least 3 mils dry film thickness and shall be **Zinc-Clad XI by Sherwin-Williams, Galvax by Alvin Products, Galvite by ZRC Worldwide**, or approved equal.

3.2 SUPPORT LOCATION AND SPACING

A. Supports for horizontal piping shall be spaced to prevent excessive sag, bending and stresses in the piping. Spacing shall not exceed the maximum indicated spans.

B. Maximum spans indicated in the tables below are for ambient temperatures or the temperatures listed for the materials and pipe wall thicknesses shown. Adjust the span spacing for different temperatures and/or pipe wall thicknesses per the manufacturer's recommendations.

C. Install pipe supports on horizontal and vertical runs at the spacing shown or detailed on the Drawings. If no spacing or rod sizes are given on the Drawings or in the specifications for a particular piping system, use the following tables or the recommendations of the support or pipe manufacturer.

1. Support Spacing for Steel Pipe (Section 40 05 13.13 – Steel Process Piping) Schedule 40 and Schedule 80:

Pipe Size (inches)	Maximum Span Water Service (feet)	Maximum Span Vapor Service (feet)	Minimum Hanger Rod Size (inches)
3/8 and smaller	4	5	3/8
1/2 through 1	6	8	3/8
1-1/4 through 2	8	10	3/8
2-1/2 through 3	10	14	1/2
3-1/2 through 4	10	15	5/8
6	12	20	3/4
8	12	24	3/4
Note: These spacings do not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.			

2. Support Spacing for Copper Pipe (Section 33 05 03 – Copper Pipe) per MSS-SP-69, Table 3:

Pipe Size (inches)	Maximum Span Water Service (feet)	Maximum Span Vapor Service (feet)	Minimum Rod Size (inches)
1/2	5	6	3/8
3/4	5	7	3/8
1	6	8	3/8
1-1/4	7	9	3/8
1-1/2	8	10	3/8
2	8	11	3/8
Note: These spacings do not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.			

3. Support Spacing for PVC Pipe (Section 33 05 07.1 – Polyvinyl Chloride Pipe) Schedule 40 and Schedule 80. The table below is meant as a general guideline and it is recommended that the pipe manufacturer be consulted for specific spacing recommendations relating to their pipe, load conditions, operating temperatures, and service conditions.

Pipe Size (inches)	Maximum Span Schedule 40 (feet)				Maximum Span Schedule 80 (feet)			
	60°F	80°F	100°F	120°F	60°F	80°F	100°F	120°F
1	5.5	5	4.5	3	6	5.5	5	3.5
1-1/4	5.5	5.5	5	3	6	6	5.5	3.5
1-1/2	6	5.5	5	3.5	6.5	6	5.5	3.5
2	6	5.5	5	3.5	7	6.5	6	4
2-1/2	7	6.5	6	4	7.5	7.5	6.5	4.5
3	7	7	6	4	8	7.5	7	4.5
4	7.5	7	6.5	4.5	9	8.5	7.5	5
Note: These spacings do not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.								
Data taken from Anvil International, Inc. Catalog PH-2006, page PH-213 and is based on continuous span and for un-insulated line carrying fluids of specific gravity up to 1.00.								

4. Supports for Ductile Iron Pipe (Section 33 05 05 – Ductile Iron Pipe) should be installed in locations shown on the Drawings with a minimum of one support per 20-foot length of pipe. If longer spans are required, the supports should be designed in accordance with DIPRA – Design of Ductile Iron Pipe on Supports and the pipe manufacturer's recommendations. Supports should be cradle type with a saddle angle of 120 degrees. The table below shows the recommended maximum spans per US Pipe – Long Span and Bridge Crossing Pipe guidelines.

Pipe Size (inches)	Maximum Span Water Service (feet)
6	28
8	30
10	30
12	35
Note: These spacings do not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.	

5. Support spacing for other pipe materials shall be based on recommendations from the pipe manufacturer.
6. Provide sway bracing for hangers where shown on the Contract Drawings. If no bracing is shown, provide bracing at 10 foot maximum center-to-center intervals.

- END OF SECTION -

SECTION 05 50 00
MISCELLANEOUS SPECIALTIES

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers materials, fabrication, and installation of miscellaneous metals, specialties, and appurtenances as specified and indicated.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 90 00 Painting and Finishes

1.3 RELATED SPECIFICATIONS

A. Fabrication and erection of the platforms, ladders and stairs shall be in accordance with the Specification for the Design, Fabrication and Creation of Structural Steel for Buildings of the latest edition of the A.I.S.C. Manual, and Section 1910.27 of the latest edition of the OSHA standards, except as specified herein.

1.4 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

1. Manual of Steel Construction

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 36 Standard Specification for Carbon Structural Steel
2. ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A 123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASMT A 153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
5. ASTM A 276 Standard Specification for Stainless Steel Bars and Shapes
6. ASTM A 307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength
7. ASTM A 615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
8. ASTM F 593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
9. ASTM F 594 Standard Specification for Stainless Steel Nuts

D. NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

1.5 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. CONTRACTOR shall submit complete shop drawings of fabricated items, such as vents, ladders, stairs, platforms, beams, pipe supports, and miscellaneous metals for approval to Engineer.

C. Shop drawings shall conform to AISC recommendations and specifications, and shall show holes, and the like, as may be required for other parts of the work.

D. Shop drawings shall include complete details of members and connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams for the sequence of erection.

E. Submit manufacturer's catalog data and dimensional drawings for lifting eyebolts and inserts; ladder safety posts, manhole covers and frames, and anchor bolts.

F. Submit ICC ES Evaluation Reports for adhesive and wedge anchors and installer qualifications and procedures.

1.6 QUALITY ASSURANCE

A. Field Measurements: Take field measurement prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.

B. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units to the extent necessary for shipping limitations.

C. Fabricator Qualifications: Fabricators shall be regularly engaged in the manufacture of the types of steel specialties they are providing and shall have at least 5 years of experience in this specialty.

D. Qualifications: Qualify welding operators in accordance with requirements of current AWS Standard. Provide certification that all welders employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within the previous 12 months. Ensure that all certifications are kept current.

PART 2 MATERIALS

2.1 CARBON STEEL

A. Materials for bolted or welded steel construction shall conform to ASTM A 36.

2.2 STAINLESS STEEL

A. All bolts, expansion bolts, nuts, washers, and expansion sleeve inserts used to attach metal supports shall be stainless steel Type 316.

B. All interior tank ladders, wall conduits, louvers, and other items required shall be stainless steel unless noted otherwise.

2.3 HOT-DIPPED GALVANIZED

A. All vents, stairs, vault ladders, handrail, guardrail, stringers, beams, and miscellaneous items shall be galvanized (zinc coated) unless noted otherwise.

B. Zinc coating for plates, bolts, anchor bolts, and threaded parts shall in in accordance with ASTM A 153. Structural steel shall be zinc coated in accordance with ASTM A 123.

2.4 BOLTS

A. Steel anchor and connection bolts for non-corrosive service shall conform to ASTM A 307, Grade A or B, unless otherwise noted. Bolts shall be hot-dip galvanized and provided with self-locking nuts or lock washers and plain nuts.

B. Steel anchor and connection bolts for corrosive service shall be fabricated from stainless steel, unless indicated otherwise in the specifications or on the Contract Drawings. Corrosive service locations are as listed below.

1. Buried locations
2. Submerged locations
3. Locations subject to occasional flooding
4. Inside hydraulic structures
5. Chemical handling areas
6. Inside buried manholes, vaults, and structures that do not have a gravity drain or sump pump
7. Inside trenches, containment walls, and curbed areas.

C. The nuts shall be capable of developing the full strength of the bolts. Bolts and cap screws shall have hexagon heads and nuts shall be heavy hexagon series. Bolts and nuts shall be installed with washers from material matching the base material of bolts. Lock washers fabricated from the material matching the bolts shall be installed where indicated.

D. The length of the bolts shall be such that the bolt extends at least 1/8 inch beyond the outside face of the nut before tightening, except for anchor bolts which shall be flush with the face of the nut before tightening.

2.5 LIFTING EYEBOLTS

A. Locate eyebolts and inserts over the centerline of the piping at locations shown on the Contract Drawings. Eyebolts and inserts shall have a minimum safety factor of 3 and be rated for a working load of 3,000 pounds.

B. Provide inserts of the ferrule wing nut design with threads to match the eyebolts. Cast inserts in the roof slab of the vault at the locations identified on the Contract Drawings.

2.6 THREADED INSERTS

A. Threaded inserts shall be of ductile iron construction with standard National Course (NC) or United National Course (UNC) threads. Inserts shall be cast-in-place at the locations shown on the Contract Drawings. Inserts shall be fabricated by **Meadow Burke**, or approved equal.

2.7 ADHESIVE ANCHORS

A. Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors. No substitutions will be considered without an ICC ES Report verifying strength and material equivalency. Anchors used inside potable water reservoirs shall be ANSI/NSF 61 certified.

B. Adhesive anchors shall be a two-component system consisting of an all threaded anchor rod with nut and washer, and the adhesive capsule. Anchor rods shall be Type 304 stainless steel conforming to ASTM F 593 with nuts conforming to ASTM F 594. The adhesive capsules shall contain a polyvinyl or urethane methacrylate-based resin and accelerator within a sealed dual chamber foil capsule. Adhesive anchors shall be **Hilti HVA Capsule Adhesive Anchoring System**, or approved equal.

2.8 WEDGE ANCHORS

A. Wedge type anchors shall be used only where indicated on the Contract Drawings. Wedge anchors shall be a stud type expansion anchor, torque controlled, with impact section to prevent thread damage. Stud and wedge shall be Type 304 or Type 316 stainless steel conforming to ASTM A 276. Nut shall be Type 304 or Type 316 stainless steel conforming to ASTM F 594 with washer of similar material. Wedge anchor bolts shall be **Hilti Kwik Bolt 3,** or approved equal. Anchors installed in non-submerged or non-corrosive environments may be carbon steel and be **Simpson Strong-Tie Strong Bolt**, or approved equal.

2.9 STEEL PIPE

A. Pipe for guard posts shall be Schedule 40 and pipe for vault vents shall be Schedule 10 conforming to ASTM A 53, unless noted otherwise on the Contract Drawings, and shall be hot-dip galvanized.

2.10 LADDERS

A. Ladders which may be partially or fully submerged or located inside a manhole or vault without a gravity drain or sump pump shall be fabricated entirely of Type 304 stainless steel. All ladder hardware and supports shall be Type 304 stainless steel. Ladders and hardware fully submerged or located inside a manholes or vault for wastewater facilities shall be Type 316 stainless steel.

B. Other ladders shall be fabricated from carbon steel and hot-dip galvanized after fabrication unless noted otherwise on the Contract Drawings. All ladder hardware and supports shall be the same material as the ladder.

C. All ladders without a permanently mounted exterior ladder extension shall be provided with a telescoping safety post. The post shall be fabricated of steel with telescoping tubular section that locks automatically when fully extended. The upward and downward movement shall be controlled by a stainless steel spring balancing mechanism. The telescoping safety post shall be fabricated from the same material and finish as the ladder. The telescoping posts shall be **LadderUP Safety Post by Bilco**, or approved equal.

2.11 VAULT VENTS

A. Fabricate vault vents as shown on the Contract Drawings. Vault vents shall be welded steel construction and hot-dip galvanized after fabrication. Coating shall be in accordance with Section 09 90 00 – Painting and Finishes.

2.12 GRATING

A. Grating shall be supported around all sides of an opening with support members. Unless otherwise indicated, grating supported on concrete shall have embedded angles that match the grating material. Grating shall be serrated bar grating, unless noted otherwise on the Contract Drawings.

B. The grating shall be completely banded at edges and cutouts and the banding shall be welded to each cut bearing bar. The banding material and cross-section shall be the same as the bearing bars.

C. Grating pieces shall be fastened to each support at a minimum of 2 locations.

D. Grating deflection shall not exceed 1/4 inch or the span divided by 180, whichever is less.

E. For standard duty grating, the loading to be used for determining stresses and deflections shall be the uniform load of the adjacent floor or 100 psf, whichever is greater, or a concentrated load of 1,000 pounds. For heavy duty grating the loading used shall be in accordance with AASHTO HS-20.

F. Standard duty grating shall be fabricated from steel and hot-dip galvanized, unless noted otherwise. Standard duty grating that will be submerged, partially submerged, or in a corrosive environment shall be fabricated entirely of Type 316 stainless steel. No single piece of standard duty grating shall weigh more than 80 pounds, unless noted otherwise on the Contract Drawings. All crossbars shall be welded into position.

G. Heavy duty grating shall be fabricated from welded steel and hot-dip galvanized after fabrication. All crossbars shall be welded into position.

H. Bar dimensions shall be 1-1/4 inch by 3/16 inch, minimum and shall be manufactured by **McNICHOLS**, **AMICO**, **Robertsons Grating Products**, or approved equal.

2.13 STEEL PIPE HANDRAIL AND GUARDRAILS

A. Railings shall conform to the Building Code and OSHA requirements.

B. Handrails, brackets and related hardware shall be steel pipe and hot-dip galvanized after fabrication. Handrails, brackets, and related hardware that shall be submerged, partially submerged, or in a corrosive environment shall be fabricated from Type 316 stainless steel.

PART 3 EXECUTION

3.1 GENERAL

A. Except as otherwise shown, the design, fabrication, and erection of structural steel shall

conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction".

B. Install miscellaneous specialties as indicated on the Contract Drawings or as recommended by the manufacturer.

C. Store materials above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

D. Clean surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign matter before placing concrete.

E. Set embedded metalwork accurately in position and support it rigidly before concrete is placed and prevent displacement during and after placement of concrete.

F. Repair or replace metal items damaged during installation. Follow the manufacturer's procedures for repairing damaged surfaces.

G. Welding shall be performed by metal-arc method or shielded metal arc method as per the American Welding Society's (AWS) "Welding Handbook". During welding component parts shall be adequately clamped or supported. Avoid irregular surface, non-uniform bead pattern, and high crown. Upon completion of welding, remove weld splatter, flux, slag, and burrs. Accomplish repair, chipping, and grinding of welds in a manner that will not gouge, groove, or reduce the base metal thickness.

H. Adhesive Anchors. Do not install anchors until the concrete has reached the required 28-day compressive strength. Drill hole in concrete by means of a percussion hammer drill. Hole shall be roughened with a brush on a power drill and then cleaned and dried. Install anchor in accordance with the manufacturer's instructions. Do not load the anchor until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

I. Wedge Anchors. Do not install anchors until the concrete has reached the required 28-day compressive strength. Drill hole in concrete by means of a percussion hammer drill. Hole shall be roughened with a brush on a power drill and then cleaned and dried. Install anchor in accordance with the manufacturer's instructions.

J. Galvanizing Field Repairs:

1. Surface preparation shall consist of removing oil, grease, soil, and soluble material by cleaning with water and detergent (SSPC SP1) followed by brush-off blast cleaning (SSPC SP7) over an area extending at least 4 inches into the undamaged area.
2. The coating shall be applied to at least 3 mils dry film thickness and shall be **Zinc-Clad XI by Sherwin-Williams, Galvax by Alvin Products, Galvite by ZRC Worldwide**, or approved equal.

- END OF SECTION -

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers the rough carpentry work which includes wood framing, plates, joists, rafters, purlins, wood trusses, blocking, furring, backing, nailers, plywood sheathing, siding, and similar elements, material, and accessories, complete and in place according to the contract documents.

1.2 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN PLYWOOD ASSOCIATION (APA)

1. APA AFG-01 Adhesives for Field-Gluing Plywood to Wood Framing
2. APA Form E30 Design/Construction Guide, Residential and Commercial

C. AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

1. AWPA M4 Standard for the Care of Preservative-Treated Wood Products

D. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 psi Tensile Strength
2. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
3. ASTM D 3498 Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
4. ASTM F 1667 Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

E. AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

1. AWPA U1-13 Use Category System: User Specification for Treated Wood

F. NATIONAL FOREST PRODUCTS ASSOCIATION (NFOPA)

1. NFOPA-01 National Design Specification for Wood Construction
2. NFOPA-02 Manual for Wood Frame Construction

G. TRUSS PLATE INSTITUTE (TPI)

1. TPI TPI-85 Design Specification for Metal Plate Connected Wood Trusses
2. TPI QST 88 Quality Standard for Metal Plate Connected Wood Trusses Addendum to TPI-85

H. WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

1. WWPA-01 Western Lumber Grading Rules

1.3 RELATED WORK

A. Related Work in other Sections includes but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Manufacturer’s catalogs showing rough hardware conforming to or equivalent to hardware indicated on the Contract Drawings.

C. Structural and Miscellaneous Wood Members: Design analysis and calculations of fabricated wood trusses shall show design criteria used to accomplish the applicable analysis. Calculations and drawings shall be stamped by a Professional Engineer licensed in the State of Utah.

D. Shop Drawings: Drawings of fabricated wood trusses shall indicate materials and shop and field erection details including methods of fastening.

E. Manufacturer's Certificates: Manufacturer's certificates attesting that lumber and material not normally grade marked or exempt from being grade marked meets the specified requirements.

1.5 DELIVERY AND STORAGE

A. Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.

1.6 QUALITY ASSURANCE

A. Materials and assembly shall be inspected to determine compliance with the Building Code.

B. At completion of fabrication of the trusses, the fabricator shall submit a certificate of compliance to ENGINEER stating that the work was performed in accordance with the contract documents.

PART 2 PRODUCTS

2.1 LUMBER AND SHEATHING

A. Grading and Marking: Materials shall bear the grade mark, stamp, or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included

in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade species used. Except for plywood and lumber; bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

B. Sizes: Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

C. Trussed Rafters: Rafters shall be a prefabricated design. Connections shall be made with light-metal plate-connectors. Light-metal-plate-connected wood trusses shall be designed in conformance with TPI TPI-85 and fabricated in conformance with TPI QST-88.

D. Plywood: Plywood shall be APA performance rated, Grade C-D with exterior glue. Sheathing for roof without corner bracing of framing shall have a span rating of 16/0 or greater for supports 16 inches on center and a span rating of 24/0 or greater for supports 24 inches on center.

E. Wood: Provide dressed lumber, S4S, unless otherwise indicated. Provide seasoned lumber with 19 percent maximum moisture. For structural framing use No. 2 grade Douglas-fir or Larch or any species or grade meeting the following requirements:

1. Fb: 900 psi
2. E: 1,600,000 psi

2.2 TRUSSES

A. Marking: Each truss shall be marked or have permanently affixed thereto the following information near the center of the span on the bottom chord: truss manufacturer’s name and address, design load, and spacing of the trusses.

B. Connector plates shall be designed by the truss manufacturer in accordance with TPI Standards. Structural plates shall be structural quality steel and hot-dip galvanized according to ASTM A 653. Connector plates shall be provided on both sides of the truss, i.e., 2 plates per joint.

2.3 PRESERVATIVE TREATMENT

A. The treatment of lumber, timber, and plywood shall meet the requirements of AWPA UC3B for above ground use only. All products shall bear the appropriate AWPB Quality Mark. The wood shall then be dried to the moisture content specified and marked with the word "Dry." Surfaces of lumber that will be exposed shall not be incised. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Wood preservative shall be **Wolman AG by Arch Treatment Technologies, Preserve CA by Viance**, or approved equal. Unless otherwise specified the following items will always be treated:

1. All wood members used in built-up roofing systems.
2. All wood members set into concrete regardless of location, including flush-with-deck wood nailers for roofs.
3. All wood members used for rough framing of openings in exterior concrete or masonry walls.
4. Nailing strips or nailers used in conjunction with roof systems.

2.4 ACCESSORIES AND NAILS

A. Anchor Bolts shall conform to ASTM A 307, size as indicated, complete with nuts and washers.

B. Expansion Shields shall be the Type and size best suited for intended use.

C. Joist Hangers and Truss Clips shall be steel or iron, zinc-coated, size to fit members where used, sufficient strength to develop the full strength of supported member, complete with any special nails or bolts required. Framing devices shall be manufacturer by **Simpson Strong-Tie Company, Inc., USP Structural Connectors**, or approved equal.

D. Nails and Staples shall be of the size and type best suited for purpose and shall conform to the requirements of ASTM F 1667. For sheathing, length of nails shall be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1-inch thick lumber and for toe nailing 2-inch thick lumber; 16-penny or larger nails shall be used for nailing through 2-inch thick lumber. Nails used with treated lumber and sheathing shall be galvanized.

PART 3 EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS

A. General: Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Nailing shall be in accordance with the recommended Nailing Schedule as contained in NFOPA-02. Where detailed nailing requirements are not specified, nail size and nail spacing shall be sufficient to develop an adequate strength for the connection without splitting the members. Installation of timber connections shall conform to applicable requirements of NFOPA-01. Members shall be framed for passage of ducts and pipes shall be cut, notched, or bored in accordance with applicable requirements of NFOPA-02. Rafters, purlins, and joists shall be set with crown edge up. Leveling of joists, beams, and girders on masonry or concrete shall be with slate or steel; on wood or metal leveling shall be without shims.

B. Cutting and Notching: Wood members shall not be cut, notched, or bored more than 1/4 of their depth without adequate and approved reinforcing.

C. Sill Plates: Sill plates shall be set level and square and anchor bolted at not more than 2 feet 8 inches on centers and not more than 12 inches from end of each piece. A minimum of two anchors shall be used for each piece. Sill plates and other wood resting on or embedded in concrete or masonry shall be pressure treated.

D. Wall Framing: Wall studs shall be installed at a spacing of 16-inches on center unless otherwise indicated on the Drawings. A single plate shall be provided at the bottom and a double plate at the top of wall framing unless noted otherwise. Joints in the top plates shall be staggered not less than 4 feet.

E. Roof Framing or Rafters: Tops of supports or rafters shall form a true plane. Valley, ridge, and hip members shall be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters. Valleys, hips, and ridges shall be straight and true intersections of roof planes. Necessary crickets and watersheds shall be formed. Rafters, except hip and valley rafters, shall be spiked to wall plate and to ceiling joists with no less than three 8-penny nails. Rafters shall be toe-nailed to ridge; valley, or hip members with at least three 8-penny nails. Rafters shall be braced to prevent movement until permanent bracing, decking or sheathing is installed. Hip and valley rafters shall be secured to wall plates by clip angles. Openings in roof shall be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter shall be double. Hip rafters longer than the available lumber shall be butt jointed and scabbed. Valley rafters longer than the available lumber shall be double, with pieces lapped not less than 4 feet and well spiked together. Trussed rafters shall be installed in accordance with TPI TPI-85.

F. Blocking and Backing: Blocking and backing shall be nominal 2-inch thick material and shall be provided as necessary to meet the latest codes for lateral bracing and for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide fire stopping. Blocking and backing shall be cut to fit between framing members and rigidly nailed thereto.

3.2 INSTALLATION OF SHEATHING

A. Plywood: Sheathing shall be applied in accordance with APA standards and with edges 1/8 inch apart at side and end joints, and nailed at supported edges at 6 inches on center and at intermediate supports 12 inches on center. Nailing of edges shall be 3/8 inch from the edges. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered. Roof sheathing shall be applied with long dimension at right angles to supports, end joints made over supports, and end joints staggered.

3.3 INSTALLATION OF ROOF TRUSSES

A. CONTRACTOR shall be responsible for field erection of the trusses, including proper handling, safety precautions, temporary bracing to prevent toppling, and other safeguards which are consistent with good workmanship and building erection practices.

B. CONTRACTOR shall comply with all applicable requirements and recommendations of TPI.

C. CONTRACTOR shall not field repair, cut or otherwise alter trusses without consulting the truss manufacturer.

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SECTION 06 20 23
INTERIOR FINISH CARPENTRY

PART 1 GENERAL

1.1 DESCRIPTION

A. Work of this Section, as shown or specified, shall be provided by the Interior Contractor and shall be in accordance with the requirements of the Contract Documents.

B. This Section covers the finish carpentry work which includes coordination, fabrication, and installation of all interior exposed wood members shown on Contract Drawings and specified herein, including but not limited to the following:

1. Lumber
2. Standing and Running Trim
3. Moldings
4. Plywood
5. Miscellaneous Items

1.2 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN HARDWOOD ASSOCIATION (AHA)

1. AHA A 135 Hardboard Plywood

C. AMERICAN WOODWORK INSTITUTE (AWI)

1. AWI 0620 Finish Carpentry/Installation

D. AMERICAN PLYWOOD ASSOCIATION (APA)

1. APA AFG-01 Adhesives for Field-Gluing Plywood to Wood Framing

E. AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

1. AWPA M4 Standard for the Care of Preservative-Treated Wood Products
2. AWPA U1-13 Use Category System: User Specification for Treated Wood

F. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

G. HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)

1. HPVA HP-1 American National Standard for Hardwood and Decorative Plywood

H. NATIONAL FOREST PRODUCTS ASSOCIATION (NFOPA)

1. NFOPA-01 National Design Specification for Wood Construction
2. NFOPA-02 Manual for Wood Frame Construction

I. NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

1. NHLA Rules Rules for the Measurement and Inspection of Hardwood and Cypress

J. WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

1. WWPA-01 Western Lumber Grading Rules

1.3 RELATED WORK

A. Related Work in other sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 90 00 Painting and Finishes

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit the following items of finish carpentry:

1. Shop Drawings, indicating fabrication and installation methods, to include plans and elevations and details. Indicate required anchorage and blocking, accessory items, field dimensions, materials and finishes. Indicate compliance with specification requirements. Indicate weight of any materials or systems to be suspended or which require support from structure.
2. Manufacturer's Product Data for all specialty items not manufactured by the Finish Carpentry Fabricator.
3. Two samples of each species and finish of wood specified. Samples shall be minimum 12-inch by 12-inch finished as specified on one face, one edge, and one end. Samples shall be fire retardant treated wood where such has been specified or required by codes. Review will be for color and texture only; compliance with other requirements is the responsibility of Interior Contractor. Samples of finishes shall be applied on the appropriate wood or base material as will occur in the final Finish Carpentry item when installed.
4. Product data for each type of process, factory and non-factory fabricated product. Indicate component materials, dimensions, profiles, textures, colors and include construction and application details.
5. Where variations in wood and finish may occur, a minimum of three variations showing the extremes which may be expected of any and all wood and finishes as specified shall be submitted to ENGINEER for approval. Minimum size: 12-inch by 20-inch.

6. Where required by OWNER or ENGINEER, the Interior Contractor shall provide full size mockup of panel or woodwork assembly.
7. Interior Contractor shall submit to ENGINEER three samples 20-inch minimum length of all moldings or molding assemblies to be used for the Project. These shall be full size and finished as specified in the Contract Documents.

1.5 DELIVERY AND STORAGE

A. Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.

B. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

C. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

D. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.6 QUALITY ASSURANCE

A. Comply with applicable provisions for Premium Grade as defined in the latest edition of the AWI Quality Standards for all materials, fabrication and workmanship for all work of this Section.

B. All Work of this Section shall be performed by skilled mechanics of the trade and shall be of the highest quality. Comply with applicable Industry Standards for all Work and materials as specified.

C. The Interior Contractor shall be responsible for obtaining and complying with all code and regulatory agency requirements for materials and methods.

D. The Interior Contractor shall be responsible for accurately obtaining all field dimensions related to his/her work prior to fabrication. Where discrepancies are found, he/she shall notify ENGINEER immediately in writing.

E. Protect sanded and finished surfaces from soiling and damage during handling and installation.

F. Provide temporary protection of all Finish Carpentry as required to protect Work from damage.

PART 2 PRODUCTS

2.1 MATERIALS

A. All woodwork materials shall be new and shall conform to the Premium Grade requirements of the AWI Quality Standards, latest edition.

B. All lumber shall be kiln-dried to the average moisture content as recommended by the AWI Quality Standards latest edition appropriate for the climatic conditions of the Site.

C. All solid wood elements shall be clear, straight-grain lumber of the best grade of specified species as listed by the NHLA. Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish. Solid wood elements shall also be according to the following, unless indicated otherwise on Contract Drawings and/or Specifications:

1. Specie of Face Woods receiving transparent finishes shall be as specified on the Contract Drawings and shall be selected for specified grain with uniform color and grain suitable for use with the finished plywood with which it is used.
2. Face Woods receiving opaque finishes shall be Birch, Poplar or custom grade but otherwise shall have same specification as solid stock for Face Woods above.
3. Unexposed woods shall be Custom grade Poplar, kiln dried.

D. All veneer core elements shall be clear straight-grain lumber of the best grade of the specified species as listed by the NHLA Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish. Where veneer differs on two sides, veneers shall be of similar thickness, density, and characteristics to prevent any warpage. Veneer core elements shall also be according to the following, unless indicated on Contract Drawings or Specifications:

1. Adhesives shall be water-resistant resin or approved equal; process shall be hot plate method using the following number of plys to achieve specified thickness:
   a. 1/4-inch overall thickness shall be of 3- ply veneer core construction.
   b. 3/8-inch overall thickness shall be of 5- ply veneer core construction.
   c. 1/2-inch overall thickness shall be of 5- ply veneer core construction.
   d. 3/4-inch overall thickness shall be of 7- ply veneer core construction.
   e. 1-inch overall thickness shall be of 9-ply veneer core construction.
2. Provide Douglas Fir or Poplar V-type solid edge trim on all exposed edges of plywood not designated to be surfaced by plastic laminate.
3. For Face Woods receiving transparent finishes, Species shall be as specified on drawings; faces shall be selected and matched by the Interior Contractor with respect to cutting lengths, uniformity of color, figure, and grain character. Face veneers shall not contain open joints, face depressions, glue stain or other manufacturing irregularities.
4. Face Woods receiving opaque finishes shall have custom grade (face veneer) Birch or Poplar select, but otherwise shall have same specification as Plywood for Face Woods (Paragraph 2.1.D.1).
5. Unexposed woods shall be Birch, Poplar or Douglas Fir, rotary cut, Unselect, good one side, interior type plywood, one side Grade A and one side Grade B; Grade A faces shall not contain plugs, knots, pitch pockets, splits, rough grain or other open defects.

E. All Finish Carpentry shall be finished as indicated on Contract Drawings and Specifications. Transparent and Opaque Finishes shall match approved samples submitted according to Section 01 33 00 and Paragraph 1.4 above.

2.2 SOFTWOOD PLYWOOD

A. Each sheet of plywood must bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.

B. The mark must identify the plywood by species group or identification index, and show glue type, grade, and compliance with PS1.

2.3 HARDWOOD PLYWOOD

A. Comply with AHA A 135.

B. Each sheet of hardwood plywood must bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark must identify the plywood by species group or identification index, and show glue type, grade, and compliance with HP-1.

C. Hardwood plywood type to meet minimum standards and must comply with specifications.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. All required hardware and accessories shall be furnished and installed by Interior Contractor and shall be as indicated on Contract Drawings and Specifications. Where specific products are not specified in the Contract Documents, the Interior Contractor shall recommend hardware to provide the function or condition indicated in the Contract Documents. Hinges, screws, clips and other mounting, attachments or fasteners to be concealed unless otherwise noted on Contract Drawings.

C. Interior Contractor shall submit samples of each hardware item/type and accessory item/type to ENGINEER for approval according to Paragraph 1.4 above and Section 01 33 00.

D. All Finish Carpentry hardware and accessories shall be installed in accordance with manufacturer's recommendations.

2.5 OTHER MATERIALS

A. Interior Contractor shall be responsible for providing and installing all items and materials as indicated on Contract Drawings and Specifications comprising all or part of the Finish Carpentry shown. Such items and materials shall be fabricated and/or installed according to manufacturer's recommendations and comply with applicable AWI Quality Standards and Industry Standards.

B. All paint and other finish material shall be pure, unadulterated and best quality from specified manufacturer as indicated on the Contract Drawings and Specifications. (See Section 09 90 00 – Painting and Finishes).

C. All finish materials shall be flame retardant or treated with flame-retardant process where required by local code. Should flame-retardant process cause change in color and effect on finish material, Interior Contractor shall notify ENGINEER.

D. All finishes and processes shall be in compliance with code requirements for the location of installation.

E. All transparent finishes shall be alcohol, water and burn resistant.

PART 3 EXECUTION

3.1 EXAMINATION OF CONDITIONS

A. The Interior Contractor shall be responsible for examination of the substrate and the conditions under which the Work under this section is to be performed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work under this section until unsatisfactory conditions have been corrected.

B. Verify surfaces and substrates are prepared to receive products of this section.

C. If substrate preparation is the responsibility of another installer, notify ENGINEER of unsatisfactory preparation before proceeding Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.

D. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the Project conditions.

B. Clean surfaces thoroughly prior to installation.

C. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.3 FABRICATION

A. All Work shall be performed in such manner as to fulfill the intent of the Contract Drawings and Specifications.

B. All items to be mill fabricated per AWI Premium Grade specifications and according to the sizes and designs indicated on the Contract Drawings and Specifications, and assembled in single and complete units insofar as the dimensions thereof will permit shipment to and installation at the building. Large pieces requiring sectional construction shall have their

several parts accurately fitted and aligned with each other and be provided with ample screws, glue and bolt blocks, tongues, grooves and splines, dowels, mortises and tenons, screws, bolts, or suitable means of concealed fastening, as required to render the Work substantial, rigid and permanently secured in proper position to each related section.

C. Where necessary to fit at site provide ample allowance for cutting and fitting. Sufficient additional material shall be allowed to permit accurate scribing to walls, floors and related work; and due allowance made wherever possible for such shrinkage as may develop after installation. All single and sectional units shall be provided with adequate cleating, blocking, crating and other forms of protection as required to preclude damages thereto during shipping and handling and installation.

D. Framing and blocking members shall be assembled with bolted and screwed connections, and shall be secured to the structural backings with expansion screws, or toggle bolts, as required, spaced and installed so as to insure ample strength and rigidity. Rails and stiles shall be mortised and tenoned, work neatly mitered and membered, all butt joints made flush and smooth, and all permanent joints made up with water-resistant glue. All fixtures shall be assembled without face screws or nails, except where it may be necessary to attach trim items. All exposed face screws or nails which are necessary to attach trim items shall be countersunk and plastic wood or wood plugs used to cover heads, and the plug neatly touched up to match finish. The heads of all screws used in any assembly shall be countersunk below the surface.

E. All items where paint is required shall be shop spray finished, except where impractical or otherwise specified.

F. Backsides of all Finish Carpentry concealed by the building shall be given a prime coat of paint, color to closely approximate the value and hue of the face finish.

3.4 INSTALLATION

A. Installation at the Project shall be by skilled mechanics supervised by the Interior Contractor in accordance with accepted standards.

B. Install in accordance with the manufacturer’s recommendations and the approved shop drawings and in proper relationship with adjacent construction.

C. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

D. Install all Finish Carpentry straight, plumb, level and in true alignment except where otherwise indicated. Fit all joints closely and fasten all pieces rigidly in place. Nails shall be finish or casing nails. Countersink nail heads and leave ready for putty. Joints shall be neatly matched and mitered. Fill exposed joints prior to jointing.

1. Finished size shall be as indicated on the Contract Drawings.
2. Surfaces shall be left free from hammer marks, free from warp, twist, open joints or other defects and shall be cleaned, scraped and sanded ready for finishing.
3. Lengths of all running trim shall be as long as practical.
4. Shim as required using concealed shims.

E. Cut Finish Carpentry to fit unless specified to be shop fabricated or shop-cut to exact size. Where Finish Carpentry abuts other finished work, scribe and cut for accurate fit. Before making cutouts, drill pilot holes at corners.

F. Distribute defects allowed in the quality grade specified to the best overall advantage, when installing job assembled items.

G. Attach Finish Carpentry securely in place with uniform joints providing for thermal and building movements. Attach to substrates by anchoring and fastening as shown, as required by recognized standards, and as follows:

1. Nailing: Blind nail where possible. Use fine finishing nails where exposed. Set exposed nail heads for filling except for exterior wood which is to receive a natural finish (if any).
2. Anchoring: Secure Finish Carpentry to anchors or blocking built-in or directly attached to substrates.

H. For standing and running trim, install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.

1. Install trim after gypsum board joint finishing operations are completed.
2. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement tor warping. Countersink fastener heads on exposed carpentry work and fill holes.
3. Cope moldings at returns, miter interior angles and corners.

I. Where finishes are applied at job site, clean items and fill nail holes in preparation for finishes application. Where work is to receive a transparent finish, use matching wood filler.

J. Fit Finish Carpentry to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper support.

K. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.

3.5 CLEANING AND PROTECTION

A. Clean shop finished work, touch-up finish as required and remove and refinish damaged or soiled areas of finish.

B. Protect installed Finish Carpentry from damage by Work of other trades until OWNER's acceptance of the Work. Subcontractor to advise Interior Contractor of procedures and precautions for protection of materials and installed work from damage and of the required temperature/humidity conditions which must be maintained during the remainder of the construction period in areas of Finish Carpentry installations.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

D. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

- END OF SECTION –

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SECTION 07 11 00
MOISTURE PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. This Section provides specifications for all waterproofing and damp proofing of the buried or below grade concrete surfaces, including moisture proof underlays for concrete slabs.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.3 QUALITY ASSURANCE

A. Performance and Design Requirements. Prior to application of waterproofing, CONTRACTOR shall cause a representative of the manufacturer of the materials to inspect and certify that the surfaces to be waterproofed are in a condition suitable for application of the waterproofing. Following application of the waterproofing, CONTRACTOR shall cause a representative of the manufacturer of the materials to inspect and certify that the materials were applied in complete accordance with the manufacturer's current recommendations.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D 450 Standard Specification for Coal-Tar Pitch Use in Roofing, Dampproofing, and Waterproofing
2. ASTM D 882 Test Method for Tensile Properties of Thin Plastic Sheeting
3. ASTM D 1668 Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing.
4. ASTM E 1643 Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slab
5. ASTM F 1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

C. PRESSURE SENSITIVE TAPE COUNCIL (PSTC)

1. PSTC 101 International Standard for Peel Adhesion of Pressure-Sensitive Tape

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer product data, cut sheets, and recommended installation instructions.

C. Prior to acceptance of the work, CONTRACTOR shall deliver to ENGINEER two copies of the specified certifications for material application.

PART 2 PRODUCTS

2.1 WATERPROOF COATING

A. Waterproof coating shall be coal tar epoxy resin. Acceptable products are **Bitumastic 300M by Carboline, Targuard Low VOC Coal Tar Epoxy by Sherwin Williamns, PorterTuf 2000 HB Coal Tar Epoxy by Porter Coating, Series 46H-413 HB Tneme-Tar by Tnemec, Amercoat 78HB by PPG Protective & Marine Coatings**, or approved equal.

2.2 MOISTUREPROOF COATING

A. Moistureproof coating shall be coal tar solution. Acceptable products are **Bitumastic 50 by Carboline, Corothane I Coal Tar by Sherwin Williams, Series 46-465 HB Tnemecol by Tnemec, HE107 by Henry**, or approved equal.

2.3 WATERPROOF MEMBRANE

A. Water-roof Pitch: Waterproof pitch shall be coal tar pitch.

B. Membrane Fabric: Membrane fabric shall be coal tar pitch coated open mesh fabric per paragraph 1.2 B.

C. Reglets: Reglets for anchoring membrane shall be fabricated of 16-ounce copper.

D. Protective Board: Protective board shall be 2-inch Celotex insulation board treated to prevent decay.

2.4 MOISTUREPROOF UNDERLAY

A. Plastic Membrane. Plastic membrane for moisture proof underlay shall be an ASTM E 1745 Class A membrane manufactured from virgin polyolefin resins having a minimum film thickness of 10 mils. Plastic membrane shall meet the following specifications:

1. Water Vapor Permeance: 0.05 perms maximum (perm unit = grains/(ft2*hr*in-Hg)) in accordance with ASTM F 1249.
2. Tensile Strength: 50 lbf/in (minimum) per ASTM D 882.

B. Acceptable membranes are **Stego Wrap Class A by Stego Industries, Perminator by W. R. Meadows, Vapor Barrier Blue VB10 by Americover**, or approved equal.

C. Pressure Sensitive Tape. Pressure sensitive tape shall be minimum 3-inch wide, 6 mil pressure sensitive polyethylene tape with acrylic, pressure-sensitive adhesive. Manufacturers shall be **Stego Tape by Stego Industries, Perminator Tape by W.R. Meadows, VTW Vapor Tape by Americover**, or approved equal.

PART 3 EXECUTION

3.1 WATERPROOF COATING

A. Location. Waterproof coating shall be applied to the water side of walls and bottoms of channels or tanks which are common with areas to be occupied by equipment, piping or personnel. Waterproof coating shall not be applied to those surfaces to receive liquid waterproofing.

B. Surface Preparation. New concrete to be waterproofed shall have aged at least 60 days and shall have a moisture content of less than 14%. Concrete surface shall be brush treated with a 10% muriatic acid solution and thoroughly flushed with water after 10 minutes.

C. Walls of existing channels and tanks shall be steam cleaned prior to application of waterproofing material.

D. Application. Prime coat shall be thinned and applied at the rate of approximately 200-300 square feet per gallon depending on surface condition. Finish coats shall be applied at the rate of 100 square feet per gallon. Final coat shall be black. Total dry film thickness shall be minimum 20 mils. Drying time between coats shall be as recommended by the paint manufacturer.

E. Application Procedures. Following the manufacturer’s application instructions and these application procedures for waterproofing products as listed in paragraph 2.1 are as follows:

1. Prime coat shall consist of one coat of coal tar epoxy resin coating, black. Finish coats shall consist of two coats of coal tar epoxy resin coating, alternating red and black colors.

3.2 MOISTURE PROOF COATING

A. Location. Moisture proof coating shall be applied to below grade, earth side of outside concrete walls which are common with areas to be occupied by equipment, piping, or personnel. Moisture proof coating is not required for walls to be provided with waterproof membrane or for walls which are poured directly against an excavated surface.

B. Surface Preparation. Preparation of concrete and masonry walls shall conform to manufacturer's recommendations.

C. Application. Prime and finish coats shall be applied at the rate of 70 square feet per gallon. The number of finish coats shall be sufficient to produce a dry film thickness of at least 13 mils. Drying time between coats shall be as recommended by the paint manufacturer.

3.3 WATERPROOF MEMBRANE

A. Location. Waterproof membrane shall be applied to exterior surfaces as designated on the drawings.

B. Surface Preparation. Concrete surfaces to receive waterproof membrane shall be clean, dry and shall have at least a Class II form finish.

3.4 MOISTUREPROOF UNDERLAY

A. Install moisture proof underlay in accordance with the manufacturer's written installation instructions.

B. Location. Unless otherwise noted, moisture proof underlay shall be provided under all concrete floors or floating slabs-on-grade deposited on gravel base or sand. Moisture proof underlay shall be provided under all concrete floors or floating slabs-on-grade with pressure relief valves and gravel base.

C. Surface Preparation. Backfilled surfaces to receive moisture proof underlay shall be leveled off and smoothed over to minimize contact with sharp edges. Joints shall be sealed by means of pressure sensitive tape. Where pipes and conduits pass through the plastic membrane, they shall be wrapped tightly with separate sheets of membrane which shall then be sealed with tape to the main membrane. Reinforcing steel or mesh shall be supported by small precast placing chairs designed with flat bases to protect the membrane. CONTRACTOR shall exercise care to maintain the integrity of the membrane at all times.

- END OF SECTION –

SECTION 07 21 00
INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the work required to provide and install insulation in buildings and structures, complete and in place.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 04 22 00 Reinforced Unit Masonry

1.3 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM C 272 Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions
2. ASTM C 518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
3. ASTM C 547 Standard Specification for Mineral Fiber Pipe Insulation
4. ASTM C 549 Standard Specification for Perlite Loose Fill Insulation
5. ASTM C 553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
6. ASTM C 578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
7. ASTM C 592 Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
8. ASTM C 612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation
9. ASTM C 665 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
10. ASTM C 1029 Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation
11. ASTM D 1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics
12. ASTM D 1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics
13. ASTM D 2842 Standard Test Method for Water Absorption of Rigid Cellular Plastics
14. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

15. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials

C. UNDERWRITERS LABORATORIES (UL)

1. UL1256 Fire Test of Rook Deck Constructions

D. FACTORY MUTUAL (FM)

1. Approval Standard for Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings and Exterior Wall Systems

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer’s literature, installation instructions, product test reports and technical data.

C. Submit manufacturer’s certification that the proposed materials comply with this Section.

D. For foam-in-place insulation, submit a copy of the foam insulation contractor’s certification and ICC-ES report and manufacturer’s documentation confirming material conforms to ASTM C 1029.

1.5 DELIVERY AND STORAGE

A. Materials shall not be allowed to become wet, soiled, or covered with ice and snow. The manufacturer’s recommendations for handling storage and protection shall be strictly followed. If required, during cold weather, store in heated storage areas following the manufacturer’s guidelines for minimum and maximum temperatures. Material shall not be exposed to sunlight and shall be protected against ignition. Materials shall be concealed as quickly as possible after completion of work.

PART 2 PRODUCTS

2.1 INSULATION

A. Thermal resistance of insulation shall be not less than the R-values shown on the Contract Drawings. R-values shall be determined at 75 degrees F in accordance with ASTM C 518. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages.

B. The materials and application of building insulation shall conform to the applicable requirement of the Underwriters Laboratories “Fire Resistance Index”, Factory Mutual requirements, and the manufacturer’s recommendations.

C. The minimum R-Value in all roof insulation shall be R-30.

2.2 FOAMED-IN-PLACE THERMAL INSULATION

A. Foamed-in-place or sprayed polyurethane foam plastic insulation conforming to the requirements of ASTM C 1029 shall be placed in cavities of masonry walls. Foamed-in-place thermal insulation in walls shall be 2-component cellular plastic insulation comprised of a spray-dried polymeric resin and a foaming catalyst concentrate insulation by frothing/pouring in place. It shall have the following characteristics:

Property	Requirement	Standard
Core Density	0.5-1.0 pcf	ASTM D 1622
Termal Resistance at 140°F/90 day Aged R Value, at 75°F mean Temp, min	R4.6/inch	ASTM C 518

A. Foamed-in-place insulation shall be **InsulSmart Interior Foam Insulation by CfiFOAM, Inc., Core-Fill 500 by Tailored Chemical Products**, or approved equal.

2.3 CMU BLOCK INSULATION INSERTS

A. As an alternative to Foamed-in-Place Thermal Insulation, CMU Block Insulation Inserts may be installed. Inserts shall be flame retardant, expandable polystyrene design specifically to fit inside standard two (2) core masonry units. Inserts shall meet the requirements of ASTM C 578 with minimum density of 1.25 pcf. Inserts shall meet the following characteristics:

Property	Requirement	Standard
Thermal Resistance (R) per inch at 75°F (minimum)	4.1	ASTM C 518
Water Vapor Permeance per inch of thickness (minimum)	1.1	ASTM C 355 or ASTM E 96
Water Absorption Percent (%) by Volume (maximum)	1.8	ASTM C 272

B. CMU Block Insulation Inserts shall be **ThermaSound CMU Block Insert, Korfil by Concrete Block Insulating Systems (DRIS),** or approved equal.

2.4 BLANKET INSULATION

A. Blanket insulation shall be glass or other inorganic fibers and resinous binders formed into flexible blankets complying with ASTM C 665, Type III, with foiled back vapor barrier laminated to one face, with 1-inch flanges on long edges, and vapor transmission not more than 0.50 perms. Manufacturers shall be **Owens-Corning, CertainTeed, Johns-Manville**, or approved equal.

2.5 EXTRUDED POLYSTYRENE BOARD (RIGID) INSULATION

A. Rigid insulation shall be polystyrene conforming to ASTM C 578, Type IV with surface burning characteristics per ASTM E84 maximum of 5 for flame-spread and 175 for smoke developed. Minimum thermal resistance per inch of R-5.0 per ASTM C 518 at 75°F mean temperature. Minimum compressive strength of 25 psi per ASTM D 1621.

B. Insulation for roof decks shall be listed per UL 1256 and shall be in compliance with FM Class I roof decks.

C. Insulation thickness in interior walls shall be 4 inches.

D. Manufacturers shall be **Dow Chemical, Owens Corning**, or approved equal.

E. Sill Sealer: Mineral wool, 1 inch thick and compressible to 1/32 inch, width of sill, designed to perform as an air, dirt, and insect seal.

2.6 ALUMINUM SHEETING WITH RIGID INSULATION

A. Vaults with electric power shall be insulated with a combination of rigid insulation (see 2.4) and 24-mil thick (min) aluminum sheeting coated flat white.

B. Accessories:

1. Adhesive: As recommended by manufacturer. Adhesive shall be formulated specifically to bond insulation to steel (hatches and panels) and to concrete surfaces.
2. Tape: Aluminum foil tape with facing to match rigid insulation as recommended by the manufacturer.
3. J-Channel: PVC Closure strip as recommended by manufacturer for terminations.
4. Clip Strip: PVC closure strip for vertical and horizontal seams.
5. Fasteners: Hilti Insulation Fasteners (IZ-type), or approved equal.

C. Aluminum Sheet Manufacturer: **Insul-Mate by RPR Products, Inc.**, or approved equal.

2.7 EXTRUDED POLYSTYRENE BOARD (RIGID) INSULATION (BURIED LOCATIONS)

A. Rigid insulation for buried locations shall be polystyrene conforming to ASTM C 578, Type IV with surface burning characteristics per ASTM E84 maximum of 75 for flame-spread and maximum of 450 for smoke-developed. Minimum thermal resistance per inch of R-5.0 per ASTM C 518 at 75°F mean temperature. Minimum compressive strength of 25 psi per ASTM D 1621.

B. Insulation thickness for exterior foundation walls shall be 1.5 inches minimum.

C. Manufacturers shall be **Dow Chemical, Owens Corning**, or approved equal.

D. Sill Sealer: Mineral wool, 1 inch thick and compressible to 1/32 inch, width of sill, designed to perform as an air, dirt, and insect seal.

2.8 SOUND ATTENUATION FIRE BATTS (SAFB)

A. Sound attenuation batts shall be mineral wool made from inorganic fibers. SAFBs shall meet the requirements of ASTM C 665, Type I, unfaced and shall have a maximum flame spread index of zero (0) and a maximum smoke developed index of zero (0) per ASTM E 84.

B. Minimum Density shall be 2.4 pcf.

C. R-value shall be as shown on the Contract Drawings.

D. Manufacturer, or approved equal:

1. Rockwool – Safe'n'Sound
2. Owens Corning – Thermafiber SAFB
3. Johns Manville – MinWool SAFB

PART 3 EXECUTION

3.1 PREPARATION

A. Verify substrate and adjacent materials and insulation board are dry and ready to receive adhesive.

B. Verify mechanical and electrical services within walls have been installed and tested.

3.2 INSTALLATION OF INSULATION

A. Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the R-values shown. For acoustical insulation the installed thickness shall be as shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

3.3 INSTALLATION OF FOAMED-IN-PLACE THERMAL INSULATION

A. The polyurethane foam shall be placed in 4-foot lifts. All insulation shall be done in close coordination with the masonry contractor to allow quality control.

B. The polyurethane foam shall be applied by qualified firms with proper dispensing equipment.

C. Apply in accordance with ASTM C 1029 guidelines and the manufacturer's instructions.

3.4 INSTALLATION - RIGID INSULATION

A. Foundation Perimeter:

1. Adhere a 6 inches wide strip of polyethylene sheet over joints with double beads of adhesive on each side of the joint. Tape seal joints between sheets. Extend sheet full height of joint.
2. Install boards on foundation wall perimeter, horizontally. Place boards in a method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent board and to protrusions.
3. Extend boards over expansion joints, unbonded to foundation 12 inches either side of joint.

B. Exterior Walls:

1. Apply adhesive in 3 continuous beads per board length. Daub adhesive tight to protrusions.
2. Install boards on wall surface perimeter, vertically. Place membrane surface of insulation against adhesive.

3. Place boards in a method to maximize contact bedding. Stagger side joints. Butt edges and ends tight to adjacent board and to protrusions.
4. Place 24" side polyethylene sheet at perimeter of wall openings from adhesive vapor and air retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor and air retarder.

C. Cavity Walls:

1. Secure impale fasteners to substrate at a frequency of 6 per insulated board.
2. Apply adhesive in 3 continuous beads per board length. Daub adhesive tight to protrusions to ensure continuity of vapor and air retarder.
3. Install boards horizontally between wall reinforcement.

D. Under Concrete Slabs:

1. Place insulation under slabs on grade after base for slab has been compacted.
2. Prevent insulation from being displaced or damaged while placing vapor retarder and placing concrete slab.

3.5 INSTALLATION - BATT INSULATION

A. Install batt insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install batt insulation without gaps or voids.

C. Trim insulation neatly to fit spaces. Use batts free of damage.

D. Fit insulation tight in spaces airtight to exterior side of mechanical and electrical services within the plane of insulation.

E. Protect all insulation materials during storage and insulation from moisture, tears or other damage. All damaged material shall be replaced at no additional cost to OWNER.

- END OF SECTION -

SECTION 07 32 00
METAL ROOFING SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install metal roofing and soffit panels, system support framing, and appurtenant work, complete and in place.

B. The principal items of sheet metal work included in the metal roofing system shall include sheet metal flashing, covers, trim, enclosure batts, collars and sleeves at all roof penetrations, metal soffit panels, and all other sheet metal items necessary for a complete and watertight metal roofing system.

C. The metal roofing applicator shall coordinate his work with sheet metal gutter work and shall report to CONTRACTOR and ENGINEER if any sheet metal work provided by others affects his work negatively.

1.2 RELATED WORK

A. Related Work in other Sections includes but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.3 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1.	ASTM A 653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
2.	ASTM A 924	Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
3.	ASTM D 226	Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
4.	ASTM D 1938	Standard Test Method for Tear-Propagation Resistance (Trouser Tear) of Plastic Film and Thin Sheeting by a Single-Tear Method
5.	ASTM E 96	Standard Test Methods for Water Vapor Transmission of Materials
6.	ASTM E 330	Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
7.	ASTM E 1646	Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
8.	ASTM E 1680	Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems

C. UNDERWRITERS LABORATORY (UL)

1. UL 580 Test for Uplift Resistance of Prepared Roof Assemblies

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit detailed shop drawings showing materials, gages, finishes, layout, corners, trim, flashing, enclosures, edge conditions, jointing, profiles, supports, fasteners, fabrication of special shapes, and method of attachment to adjacent construction to Engineer prior to fabrication. Submit drawings indicating roof size, location and type of penetrations, perimeter and penetration details, roof insulation make-up and sheet layout that have been accepted by an authorized manufacturer's representative.

C. Submit manufacturer's literature indicating materials, finish, construction, and method of installation of prefabricated items and sealant.

D. Provide color samples for color selection by OWNER.

E. Submit the following test reports, certified by an Independent Testing Laboratory or a professional engineer registered in the State of Utah to verify the proposed roofing will meet performance requirements of this Specification:

1. Thermal Cycle Test
2. ASTM E-330 Adapted to Test Formed Metal Panels
3. Clip Fastener Pull-Out Tests and Calculations
4. UL 580 Class 90
5. Concentrated Load Test Data
6. Air Infiltration (E-283) and Water Penetration (E-331) Test Results
7. Coating Performance Testing

F. Submit certification by the manufacturer that the roofing assembly is listed in the UL Building Materials Directory with a Class 1-90 wind uplift rating, including relevant construction number.

1.5 WARRANTIES

A. The manufacturer shall provide to OWNER written warranty that the roof panels will not rupture, fail structurally, or perforate due to corrosion for a period of 20 years from the date of installation.

B. The roofing manufacturer shall provide written 10-year material and labor warranty beginning at the date of final acceptance.

C. CONTRACTOR shall provide to OWNER written warranty that the roof system is installed in accordance with the manufacturer's recommendations and will be free from defective workmanship and remain watertight and weatherproof with normal usage for two (2) years following Project Substantial Completion date.

1.6 QUALITY ASSURANCE

A. A single installer shall perform the work of this Section and shall have completed

projects of similar scope and complexity.

PART 2 PRODUCTS

2.1 GENERAL

A. Subject to compliance with the requirements, manufacturers who may offer metal roofing systems and products, which may be incorporated into the work, include **AEP Span, Fabral**, or approved equal.

2.2 ROOF PANELS

A. Minimum Performance Ratings and Properties:

1. Air infiltration: Panel shall have no air infiltration at 20 psf pressure differential and no air exfiltration at 20 psf pressure differential when tested in accordance with ASTM E 1680.
2. Water penetration: Panel shall have no leakage through panel joints when tested in accordance with ASTM E 1646 at static pressure differential of 20.0 psf.
3. Provide UL90 rated roofing system that has been tested in accordance with UL 580 test procedure. Panels shall be capable of spanning 5'-0" on-center purlins with UL90 rating.

B. Profile:

1. Roof panels shall be factory formed ribbed seam pattern with minimum 1" high seams and a nominal panel width of 16 inches.
2. Soffit panels shall be 12-inches wide, 1-1/2" deep, 22- gauge, G90 galvanized finish steel, with concealed fastener, lock-joint design and shall be continuous-vented.

C. Length:

1. Provide panels of sufficient length to minimize end laps.

D. Profile Composition:

1. Base metal shall be a minimum 24-gage structural steel (minimum yield strength 50,000 psi) with G90 hot dipped galvanized coating conforming to ASTM A 653.
2. Sheet metal trim, flashing, and accessories shall be the same material, gauge, finish, and color as the metal roofing.
3. Paint Finish:
   a. All panels shall receive a factory applied Kynar 500/Hylar 5000 finish applied to both sides of the panel over the base protective coating, or approved equal. The exposed side coating shall have a minimum total dry film thickness of 1.0 mil and the underside coating shall have a minimum total dry film thickness of 0.5 mil. Color to be determined by OWNER.

E. Concealed-Clips:

1. Material: 18-gauge steel with class G60 galvanized coating.
2. Configuration: clips shall be designed so as to attach with two concealed fasteners, and fully attach two ribs of every panel.
3. Spacing: In accordance with the manufacturer's recommendations.

F. Fasteners:

1. Self-drilling or self-tapping galvanized steel screws and/or stainless steel pop rivets painted to match the panels where visible, per the panel manufacturer's recommendations.

G. Sealants:

1. Sealants shall not contain oil, asbestos, or asphalt. Factory applied sealant shall be applied in the seam and designed for metal to metal concealed joints. Field applied panel end sealant shall be mastic tape sealant. Exposed sealant shall be one-part polyurethane joint sealant. All sealants used shall be as recommended by the metal roofing manufacturer for the job conditions and warranty requirements.

H. Weather resistive barrier:

1. Membrane underlayment shall be composed of a high-strength, spun-bonded polypropylene base sheet, co-extruded on both sides with UV stabilized polyolefin, weight 30-pound. Membrane underlayment shall conform to ASTM D 226, Type II. Permeability shall be 0.54 perms maximum in accordance with ASTM E 96, Procedure A, and tear strength shall be minimum 20 pounds in accordance with ASTM D 1938. Membrane underlayment shall be **Grace Tri-Flex 30 by Grace Construction Products**, or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify proper placement of all roof openings, pipes, curbs, sleeves, ducts, vents and drains.

3.2 SUBSTRATE PREPARATION

A. Comply with manufacturer’s instructions for preparation of substrate to receive roofing. Clean substrate of dust, debris and other substances detrimental to the roofing work.

3.3 NAILERS

A. Install treated wood nailers at roof perimeters, at base of roof projections, and around specified roof penetrations.

1. Total nailer height shall match total thickness of insulation being used. Install with 1/8” gap between each length and at changes in direction.
2. Firmly fasten nailer to the deck, wall, or existing structurally sound and secured nailer at (16”) o.c. maximum, so as to resist a force of 200 pounds per lineal foot in any direction.
3. Taper nailer where applicable to be flush at point of contact with membrane in either the vertical or horizontal applications.

3.4 GENERAL

A. The metal roofing shall be installed by an applicator and fabricator approved by the roofing system manufacturer who has working experience with the roofing system. Contractor shall provide a letter signed by the roofing manufacturer that the installer is an approved applicator and fabricator of the roofing system.

B. The metal roofing systems shall be installed in accordance with the manufacturer's instructions and recommendations applicable to the job conditions and supporting substrates.

C. The panels and other components of the system shall be securely anchored and placed with concealed fasteners and shall be provided with provisions for thermal/structural movement.

D. Shim and align panel units within installed tolerances of 1/4-inch in 20 feet on level/plumb/slope and location/line as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

E. Joint sealers shall be furnished and installed where necessary or where required for weatherproofing of the system.

3.5 INSTALLATION

A. Metal panels shall be installed in accordance with the approved shop drawings and the manufacturer's recommendations.

B. Remove any strippable protective coating on the panels and flashings prior to installation and in any case do not allow the strippable coating to remain on the panels in extreme heat, cold, or in direct sunlight or other UV source.

C. Loosely lay roof insulation with end joints staggered. (Stagger joints between layers.) Joints shall be 1/4" or less in width. Neatly cut and fit insulation around roof penetrations and projections. Install only dry insulation and only as much insulation as can be covered the same day with membrane and completed.

3.6 CLEANING AND PROTECTION

A. Panels and other components of the work which have been damaged or have deteriorated beyond successful repair by means of finish touch-ups or similar minor repair procedures, shall be removed and replaced at no cost to Owner.

B. Temporary protective coverings and strippable films shall be removed from the materials during installation. Upon completion of the work, the roofing systems shall be cleaned as recommended by the roofing manufacturer and shall be maintained in a clean condition until acceptance of the work by Owner.

- END OF SECTION –

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SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall provide and install sheet metal flashing and trim, and appurtenant work, complete in place, in accordance with the Contract Documents.

1.2 RELATED DOCUMENTS

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 06 10 00 Rough Carpentry
3. Section 07 32 00 Metal Roofing Systems
4. Section 07 92 00 Joint Sealants

1.3 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
3. ASTM A792 Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
4. ASTM C920 Standard Specification for Elastomeric Joint Sealants.
5. ASTM C1311 Standard Specification for Solvent Release Sealants.
6. ASTM D1187 Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
7. ASTM D4586 Standard Specification for Asphalt Roof Cement, Asbestos-Free.

C. Sheet Metal and Air Conditioning Contractors Association, SMACNA - Architectural Sheet Metal Manual

1.4 PERFORMANCE REQUIREMENTS

A. Materials, anchorage, fastenings, and workmanship shall qualify for U.L. Class 115 MPH (3 second gust) wind uplift rating.

B. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation,

overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and night time-sky heat loss.

1. Temperature Change (Range): 120° F, ambient; 180° F, material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.5 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Submit manufacturer’s specifications, literature, and published installation and maintenance instructions for all sheet metal products.

D. Provide samples of color where required.

1.6 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.8 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak-proof, secure, and noncorrosive installation.

PART 2 MATERIALS

2.1 SHEET METAL

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.

1. Thickness 0.0239-inch (24 U.S. Standard gauge), unless shown otherwise.
2. Finish-factory applied to match color of metal frames, or trim.

B. Manufacturers shall be **Cheney Flashing Company, Fry Reglet Corporation, Heckmann Building Products, Inc.,** or approved equal.

2.2 DOWNSPOUTS, GUTTER AND TRIM

A. Downspouts, gutters, and trim shall be same metal and thickness as roof panels. Fabricate gutters in minimum 96-inch long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from the same material as gutters. Fabricate expansion joints, expansion joints covers, gutter bead reinforcing bars, and gutter accessories from same material as gutters. Shop fabricate interior and exterior corners.

B. Color shall match roof panels.

2.3 FASCIA AND RAKE TRIM

A. Fascia and rake trim shall be same metal and thickness as roof panels.

B. Color shall match roof panels.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating. Steel, galvanized per ASTM A153/A153M or stainless steel.
2. Fasteners for Flashing and Trim: Steel, galvanized per ASTM A153/A153M or stainless steel. Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength stainless-steel rivets.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, non-staining tape.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. 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.

C. Fabricate 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.

1. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flatlock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual for application but not less than thickness of metal being secured.

H. Reinforcement and Supports; Provide same material as flashing, unless other material is shown. Steel, where shown or required, shall be galvanized or stainless.

I. Rigid Joints and Seams: make mechanically strong. Solder galvanized and stainless steel metal joints. Do not us solder to transmit stress.

J. Provide watertight closures at exposed ends of counterflashing.

2.6 DOWNSPOUTS AND GUTTERS FABRICATION

A. Form downspouts and gutters in maximum lengths as practicable to sizes and shapes indicated on the Contract Drawings.

1. Lock longitudinal joints of downspouts.
2. Telescope end joints 1-1/2 inches.
3. Provide elbows at bottom where downspouts discharge onto splash blocks.
4. Anchor downspouts with straps of same material as downspouts.
5. Install gutters at locations indicated on drawings.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:

1. Galvanized Steel: 0.028 inch thick.

2.8 FLEXIBLE BASE PIPE SEALS

A. Flexible base pipe seals shall be prefabricated on-piece aluminum flanged base with stepped, graduated EPDM profile which creates a compression seal between the piping and the flashing. Aluminum base shall be flexible to conform to profile of roof panels.

B. Manufacturers and Products:

1. Pate Co.; Dektite.
2. Portals Plus, Inc.; Deck-Mate.

C. Coat aluminum surfaces in contact with dissimilar metals in accordance with 3.2.B of this Section.

D. Isolation tape shall be butyl or polyisobutylene, internally reinforced.

E. Fasteners shall be stainless steel of type required.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. 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 fabricator or manufacturers of dissimilar metals.

1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
2. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
3. Use only stainless steel fasteners to connect isolated dissimilar metals.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and [elastomeric] [butyl] sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 30 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

G. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When

ambient temperature at time of installation is moderate, between 40 and 70° F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40° F.

2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 - "Joint Sealants."

H. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Pretinning is not required for lead-coated copper.
2. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
3. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
4. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of anchor and washer at 36-inch centers, or other method approved by ENGINEER.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Use appropriate flexible base pipe seal where pipe, conduit or cable, etc. penetrate roofing system.
2. Make work watertight and free of expansion and contraction noise. Seal and clamp flashing to pipes penetrating roof.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION -

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Polyurethane Sealants

B. Tape Mastic Sealants

C. Non-skinning Sealants

D. Silicone Sealants

E. Acrylic Sealants

1.2 RELATED DOCUMENTS

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.3 REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN ARCHITECTURAL MANUFACTURER'S ASSOCIATION (AAMA)

1. AAMA 800-10 Voluntary Specifications and Test Methods for Sealants

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 653 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 792 Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy Coated by the Hot-Dip Process.
3. ASTM C 639 Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
4. ASTM C 661 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
5. ASTM C 681 Standard Test Method for Volatility of Oil- and Resin-Based, Knife Grade, Channel Glazing Compounds
6. ASTM C 711 Standard Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants
7. ASTM C 794 Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
8. ASTM C 834 Standard Specification for Latex Sealants
9. ASTM C 908 Standard Test Method for Yield Strength of Preformed Tape Sealants
10. ASTM C 920 Standard Specification for Elastomeric Joint Sealants

11. ASTM D 56	Standard Test Method for Flash Point by Tag Closed Cup Tester
12. ASTM D 217	Standard Test Methods for Cone Penetration of Lubricating Grease
13. ASTM D 412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
14. ASTM D 792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
15. ASTM D 925	Standard Test Methods for Rubber Property—Staining of Surfaces (Contact, Migration, and Diffusion)
16. ASTM D 2452	Standard Test Method for Extrudability of Oil- and Resin-Base Caulking Compounds
17. ASTM D 2453	Standard Test Method for Shrinkage and Tenacity of Oil- and Resin Base Caulking Compounds
18. ASTM D 1475	Standard Test Method For Density of Liquid Coatings, Inks, and Related Products
19. ASTM D 2202	Standard Test Method for Slump of Sealants
20. ASTM D 2203	Standard Test Method for Staining from Sealants
21. ASTM E 84	Standard Test Method for Surface Burning Characteristics of Building Materials
22. ASTM E 90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
23. ASTM E 814	Standard Test Method for Fire Tests of Penetration Firestop Systems
24. ASTM E 1966	Standard Test Method for Fire-Resistive Joint Systems
25. ASTM G 154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

D. INTERIM FEDERAL SPECIFICATIONS (FS)

1. FS TT-S-00230C	Sealing Compound: Elastomeric Type, Single Component
2. FS TT-C-1796A	Caulking Compounds, Metal Seam and Wood Seam
3. FS TT-S-001543A	Sealing Compounds: Silicone Rubber Base (For Caulking, Sealing, and Glazing in Buildings and Other Structures

E. SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

1. Rule 1168	Adhesive and Sealant Applications

F. UNDERWRITER'S LABORATORIES (UL)

1. UL 580	Tests for Uplift Resistance of Roof Assemblies

1.4 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Material Safety Data Sheets (MSDS): Provide in accordance with 29 CFR 1910.1200,

C. Hazard Communication

D. Product Test Reports: Reports of tests required by this section performed by a qualified testing agency, indicating that the sealants comply with the requirements.

E. VOC Content: Provide documentation of the Volatile Organic Content (VOC) in accordance with SCAQMD Rule 1168

F. USDA Approval: Provide documentation that the product is approved for use in meat and poultry processing areas by the USDA for the following types of sealants:

1. Polyurethane
2. Tape Mastic
3. Non-skinning Sealant

1.5 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within 5 years of installation.

PART 2 PRODUCTS

2.1 GENERAL MATERIAL REQUIREMENTS

A. Substrate Requirements: When testing is required on a substrate, the material used shall be either ASTM A653 G-90 or ASTM A792 AZ50 and tests shall be conducted with each of the following coatings:

1. Bare (No coating)
2. Acrylic (Galvalume Plus)
3. Polyester
4. Siliconized Polyester
5. Polyvinylidene Fluoride Resin (PVDF)

2.2 POLYURETHANE SEALANT

A. General: Provide Sealants that meet the following specifications:

1. ASTM C 920, Type S, Grade NS, Class 25, Use: NT, A, M, G and O paintable sealant
2. AAMA 808.3
3. FS TT-S-00230C, Type II, Class A

B. Color: The sealant color shall be selected by OWNER.

C. Physical Properties: The sealant shall have the following additional physical properties:

1. Peel Adhesion: All panels shall have at least a 90% cohesive failure of at least 15 lb/in when tested in accordance with ASTM C 794.
2. Tensile Strength: Sealant shall have a tensile maximum of 300 psi and an elongation of 500-600% when tested in accordance with ASTM D 412.
3. Sag: There shall be no sag when tested in accordance with ASTM C 639.
4. Hardness: Shore “A” hardness on all three samples shall not exceed 40 when tested in accordance with ASTM C 661
5. Service Temperature Range: -40 degrees F to 200 degrees F.

6. Water Resistance: There shall be no presence of voids, cracks, separation or breakdown of the compound when tested in accordance with AAMA 800-10, Section 2.11.1.
7. Flash Point: No less than 145 degrees F when tested in accordance with ASTM D 56.
8. Shelf Life: The compound shall have a shelf life of 9 months or more when stored at or below 80 degrees.
9. Skin Time: The compound shall have a skin time of 2-4 hours
10. Cure Time: The compound shall have a cure time of 24-48 hours
11. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

2.3 TAPE MASTIC SEALANT

A. General: Provide Sealants that meet the following specifications:

1. AAMA 804.3
2. AAMA 807.3
3. FS TT-C-1796A, Type II, Class B
4. Approved by Underwriters Laboratories for use in roof deck constructions classified under UL-518 Class 90

B. Color: The sealant color shall be selected by OWNER.

C. Physical Properties: The sealant shall have the following additional physical properties:

1. Specific Gravity: 1.4 or higher when tested in accordance with ASTM D 792
2. Tensile Adhesive Strength: 20 psi or higher when tested in accordance with ASTM C 908
3. Elongation: 1000% or higher when tested in accordance with ASTM C 908
4. Cone Penetration: The sealant shall meet the following conditions when tested in accordance with ASTM D 217 with a 300g cone in 5 seconds:
   a. 8.5 – 100 mm at 77 degrees F
   b. 125-135 mm at 120 degrees F
   c. 45-55 mm at Zero degrees F
5. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

2.4 NON-SKINNING SEALANT

A. General: Provide sealants that meet the following specifications:

1. AAMA 809,2
2. FS TT-C-1796A, Type 1, Class A

B. Color: The sealant color shall be selected by OWNER.

C. Physical Properties: The sealant shall have the following additional physical properties:

1. Extrudability: The sealant shall deposit in 30 to 50 seconds through a 0.104” orifice at 50 psi pressure in accordance with ASTM D 2452.

2. Total Solids: At least 85% by weight when determined in accordance with ASTM C 681.
3. Volume Shrinkage: Less than 15% when determined in accordance with ASTM D 2453.
4. Weight per U.S. Gallon: 10.75 lbs. +/- 0.25 lbs. when determined in accordance with ASTM D 1475.
5. Vehicle Bleed out: There shall be no visible exudation of vehicle from sealant after 21 days at 158 degrees F on the test panel.
6. Flexibility: There shall be no loss of adhesion at -60 degrees F when tested in accordance with ASTM C 711.
7. Sag: 0.20 in max, full button when tested in accordance with ASTM D 2202.
8. Staining: Sealant will not stain a painted test panel when tested in accordance with ASTM D 925, Method A.
9. UV Resistance: There shall be no cracking, bleeding, or loss of elasticity after 1,000 hours of QUV exposure in accordance with ASTM G 154.
10. Wet Flammability: No less than 110 degree F flash point when determined in accordance with ASTM D 56.
11. Coverage: Each gallon of sealant shall provide the following minimum coverage:
    a. 500 lineal feet with 1/8-inch bead
    b. 690 lineal feet with 3/16-inch bead
    c. 390 lineal feet with 1/4-inch bead.
12. Shelf Life: 18 months minimum in unopened container when stored at or below 90 degrees F.
13. Drying time: Non-skinning, remains permanently soft and tacky.
14. Engageability: Sealant will easily engage and transfer to male joint at 10 degrees F.
15. Service Temperature Range: -60 degrees F to 200 degrees F.
16. Application Temperature Range: 10 degrees F to 120 degrees F.
17. Non-Reactive: Will not darken, etch, or leave salt deposits on the test panel after two years.
18. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

2.5 SILICONE SEALANT

A. General: Provide sealants that meet the following specifications:

1. ASTM C 920, Type S, Grade NS, Class 25
2. AAMA 802.3, Type I and II
3. AAMA 805.2 Group C
4. AAMA 808.3
5. FS TT-S-001543A, Class A
6. FS TT-S-00230C, Class A

B. Color: Clear

C. Physical Properties: The sealant shall have the following additional physical properties:

1. Mechanical Properties: The sealant shall have the following mechanical properties as determined by ASTM D 412:
    a. Tensile Strength: 150 psi minimum (Method A)
    b. Modulus at 100% Elongation: 35 psi minimum
    c. Elongation: 400% minimum

d. Recovery: 100%

2. Hardness: Maximum Shore A hardness of 15 when determined in accordance with ASTM C 661.
3. Tack-free Time: 1/4-inch diameter bead at 77 degrees F, 50% relative humidity, 10-15 minutes.
4. Cure Time: 1/4-inch diameter bead at 77 degrees F, 50% relative humidity, 10-12 hours.
5. Service Temperature: -60 degrees F to 300 degrees F.
6. Shelf Life: 9 months when stored in unopened original containers at 80 degrees F or less.
7. VOC Content: The Volatile Organic Compound (VOC) content shall be less than 250 g/L when calculated SCAQMD Rule 1168.

2.6 ACRYLIC SEALANT

A. Color: Clea, white or gray.

B. Physical Properties:

1. Percent Solids:
   a. Colors: 75% minimum determined in accordance with ASTM D 1475
   b. Clear: 70% minimum determined in accordance with ASTM D 1475
2. Peel Adhesion: All panels shall have at least a 90% cohesive failure of at least 5 lb/in when tested in accordance with ASTM C 794.
3. Weight per U.S. Gallon: 8.7 lbs. +/- 0.25 lbs. when determined in accordance with ASTM D 1475.
4. Viscosity: The sealant shall meet the following conditions when tested in accordance with ASTM D 2452 with a 20g cone with a 0.104-inch orifice at 60 psi at 77 degrees F in the indicated time:
   a. Colors: 40-60 seconds
   b. Clear: 35-45 seconds
5. Elongation: 200% minimum when tested in accordance with ASTM D 412.
6. Hardness: Maximum Shore A hardness of 55 when determined in accordance with ASTM C 661.
7. Flash Point: No less than the following when tested in accordance with ASTM D 56
   a. Colors: 52 degrees F
   b. Clear: 40 degrees F
8. Slump: 0.10” maximum when tested in accordance with ASTM D 2202.
9. Vehicle Migration: No vehicle migration from the sealant edge when tested in accordance with ASTM D 2203 as modified by Section 2.8.1 of AAMA 800-10.
10. Paintability: Compatible with Alkyds, enamels and lacquers post-solvent release.
11. Service Temperature Range: Zero degrees F to 180 degrees F.
12. Shelf Life:18 months when stored in original, unopened containers at or below 80 degrees F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install joint sealants in accordance with manufacturer’s specifications and requirements.

- END OF SECTION –

SECTION 08 10 00
DOORS, FRAMES, AND HARDWARE

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers all the work necessary to furnish and install the new doors, frames, and hardware, complete and operable.

B. All doors and their pressed steel frames shall be steel, insulated, and the type and size as indicated on the Door Schedule on the Contract Drawings.

1.2 RELATED WORK

A. Related work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 91 00 Painting and Finishes

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI A 115.IG Installation Guide for Doors and Hardware
2. ANSI A 156.6 Standard for Architectural Door Trim
3. ANSI A 156.16 Standard for Auxiliary Hardware
4. ANSI A 250.8 SDI-100 Recommended Specifications for Standard Steel Doors and Frames
5. ANSI A 250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
6. ANSI A 250.11 Recommended Erection Instructions for Steel Frames

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 36 Standard Specification for Carbon Structural Steel
2. ASTM A 108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
3. ASTM A 123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
4. ASTM A 229 Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs
5. ASTM A 653 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process
6. ASTM A 1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

7. ASTM A 1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
8. ASTM C 177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
9. ASTM D 256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
10. ASTM D 635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
11. ASTM D 790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
12. ASTM D 792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
13. ASTM D 882 Standard Test Method for Tensile Properties of Thin Plastic Sheeting
14. ASTM D 1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics
15. ASTM D 2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
16. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
17. ASTM E 330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

D. AMERICAN WELDING SOCIETY (AWS)

1. AWS D1.1 Structural Welding - Steel
2. AWS D1.3 Structural Welding Code – Sheet Steel

1.4 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Manufacturer's catalog data and preprinted installation instructions of doors.

C. A schedule showing the location of each door shall be included with the drawings. Submittal drawings shall include elevations of each door type, details and method of anchorage, details of construction, method of assembling sections, location and installation of hardware, shape and thickness of materials, details of joints and connections.

D. Manufacturer’s certificates that certify products meet or exceed the specified requirements.

E. Warranty: Provide documentation of the manufacturer’s standard written one (1) year warranty.

1.5 DELIVERY AND STORAGE

A. Doors shall be delivered to the job site wrapped in a protective covering with the brands and names clearly marked thereon. Doors shall be stored in a dry location that is adequately ventilated and free from dust or water, and in a manner that permits easy access for inspection and handling. Doors shall be handled carefully to prevent damage to the faces, edges, and ends. Damaged items that cannot be restored to like-new condition shall be replaced.

PART 2 PRODUCTS

2.1 STEEL DOORS

A. Steel doors and frames shall be of hollow metal construction and shall be full flush design with no visible seams. Interior and Exterior door face sheets shall be hot-dip galvannealed according to the requirements of ASTM A 653. Manufacturers shall be **Republic Doors and Frames, Steelcraft, Ceco Door Products**, or approved equal. Doors shall conform to ANSI A 250.8 and to the following requirements:

1. Hollow metal door, 1 3/4 inches thick flush type, constructed of two sheets of not less than stretcher leveled, 16-gauge steel sheets formed and welded for flush pan assembly, with internal 20-gauge vertical reinforcing channels spaced not over 8 inches on centers the full height of the door. There shall be no visible joints on the face of the doors. Reinforcing channels shall be uniformly spot welded to face plates at top and bottom of all doors. Filler channels shall be provided at the top and bottom of doors to provide a flush closure. The top of exterior doors shall be provided with flush, water- and weather-tight top enclosures.
2. All interior void spaces shall be completely filled with EPS foam or polyurethane.
3. Concealed sheet or bar steel reinforcement shall be provided for mortise type hardware. Reinforcing shall not be less than the following: 9-gauge for butts, 12-gauge for locksets and 14-gauge for surface applied hardware. Reinforcing shall be drilled and tapped to template requirements. Concealed reinforcing shall be provided for closures. Door bottom weather stripping shall be included to match thresholds.
4. Door frames shall be pressed steel constructed of not less than 16-gauge steel and shall be of the shape indicated on the plans and as required to fit the various wall constructions. Frames shall be of welded unit construction assembled and welded in the shop. Welding shall be to a hairline joint with all exposed beads ground smooth.
5. Concealed reinforcing of the frames for the mortise hardware shall be not less than the following: 3/16 inch for butts, 12- gauge for lock strike, 14-gauge for surface applied items and 18-gauge for plaster guards over mortised hardware reinforcement. Frames shall be mortised drilled, and tapped to template requirements. Lock reinforcing units shall be supplied by finishing hardware supplier. Frames shall be anchored as shown in the drawings.
6. Hinges shall be heavy duty ball bearing hinges with non-removable pins.
7. Pull plates shall be chrome plated or stainless steel and mounted on interior and exterior sides of all doors.
8. All double doors are to be supplied with a “Z” astragal of 14-gage steel for 1-3/4-inch doors and 16-gage for 1-3/8-inch doors.
9. Hardware including locksets and hinges shall be stainless steel.

2.2 DOOR HARDWARE

A. Trim material shall be stainless steel, unless noted otherwise.

B. Pull Plates: 8” CTC pull, 4” x 16” plate, stainless steel, No. 110 x 70C by **Rockwood Mfg. Co**., or approved equal, conforming to ANSI A 156.6.

C. Hinges: satin stainless steel, 5 knuckles minimum, non-rising pin for interior doors and non-removable pin for exterior doors, number of hinges per door manufacturer’s recommendation (minimum of 3 hinges per door). Where necessary to keep door leaf clear of walls, casings, jambs or reveals in door opening, wide throw hinges of an approved type shall be furnished. Finish shall be stainless steel satin (32D or 630). Manufacturer shall be **Mckinney T4A3386, Hager, Stanley Works FBB199 (32D),** or approved equal.

D. Cylinder Lock Set: Best Access Systems, Lockset 47H-7-AB-15-J-630-SH-S6-VT for exterior doors and 45H-7-N-15-M-630 for interior doors. Locks must be compatible with Owners existing keys. Contractor shall provide lock sets and keys that will match Owner’s requirements.

E. Lever Extension Flush Bolt, Upper, **Rockwood No. 555**, or approved equal, cadmium plated finish (inactive leaf only), conforming to ANSI A 156.16.

F. Lever Extension Flush Bolt, Lower, **Rockwood No. 555**, or approved equal, cadmium plated finish (inactive leaf only), conforming to ANSI A 156.16.

G. Threshold: **#277AS by Pemko Corporation**, or approved equal, raised interior, extruded aluminum threshold with neoprene seal.

H. Drip Cap: Provide drip cap on all exterior doors. Drip cap shall be clear anodized aluminum, **Pemko 346C**, or approved equal.

I. Door Closers: Door closers shall be full rack and pinion, cast iron, with adjustable regulators for closing and latching speed, back check and spring power. Closers shall be mounted for 180 degrees of swing whenever possible. All closers shall be LCN Model 4040XP with 4041-3071 DEL cylinder with extra duty hold open arm. Mounting plates shall be supplied as necessary. All door closers attached to mineral core or particle filled doors shall be installed with hex bolts. Cover shall be metal 4040XP-72MC with 689 Aluminum finish.

J. Lock Strikes: Strikes shall have extended curved lips where required to protect trim from being marred by latch bolt. Strike lips shall not protrude more than 1/8-inch beyond door frame trim. Wrought box strikes shall be furnished on all locks, latches and deadlocks.

K. Door Stop: Solid cast brass, DuraFlex bumper, **Rockwood #445**, or approved equal (Inactive leaf only)

L. Non-Mortise Door Edge with Astragal: 0.06” thick stainless steel, **Rockwood HD306B-AST**, or approved equal (double doors only)

M. Kick Plates: Unless otherwise indicated, kick plates shall be provided and shall be satin stainless 18-8, 18 gage, **Rockwood No. K1050F**, or approved equal.

N. Weatherstripping and Seals: silicone gasketing, **Pemko S88D**, or approved equal.

2.3 ACCESS DOORS AND FRAMES

A. Fabricate doors and frames as shown on the drawings and in accordance with best shop practices. Frames shall be rigid, neat in appearance and free from defects. Field measurements shall be taken as required for coordination with adjoining work.

B. Form exposed surfaces free from warp, wave and buckle, with all corners square, unless otherwise shown. Set each member in proper alignment and relationship to other members with all surfaces straight and in a true plane.

C. Reinforce members and joints with plates, tubes or angles for rigidity and strength.

D. Doors and frames shall be mortised and reinforced for hardware in accordance with the hardware manufacturer's instructions and templates. The reinforcing shall be designed to receive hinges, locks, strikes, closures, etc.

E. Mortar guard boxes shall be provided for hardware cutouts in frames.

F. Furnish at least three (3) metal anchors or polymer spacers in each jamb of frames up to 84" high and one (1) additional anchor for each 24" in height above 84", in shapes, sizes and spacing shown or required for anchorage into adjoining wall construction. Fabricate joint anchor of stainless steel.

G. Terminate bottom of frames at the indicated finished floor level.

H. Provide clearance for doors of 1/8" at jambs and heads; 1/4" clearance above threshold.

I. Where glazing is required, flush integral stops on one side and screw-on stops on the opposite side shall be provided.

2.4 FINISH

A. Surfaces shall be provided with a shop-primed galvannealed finish. Prior to receiving primer, all surfaces shall be cleaned thoroughly and phosphate-treated to assure maximum paint adherence. Primer shall be a metallic oxide or synthetic resin primer of the manufacturer's standard type and shall be applied by dipping or spraying in accordance with ANSI A 250.10.

B. Field painting of doors and frames shall be in accordance with Section 09 91 00 – Painting and Finishes. Finish coat shall be compatible with the shop applied primer coating.

PART 3 EXECUTION

3.1 INSTALLATION

A. Doors shall be installed in accordance with approved detail drawings and manufacturer's instructions and in accordance with ANSI A 115IG. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, doors shall be weather tight and shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

B. Access Door Frame Installation

1. Place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged. Frame must not be drilled for brace supports as finish may be damaged. Install frames in accordance with ANSI A 250.11.
2. Locate three (3) wall anchors per jamb at hinge and strike levels. Frames may be grouted full of mortar at jambs and anchors shall be built into the joints as walls are laid up. A continuous bead of silicone sealant is to be applied between the head and jamb at the miter joint.

C. Adjust doors for free swing without binding. Adjust hinge sets, locksets, and other hardware. Lubricate using a suitable lubricant compatible with the door and frame coatings.

D. Install work of this Section in strict accordance with approved shop drawings and manufacturer's recommended installation instructions. Where installations require field welding, all work must be performed by certified welders in accordance with AWS D1.1/D1.3.

E. Upon installation, secure the services of a qualified representative of the manufacturer to visit the jobsite and inspect the complete installation of the door and frame assemblies, test all components thru a minimum of ten (10) cycles of operation and direct installer in correcting any non-conforming items found.

F. Remove temporary coverings. Repair or replace damaged installed products. Clean installed products in accordance with the manufacturer's instructions before acceptance by OWNER.

G. Clearances at edge of doors:

1. Between door and frame at head and jambs: 1/8 inch.
2. At meeting edges pairs of doors and at mullions: 1/8 inch.
3. At transom panels, without transom bars: 1/8 inch.
4. At sills without thresholds: 5/8-inch maximum above finish floor.
5. At sills with thresholds: 1/8-inch above threshold.

3.2 HARDWARE SCHEDULE

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.

B. Hardware equal in quality and utility will be accepted provided it conforms in operation, quality, weight, size, workmanship, and finish to the products hereinafter described. All component parts of locksets shall be the product of one manufacturer.

Hardware Set 100 (Door 101, 103)				
Each to Receive:				
Quantity	Item	Model No.	Finish	Manufacturer
3 each*	Hinge	T4A3386 4.5”x4.5”	32D	McKinney
1 each	Lockset	47H-7-AB-15-J-630-SH-S6-VT	630	Best Access Systems
1 each	Closer	4040XP	689	LCN
1 each	Kickplate	K1050F	630	Rockwood
1 each	Wall Stop	409	32D	Rockwood
3 each	Silencer	608	Gray	Rockwood
1 each	Threshold	277AS	Alum	Pemko
1 each	Drip Cap	346C	Alum	Pemko
1 set	Perimeter Seal	S88D	Alum	Pemko
*Five Knuckle, Stainless Steel, Non-removal Pin Hinges (size and quantity by door manufacturer)				

Hardware Set 200 (Door 102)				
Each to Receive: Five Knuckle, Stainless Steel, Non-removal Pin Hinges (size and quantity by door manufacturer)				
Quantity	Item	Model No.	Finish	Manufacturer
1 each*	Lockset	47H-7-AB-15J-M-630-SH-S6-VT	630	Best Access Systems
3 each***	Hinge	T4A3386-NRP 4.5”x4.5”	32D	McKinney
1 each	Closer	4040XP	689	LCN
1 each	Kickplate	K1050F	630	Rockwood
1 each	Astragal	HD306B-AST	630	Rockwood
1 each**	Flush Bolt, upper	555	626	Rockwood
1 each**	Flush Bolt, lower	555	626	Rockwood
1 each	Threshold	277AS	Alum	Pemko
1 each	Drip Cap	346C	Alum	Pemko
1 set	Perimeter Seal	S88D	Alum	Pemko
* Deadbolt required on Active Leaf only ** Inactive Leaf Only ***Five Knuckle, Stainless Steel, Non-removal Pin Hinges (size and quantity by door manufacturer)				

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SECTION 08 31 00
ACCESS HATCHES

PART 1 GENERAL

1.1 SUMMARY

A. This section covers all the work necessary to furnish and install all hatches and appurtenances, complete and in place.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 90 00 Painting and Finishes

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 123 Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
2. ASTM A 229 Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs
3. ASTM A 36 Standard Specification for Carbon Structural Steel
4. ASTM A 653 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process

1.4 DESIGN REQUIREMENTS

A. Any hatch in a roadway or located where occasional, slow traffic may drive over the hatch shall be designed to meet H-20 highway wheel loading. For continuous or heavy traffic, use hinged cast iron castings with lift assist type covers.

B. Flush mounted hatches for vaults not subject to traffic loading shall be designed to handle a minimum live loading of 300 psf.

C. Shoe-box type hatches with minimum 2-inch lip for spring boxes shall be designed to handle a live load of 100 psf.

D. Hatches for spring boxes shall meet the requirements of the Utah Administrative Code Section R309-545-14.

1.5 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer’s catalog data and preprinted installation instructions for the hatches.

C. Submit a schedule showing the location of each hatch. Shop drawings shall include details and method of anchorage, details of construction, method of assembling sections, location and installation of hardware, shape and thickness of materials, details of joining and connections.

1.6 DELIVERY AND STORAGE

A. Hatches shall be delivered to the job site wrapped in a protective covering with the brands and names clearly marked thereon.

1.7 WARRANTY

A. The manufacturer shall provide to OWNER written guarantee against defects in material or workmanship for a period of five (5) years. The manufacturer must be able to have a representative on site within 48 hours to address any complaint or issues.

PART 2 PRODUCTS

2.1 HATCHES AND ACCESS DOORS

A. Hatches or access doors shall be as noted on the Contract Drawings and meet the requirements specified herein. All hardware shall be stainless steel throughout. Each hatch shall be provided with a permanent label showing the manufacturer's name and address and the model number. Hatches shall have stainless steel hold open arm with positive locking. The hold open arm shall be coated red.

B. Hatches or access doors shall be Type 316 stainless steel, unless noted otherwise, in corrosive conditions or environments and steel or aluminum as noted in all other areas. Aluminum frames to be cast in concrete shall be mill finished with a bituminous coating applied to the exterior of the frame. Steel hatches and access doors shall be hot-dip galvanized per ASTM A 123 or ASTM A 653. All hardware shall be stainless steel throughout.

C. Hatch hardware, including the hinges, shall be fabricated from Type 316 stainless steel.

D. Hatches shall be provided with an automatic hold-open arm with release handle.

E. Hatches shall be designed to be watertight and equipped with an EPDM gasket.

F. Unless otherwise indicated on the Contract Drawings, a fall protection system shall be provided on all hatches. Fall protection systems shall be grating panels that conform to OSHA 29 CFR 1910.23 requirements. The fall protection grating shall be epoxy coated with an OSHA type safety orange color. Safety nets or safety grates fabricated from fiberglass or fiberglass blend are not acceptable.

G. Hatches for spring boxes shall have the interior and exterior handles eliminated and shall have a concealed padlock hasp. The hasp shall be protected from tampering on at least three (3) sides.

H. Hatches for spring boxes shall have a close fitting shoebox type cover which extends down around the frame at least two inches with a gasket between the cover and the frame. The three non-hinged sides of the hatch shall be provided with adjustable cam levers to tighten the cover against the gasket to ensure the hatch is water tight. Hinge fasteners must be completely concealed to inhibit tampering.

I. Hatches shall be supplied with built-in or Contractor installed position intrusion switches as specified on the drawings.

J. Manufacturer's shall be **USF Fabrication, Inc., East Jordan Iron Works,** or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Hatches shall be installed in accordance with the approved detailed shop drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, hatches shall be weather tight and shall be free from warp, twist, or distortion. Hatches shall be lubricated, properly adjusted, and demonstrated to operate freely.

B. All surfaces that come in contact with the concrete shall have a protective coating.

C. Unless otherwise indicated on the Contract Drawings, a 1/2-inch PVC Schedule 80 drain pipe shall be provided from all roof or vault hatches to within 6 inches of the floor if the structure has a floor drain. If a floor drain is not available, the hatch drain shall be extended to drain to the ground surface to a location that will not promote surface ponding of the drain water.

- END OF SECTION -

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SECTION 09 90 00
PAINTING AND FINISHES

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers furnishing, surface preparation, and applying paints and coatings, complete and in place, to all specified surfaces including exposed valves, piping or fittings.

B. Definitions

1. The term “paint”, “coatings”, or “finishes” as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.
2. The term “DFT” means minimum dry film thickness, without any negative tolerance.
3. The term “mil” means thousandths of an inch.
4. The term “SSPC” means The Society for Protective Coatings.

C. The following surfaces shall not be coated:

1. Concrete, unless required by items on the concrete coating schedule below or the Drawings.
2. Stainless steel
3. Machined surfaces
4. Grease fittings
5. Glass
6. Equipment nameplates
7. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.

D. The protective coatings applicator (Applicator) shall possess a valid state license as required for the performance of the painting and coating work called for in this specification and shall provide 5 references which show the Applicator has previous successful experience with the indicated of comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the Applicator provided the protective coating.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limit to:

1. Section 01 33 00 Submittal Procedures
2. Section 33 05 05 Ductile Iron Pipe
3. Section 33 11 10 Miscellaneous Appurtenances
4. Section 40 05 13.13 Steel Process Piping

1.3 REFERENCES AND STANDARDS

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

1.	OSHA	Occupation Safety and Health Act: State of Utah and Federal
2.	ICRI	International Concrete Repair Institute Guideline No. 310.2 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1.	ANSI A 13.1	Standard for Scheme for the Identification of Piping Systems
2.	ANSI Z 535	Standard for Safety Colors

C. AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

1.	ASTM C 309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
2.	ASTM D 520	Standard Specification for Zinc Dust Pigment
3.	ASTM D 521	Standard Test Methods for Chemical Analysis of Zinc Dust (Metallic Zinc Powder)
4.	ASTM D 6943	Standard Practice for Immersion Testing of Industrial Protective Coatings Linings
5.	ASTM D 1653	Standard Test Methods for Water Vapor Transmission of Organic Coating Films
6.	ASTM D 2370	Standard Test Method for Tensile Properties of Organic Coatings
7.	ASTM D 2794	Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
8.	ASTM D 4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
9.	ASTM D 4414	Standard Practice for Measurement of Wet Film Thickness by Notch Gages
10.	ASTM D 4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
11.	ASTM D 7234	Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
12.	ASTM D 7682	Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty
13.	ASTM E 96	Standard Test Methods for Water Vapor Transmission of Materials
14.	ASTM F 1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
15.	ASTM F 2170	Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

D. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1.	AWWA C 210	Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
2.	AWWA C 222	Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings

E. AMERICAN CONCRETE INSTITUTE (ACI)

1. ACI 301 Specifications for Structural Concrete

F. NACE International (NACE)

1. NACE RP0287 Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape
2. NACE SP0188 Standard Practice for Discontinuity (Holiday) Testing of Protective Linings
3. NACE SP0892 Standard Practice for Coatings and Linings over Concrete for Chemical Immersion and Containment Service
4. NACE No. 1/SSPC-SP 5 White Metal Blast Cleaning
5. NACE No. 2/SSPC-SP10 Near White Metal Blast Cleaning
6. NACE No. 3/SSPC-SP6 Commercial Blast Cleaning
7. NACE No. 6/SSPC-SP13 Surface Preparation of Concrete

G. SSPC: The Society for Protective Coatings (SSPC)

1. SSPC PA1 - Shop, Field, and Maintenance Painting of Steel
2. SSPC-PA2 – Paint Application Specification No. 2: Measurement of Dry Coating Thickness with Magnetic Gages.
3. SSPC-PA11 - Protecting Edges, Crevices, and Irregular Steel Surfaces by Stripe Coating
4. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning.
5. SSPC-SP10/NACE 2 - Near White Metal Blast Cleaning
6. SSPC-SP16 – Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
7. SSPC-VIS 1 - Guide to Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. CONTRACTOR shall supply shop drawings for approval on all paint materials at least 30 days prior to installation. Submittals shall include the following data sheets:

1. For each paint system used herein, furnish a Paint System Data Sheet (PSDS), Technical Data Sheets, and paint colors available (where applicable) for each product used in the paint system, except for products applied by equipment manufacturers.

C. Where ANSI/NSF 61 approval is required, submit ANSI/NSF 61 certification letter for each coating in the system indicating the product application limits on size of tank or piping, dry film thickness, number of coats, specific product tests, colors certified, and approved additives.

D. Quality Control Submittals:

1. Furnish a list of references for the Applicator substantiating the requirements as specified.

2. Manufacturer's certification stating factory applied coating systems meets or exceeds requirements specified herein.
3. If the manufacturer of finish coating differs from that of shop primer, provide both manufacturers' written confirmation that materials are compatible.

1.5 PAINT DELIVERY, STORAGE, AND HANDLING

A. Deliver paint to the project site in unopened containers that plainly show, at the time of use, the designated name, date of manufacture, color, and name of manufacturer.

B. Store paints in a suitable protected area that is heated or cooled as required to maintain temperatures within the range recommended by the manufacturer.

1.6 QUALITY ASSURANCE

A. All inspection for quality assurance shall ultimately be the responsibility of CONTRACTOR. OWNER retains the right to observe, accept, or reject the work based on the results of CONTRACTOR's inspection or observations by ENGINEER, at OWNER's discretion, in accordance with the specifications.

B. Repair and recoat all runs, overspray, roughness, or any other signs of improper application in accordance with paint manufacturer's instructions and as reviewed by ENGINEER.

C. Observations by OWNER or ENGINEER, or the waiver of inspection of any particular portion of the work, shall not be construed to relieve CONTRACTOR of his responsibility to perform the work in accordance with these Specifications.

1.7 MANUFACTURER'S SERVICES

A. Furnish paint manufacturer's representative to visit jobsite at intervals during surface preparation and painting as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions and these specifications, and as may be necessary to resolve field problems attributable to, or associated with, manufacturer's products furnished under this Contract.

1.8 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS

A. An inspection may be conducted during the eleventh month following completion of coating work. CONTRACTOR and a representative of the coating material manufacturer shall attend this inspection. Defective work shall be repaired in accordance with these specifications and to the satisfaction of OWNER. OWNER may, by written notice to CONTRACTOR, reschedule the inspection to another date within the one-year correction period or may cancel the inspection altogether. CONTRACTOR is not relieved of its responsibilities to correct defects whether or not the inspection is conducted.

PART 2 PRODUCTS

2.1 GENERAL

A. CONTRACTOR shall use suitable coating materials as recommended by the manufacturer. Materials shall comply with Volatile Organic Compound (VOC) limits applicable at the Site.

B. Where manufacturers and product numbers are listed, it is to show the type and quality of coatings that are required. If a named product does not comply with VOC limits in effect at the time of Bid opening, that product will not be accepted, and CONTRACTOR shall propose a substitution product of equal quality that does comply. Proposed substitute materials will be considered as indicated below. Coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, and water and wastewater treatment plants.

C. In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

D. Colors and shades of colors of coatings shall be as indicated or selected by ENGINEER. Each coat shall be of a slightly different shade to facilitate observation of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by OWNER.

E. Substitute or “Or-Equal” Products

1. Basis of Design: The Coating Systems listed below in paragraph 2.3 are based on products from Tnemec Company Incorporated, except where indicated below.
2. Product Substitution: To establish equality under Section 01 60 00 – Product Requirements, the specified coating systems are the minimum standard of quality for this project. Equivalent materials of other manufacturers may be substituted only by approval of ENGINEER. Requests for material substitutions shall be in accordance with requirements of the project specification.
3. Product Requirements: CONTRACTOR shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or equal" product that the material meets the indicated requirements and is equivalent or better in the following properties: Quality, Durability, Resistance to abrasion and physical damage, Life expectancy, Ability to recoat in the future, Solids content by volume, Dry film thickness per coat, Compatibility with other coatings, Suitability to chemical attack, Temperature limitations during application and in service, Type and quality of recommended undercoats or topcoats, Ease of repairing damaged areas, and stability of colors.
4. Manufacturers of “or equal” products shall provide direct performance comparison with the materials specified, in addition to complying with all other requirements of these Specifications. “Or equal” products shall employ the same generic type materials and system components as the specified coating systems.
5. Requests for product substitution shall be made and approved at least 10 days prior to bid date.
6. CONTRACTOR shall bear any additional costs, if a proposed substitution requires changes or additional work.

2.2 COLORS

A. Provide colors as selected by OWNER or ENGINEER.

B. Colors shall be formulated with colorants free of lead, lead compounds, or other materials which might be affected by the presence of hydrogen sulfide or other gas likely to be present at the project.

C. Proprietary identification of colors is for identification only. Any authorized manufacturer may supply color matches.

D. Equipment colors;

1. Equipment shall mean the machinery or vessel itself plus the structural supports and fasteners.
2. Paint non-submerged portions of equipment in the same color as the process piping it serves, except as indicated below:

a. Dangerous parts of equipment and machinery: OSHA Orange
b. Fire protection equipment and apparatus: OSHA Red
c. Radiation hazards: OSHA Purple
d. Physical hazards in normal operating area: OSHA Yellow

3. Fiberglass reinforced plastic (FRP) equipment with an integral colored gel coat does not require painting, provided the color is as specified.

E. Piping color coding shall be in accordance with ANSI A13.1, Division of Drinking Water R-309-525, and International Plumbing Code.

1. Color code non-submerged metal piping except electrical conduit. Paint fittings and valves the same color as the pipe unless otherwise specified.
2. Pipe supports: If pipe supports are not galvanized or stainless steel, supports shall be painted ANSI No. 70 light gray as specified in ANSI Z535.
3. Fiberglass reinforced plastic (FRP) pipe and polyvinyl chloride (PVC) pipe located outside of buildings and enclosed structures will not require painting, unless noted otherwise on the Drawings.

2.3 COATING SYSTEMS

A. System No. 1 Steel – Immersion Potable Water NSF 61 Certification

1. Materials

Type	Epoxy conforming to AWWA C 210 and D 102 (for steel tanks).
VOC content, max, g/L	311
Volume Solids, min, %	67
Demonstrated Suitable for	Long term immersion in water, resistant to corrosion, good color retention
Certification	NSF 61 if in contact with potable water

2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
SSPC-SP10 Near-White Blast Cleaning with minimum angular profile of 1.5 mils	<u>6" -16" Pipes</u> Primer: Tnemec Series 1220 (White) Intermediate: N/A Finish: Tnemec Series 1220 (White) Max thinner: 15%, Recoat cure time 6 hrs @ 75-deg F, Final cure time 7 days @ 75-deg F, Mix ratio 2:1 (A:B by volume), Series 44-700 Accelerator may be added up to 1 fl. oz./gal	<u>6" – 16" Pipes (Tnemec Only)</u> Primer: 6-8 DFT Finish: 6-8 DFT <u>18" and Greater</u> Primer: 3-5 DFT Intermediate: 4-6 DFT Finish: 4-6 DFT
	<u>18" and Greater</u> Primer: Tnemec N140 Pota-Pox Plus (00WH White or 15BL Tank White) Intermediate: Tnemec N140 Pota-Pox Plus (00WH White or 15BL Tank White) Finish: Tnemec N140 Pota-Pox Plus (00WH White or 15BL Tank White) Max thinner: 5% No. 60 by volume, Recoat cure time 9 hrs @ 75-deg F (5 hrs @ 75-deg F with accelerator), Final cure time 30 days @ 75-deg F; Mix ratio 1:1 (A:B by volume), Series 44-700 Accelerator may be added to Part A in the field and may be added at up to 4 fluid ounces per two mixed gallons of parts A and B.	
	Primer: Sherwin Williams Tank Clad HS Intermediate: Sherwin Williams Tank Clad HS Finish: Sherwin Williams Tank Clad HS	
	Primer: Carboline Carboguard 891 VOC Intermediate: Carboline Carboguard 891 VOC Finish: Carboline Carboguard 891 VOC (For AWWA C210 only)	

3. Application
   a. For use on the interior and exterior of steel tanks, pipes, valves, pumps, equipment in potable water service including concrete embedded surfaces of metallic items under submerged conditions, such as wall pipes, pipes, pipe sleeves, access manholes, gate guides and thimbles, and structural steel, except reinforcing steel, and the following specific surfaces unless noted otherwise:
      1) Pump suction and discharge pipe and fittings, steel pipe in spring box, junction box, and overflow structure.

B. System No. 2 (Not Used)

C. System No. 3 Steel – Interior Exposed

1. Materials

Type	Polyamide Epoxy
VOC content, max, g/L	250
Volume Solids, min, %	67
Demonstrated Suitable for	Ferrous, galvanized, surfaces in industrial exposure, resistant to mild corrosion and chemical fumes, has good color and gloss retention
Certification	None

2. Surface preparation and Coating System

Surface Preparation	**Products**	**Total System** (mils)
Ferrous Metal: SSPC-SP6 Commercial Blast Cleaning with a minimum angular anchor profile of 1.5 mils Galvanized and Non-Ferrous: SSPC-SP16 with a minimum angular anchor profile of 1.5 mils	Primer: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Series 69 Hi-Build Epoxoline II	Primer: 3-5 DFT Finish: 4-6 DFT
	Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams Macropoxy 646 Fast Cure Epoxy	
	Primer: Carboline Carboguard 60 Finish: Carboline Carboguard 60	

3. Application
   a. All exposed metal surfaces located inside of structures.
4. Special Requirements
   a. The surface preparation and primer shall be shop applied to all surfaces prior to installation. Finish coats need only be applied to the surfaces exposed after completion of construction.

D. System No. 4 Steel – Exterior Exposed

1. Materials

Type	Zinc-Rich primer with Polyamide Epoxy (intermediate coat), and Aliphatic Acrylic Polyurethane (topcoat)
VOC content, max, g/L	340 Zinc Primer 300 Intermediate and Finish Coats
Demonstrated Suitable for	Ferrous, galvanized, surfaces in industrial exposure, highly resistant to

	abrasion, wet conditions, corrosive fumes, and exterior weathering
Certification	Primer shall be SSPC Paint 20, Type II and meet requirements for ASTM 520 Type III or ASTM 521

2. Surface preparation and Coating System

Surface Preparation	**Products**	**Total System** (mils)
SSPC-SP6 Commercial Blast Cleaning with a minimum angular anchor profile of 1.5 mils	Primer: Tnemec Series 90-97 Tneme-Zinc Intermediate: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Series 1095 Endura-Shield	Primer: 2.5-3.5 DFT Intermediate: 4-6 DFT Finish: 3-5 DFT
	Primer: Sherwin Williams Zinc Clad III HS Intermediate: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams HS Polyurethane 250	
	Primer: Carboline Carbozinc 859 Intermediate: Carboline Carboguard 60 Finish: Carboline Carbothane 134VOC(Gloss) or 133LV(Satin)	

3. Application
   a. All exposed steel surfaces located outside of structures.
4. Special Requirements
   a. The surface preparation and primer shall be shop applied to all surfaces prior to installation. Finish coats need only be applied to the surfaces exposed after completion of construction.

E. System No. 5 Buried Steel Pipe

1. Materials

Type	Polyurethane per AWWA C222
VOC content, max, g/L	No VOC content
Demonstrated Suitable for	Buried or immersed steel pipelines
Certification	NSF 61 if in contact with potable water

2. Surface preparation and Coating System

Surface Preparation	**Products**	**Total System** (mils)
	Futura Coatings - Protec II (White NSF 61 certified)	35-50 mils DFT

Abrasive Blast, or Centrifugal Wheel Blast SSPC-SP5	Tnemec Series 406 Elasto-Shield (NSF 61 Certified) or Series 431 Perma-Shield PL (Non-NSF)	
	Lifelast, Inc. – Durashield 210 (NSF 61 certified)	
	Chemiline – Chemline 2265 (NSF 61 certified)	
	Carboline Polyclad 777 Series (Non-NSF) – Polyclad 767 (NSF 61 certified)	

3. Application
   a. Shop applied on steel pipe where indicated in Section 40 05 13.13 – Steel Process Piping

F. System No. 6 Steel – Doors and Frames

1. Materials

Type	Modified Polyamidoamine Epoxy with Aliphatic Acrylic Polyurethane (topcoat)
VOC content, max, g/L	250
Demonstrated Suitable for	Interior and Exterior Industrial, Architectural, and Commercial applications

2. Surface preparation and Coating System

Surface Preparation	**Products**	**Total System** (mils)
SSPC-SP2/SP3 Hand and Power Tool Cleaning; feather rough edges; remove loose rust, dirt, and other contaminants with sandpaper	Primer: Tnemec Series 135 Chem-Build Finish: Tnemec Series 1095 Endura-Shield	Primer: 3-5 DFT Finish: 3-5 DFT
	Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams HS Polyurethane 250	
	Primer: Carboline Carboguard 60 Finish: Carboline Carbothane 133LV(Satin) or 134VOC(Gloss)	

3. Application
   a. Factory primed steel doors and frames

G. System No. 7 Galvanized Steel and Cast/Ductile Iron – Exterior Exposed

1. Materials

Type	Polyamide Epoxy with Aliphatic Acrylic Polyurethane (topcoat)
VOC content, max, g/L	250
Demonstrated Suitable for	Ferrous, galvanized, nonferrous, cast/ductile iron surfaces in industrial exposure, highly resistant to abrasion, wet conditions, corrosive fumes, and exterior weathering

2. Surface preparation and Coating System

Surface Preparation	**Products**	**Total System** (mils)
Galvanized Steel and Non-Ferrous: SSPC-SP16 brush-off blast cleaning of coated and uncoated galvanized steel and non-ferrous metals to achieve a uniform anchor profile of 1.0-2.0 mils. Ductile and Cast Iron: Prepare all surfaces as per NAPF 500-03 - Uniformly abrasive blast the entire exterior surface using abrasive to an NAPF 500-03-04 with a minimum angular anchor profile of 1.5 mils.	Primer: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Series 1095 Endura-Shield	Primer: 3-5 DFT Finish: 2.5-4 DFT
	Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams HS Polyurethane 250	
	Primer: Carboline Carboguard 890 Finish: Carboline Carbothane 133LV(Satin) or 134VOC(Gloss)	

3. Application
   a. Exposed galvanized and cast/ductile iron surfaces located outside of structures requiring painting and the following specific surfaces unless noted otherwise:
      1) All exposed galvanized pipe
      2) All exposed cast/ductile iron pipe

H. System No. 8 Galvanized Steel and Cast/Ductile Iron – Interior Exposed

1. Materials

Type	Polyamide Epoxy
VOC content, max, g/L	250
Demonstrated Suitable for	Ferrous, galvanized, nonferrous, cast/ductile iron surfaces in industrial exposure, resistant to mild corrosion and chemical fumes, has good color and gloss retention

2. Surface preparation and Coating System

Surface Preparation	**Products**	**Total System** (mils)
Galvanized Steel and Non-Ferrous: SSPC-SP16 brush-off blast cleaning of coated and uncoated galvanized steel and non-ferrous metals to achieve a uniform anchor profile of 1.0-2.0 mils. Ductile and Cast Iron: Prepare all surfaces as per NAPF 500-03 - Uniformly abrasive blast the entire exterior surface using abrasive to an NAPF 500-03-04 with a minimum angular anchor profile of 1.5 mils.	Primer: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Series 69 Hi-Build Epoxoline II	Primer: 3-5 DFT Finish: 3 – 5 DFT
	Primer: Sherwin Williams Macropoxy 646 Fast Cure Epoxy Finish: Sherwin Williams Macropoxy 646 Fast Cure Epoxy	
	Primer: Carboline Carboguard 60 Finish: Carboline Carboguard 60	

3. Application
   a. Exposed galvanized and cast/ductile iron surfaces located inside of structures requiring painting and the following specific surfaces unless noted otherwise:
      1) All exposed galvanized pipe
      2) All exposed cast/ductile iron pipe
   b. Do not paint galvanized steel mechanical pipe and equipment supports unless noted otherwise.

I. System No. 9 Concrete Floors – Light Traffic, Low Impact

1. Materials

Type	Modified Polyamine Epoxy
VOC content, max, g/L	75
Demonstrated Suitable for	Concrete floors providing protection against various acids and alkalis and frequent cleaning

2. Surface preparation and Coating System

Surface Preparation	**Products**	**Total System** (mils)
SSPC-SP13 Concrete Surface Preparation, ICRI CSP 2-4	Primer: Tnemec Series 201 Epoxoprime Intermediate: Tnemec Series 281 Tneme-Glaze Finish: Tnemec Series 281 Tneme-Glaze	Primer: 6-8 DFT Intermediate: 6-8 DFT Finish: 6-8 DFT
	Primer: Sherwin Williams Armorseal 33 Intermediate: Sherwin Williams 650 SL/RC Finish: Sherwin Williams 650 SL/RC	
	Primer: Carboseal 720 Intermediate: Carboline Carboseal 745 Finish: Carboline Carboseal 745	

3. Application
   a. Concrete floors inside the pump station.

J. System No. 10 Concrete Floors – Chemical Exposure

1. Materials

Type	Modified Polyamine Epoxy (primer) with Polyamine Novolac Epoxy (topcoats)
VOC content, max, g/L	75
Demonstrated Suitable for	Highly chemical- and solvent-resistant on concrete floors and walls providing protection against abrasion, impact, most acids, alkalis, and solvents

2. Surface preparation and Coating System

Surface Preparation	Products	Total System (mils)
SSPC-SP13 Concrete Surface Preparation, ICRI CSP 2-4	Primer: Tnemec Series 201 Epoxoprime Intermediate: Tnemec Series 282 Tneme-Glaze Finish: Tnemec Series 282 Tneme-Glaze	Primer: 6-8 DFT Intermediate: 6-8 DFT Finish: 6-8 DFT
	Primer: Carboline Semstone 110 Intermediate & Finish: Semstone 145 (Applied in singe coat at total 12-16 DFT)	

3. Application
   a. Concrete floors inside the Chlorination Room.

K. System No. 11 (Not Used)

L. System No. 12 – Concrete Walls and Concrete Masonry Units, Interior – Not Exposed to Chemicals

1. Materials

Type	Latex Filler/Water Based Acrylic Epoxy
VOC content, max, g/L	<60/244
Demonstrated Suitable for	long term protection for interior exposures

2. Coating System

Products	Total System (mils)
Filler: Tnemec Series 54 Intermediate: Tnemec H.B. Tneme-Tufcoat Series 113 Finish: Tnemec H.B. Tneme-Tufcoat Series 113	Surfacer/Filler Intermediate: 4-6 DFT Finish: 4-6 DFT
Filler: Sherwin-Williams PrepRite B25W25 Finish: Sherwin-Williams Water Based Catalyzed Epoxy B70 Series	
Filler: Carboline Sanitile 100 Finish: Carboline Sanitile 555VOC	

3. Surface preparation
   a. Surface cracks, holes, or other imperfections in concrete surfaces only that exceed 1/64 of an inch shall be filled with pointing mortar. Masonry joints found to be unsound, hollow, or otherwise defective shall be raked out to a depth of 1/2 inch and pointed with mortar.

b. Remove loose particles and foreign matter. Remove oil or foreign substances with a cleaning agent which will not affect the coating.
c. Scrub and rinse surfaces with water and let dry.
d. Protect adjacent surfaces not scheduled to receive coating and landscaping, property and vehicles from over spray and drift.
e. Concrete shall cure a minimum of 28 days before application.
f. Apply coating per manufacturer's recommendations and instructions.

4. Application
   a. Interior concrete masonry unit walls in the Pump Room.

M. System No. 13 – Concrete Walls and Concrete Masonry Units, Interior – Exposed to Chemicals

1. Materials

Type	Epoxy
VOC content, max, g/L	<50/244
Demonstrated Suitable for	long term protection for interior exposures

2. Coating System

Products	**Total System** (mils)
Filler: Tnemec Series 130 Environfill Intermediate: Tnemec Series 69 Hi-Build Epoxoline II Finish: Tnemec Hi-Build Series 69 Epoxoline II	Surfacer/Filler: 60 to 115 sq ft per gallon Intermediate: 4-6 DFT Finish: 4-6 DFT

3. Surface preparation
   a. Masonry joints found to be unsound, hollow, or otherwise defective shall be raked out to a depth of 1/2 inch and pointed with mortar.
   b. Remove loose particles and foreign matter. Remove oil or foreign substance with a cleaning agent which will not affect the coating.
   c. Scrub and rinse surfaces with water, and let dry.
   d. Protect adjacent surfaces not scheduled to receive coating and landscaping, property and vehicles from over spray and drift.
   e. Concrete shall cure a minimum of 28 days before application.
   f. Apply coating per manufacturer's recommendations and instructions.
4. Application
   a. Interior concrete masonry unit walls inside the Chlorination Room.

N. System No. 14 (Not Used)

O. System No. 15 Wood, Interior Exposed

1. Materials

Type	Acrylic
VOC content, max, g/L	50

Demonstrated Suitable for	Wood trim and plywood sheathing in pump stations and similar municipal water and wastewater facilities.

2. Surface preparation and Coating System

Surface Preparation	**Products**	**Total System** (mils)
Surface Preparation: Sand rough areas, Clean and Dry	Primer: Sherwin Williams Multi-purpose Interior-Exterior Latex Primer-Sealer Intermediate: Sherwin Williams Pro-Industrial Acrylic Coating Finish: Sherwin Williams Pro-Industrial Acrylic Coating	Primer: 0.7-1.5 DFT Intermediate: 2-3 DFT Finish: 2-3 DFT
	Primer: Tnemec Series 51-1051 Elasto-Grip Intermediate: Tnemec Series 1026 EnduraTone Finish: Tnemec Series 1026 EnduraTone	
	Primer: Carboline Sanitile 120 Intermediate: Carboline Carbocrylic 3359 Finish: Carboline Carboguard 3359	

3. Application
   a. Trim and plywood sheathing

2.4 SPECIAL COATING SYSTEMS

A. System 200 - PVC Tape: Prior to wrapping the pipe with PVC tape, the pipe and fittings first shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half-lapped, to a total thickness of 40 mils. PVC Tape wrap buried pipe where indicated on the Contract Drawings.

B. System 201 – Water Retardant, Concrete and Masonry

1. Materials and Coating System

Type	Silane-modified siloxane
Demonstrated suitable for	Repelling water from vertical concrete and masonry surfaces
VOC Content, g/L, max	250
Products, or approved equal	TAMMS Barracade M.E./9 Rainguard Blok-Lok Tnemec Dur A Pell 20 Series 636

2. Preparation

a. Surface cracks, holes, or other imperfections in concrete surfaces only that exceed 1/64 of an inch shall be filled with pointing mortar. Masonry joints found to be unsound, hollow, or otherwise defective shall be raked out to a depth of 1/2 inch and pointed with mortar.
b. Remove loose particles and foreign matter. Remove oil or foreign substance with a cleaning agent which will not affect the coating.
c. Scrub and rinse surfaces with water, and let dry.
d. Protect adjacent surfaces not scheduled to receive coating and landscaping, property and vehicles from over spray and drift.
e. Concrete shall cure a minimum of 28 days before application.
f. Apply coating per manufacturer's recommendations and instructions.

3. Application
   a. Exterior concrete walls of Pump House.

C. System 202 – Polyethylene Encasement: Application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C. Provide polyethylene encasement where indicated on the Contract Drawings or per Section 30 05 05 – Ductile Iron Pipe.

D. System 203 - Cement Mortar Coating: A 1-1/2-inch minimum thickness mortar coating reinforced with 1/4-inch galvanized welded wire fabric shall be provided. The cement mortar shall contain no less than one part Type V cement to 3 parts sand. The cement mortar shall be cured by a curing compound meeting the requirements of ASTM C 309, Type II, white pigmented, or by enclosure in an 8-mil thick polyethylene sheet with all edges and joints lapped by at least 6-inches.

E. System 204 (Not Used)

2.5 CONCRETE FINISHES

A. Exterior Above Grade Concrete: Concrete surfaces exposed to view outside the building and including 6 inches below finished grade on the building or structure should be finished with a "Class B" finish. Products for the "Class B" finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.

B. Interior Exposed Above Floor Concrete: Interior above grade concrete shall be finished with a "Class B" finish. Products for the "Class B" finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.

C. Interior Concrete Floors: Interior concrete floors shall be finished with a "Trowel" finish. Products for the "Trowel" finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.

D. Exterior Concrete Flat Surfaces: Exterior concrete flat surfaces shall be finished with a "Broom" finish. Products for the "Broom" finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.

PART 3 EXECUTION

3.1 GENERAL

A. The intention of this specification is for all new, interior and exterior, masonry, concrete, and metal, whether atmospheric or submerged exposure surfaces to be painted whether specifically mentioned or not, except as modified herein. Concealed structural steel surfaces shall receive a prime coat only unless modified herein.

B. Surface preparation and coating application shall be in accordance with these specifications and the coating manufacturer's written product data sheets and written recommendations of the manufacturer's technical representative. Where conflict occurs between the manufacturer's recommendations and these specifications, the more stringent of the two shall apply unless approved by ENGINEER.

C. For immersion coatings, obtain full cure for completed system before immersing or allowing exposure to water of condensation for more than 12 hours.

3.2 REGULATORY REQUIREMENTS

A. Meet federal, state, and local requirements limiting the emission of volatile organic compounds and worker exposures.

B. Protect workers and comply with applicable federal, state, and local air pollution and environmental regulations for surface preparation, blast cleaning, disposition of spent aggregate and debris, coating application, and dust prevention including but not limited to the following Acts, Regulations, Standards, and Guidelines:

1. Clean Air Act
2. National Ambient Air Quality Standard
3. Resource Conservation and Recovery Act (RCRA)
4. SSPC Guide 6

C. Comply with applicable federal, state, and local regulations for confined space entry.

D. Provide and operate equipment that meets explosion proof requirements.

3.3 ENVIRONMENTAL CONDITIONS

A. Do not apply paint in extreme heat, temperatures below 40 degrees F, nor in dust, smoke-laden atmosphere, damp or humid weather. The Applicator shall adhere to the manufacturer's recommendations regarding environmental conditions. The Applicator shall monitor humidity, air temperature, and surface temperature with properly calibrated instruments.

B. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent, nor whenever surface temperature is less than 5 degrees F above dew point of ambient air. Strictly adhere to manufacturer's recommendations.

C. Surface preparation power tools and blast equipment shall contain dust collection devices that will prevent discharge of dust particles into the atmosphere around electrical or mechanical equipment unless otherwise permitted by ENGINEER.

D. Where weather conditions or project requirement dictate, the Applicator shall provide and operate dehumidification equipment to maintain environmental conditions suitable for abrasive blasting and coating application as specified.

3.4 WORKMANSHIP

A. Skilled craftsmen and experienced supervision shall be used on coating work.

B. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough surface preparation. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given so that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.

C. Damage to other surfaces resulting from the work shall be cleaned, repaired, and refinished to original condition.

3.5 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for other procedures relative to coating shall be strictly observed.

B. Coating materials shall be used within the manufacturer's recommended shelf life.

C. Coating materials shall be stored under the conditions recommended by the Product Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings from different manufacturers shall not be mixed together.

3.6 SURFACE PREPARATION

A. All surfaces which receive paint or other coatings shall be prepared in accordance with the recommendations of the manufacturer of the material being used. The Applicator shall examine surfaces to be coated and shall correct surface defects before application of any coating material. Marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any field coating application.

B. Perform sandblasting for piping and any other items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed. Materials, equipment, and procedures shall meet requirements of the Society for Protective Coatings (formerly the Steel Structures Painting Council).

3.7 PROTECTION OF MATERIALS NOT TO BE PAINTED

A. Surfaces that are not to receive coatings shall be protected during surface preparation, cleaning, and coating operations.

B. Remove, mask or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.

C. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

D. Protect working parts or mechanical and electrical equipment and motors from damage.

E. Care shall be exercised not to damage adjacent work during blasting operations. Spraying shall be conducted under carefully controlled conditions. CONTRACTOR shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blasting or coating operations.

3.8 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the the Society for Protective Coatings shall form a part of this specification:

1. Solvent Cleaning (SSPC SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.
2. Hand Tool Cleaning (SSPC SP2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.
3. Power Tool Cleaning (SSPC SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.
4. White Metal Blast Cleaning (SSPC SP5): Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.
5. Commercial Blast Cleaning (SSPC SP6): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.
6. Brush-Off Blast Cleaning (SSPC SP7): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.
7. Near-White Blast Cleaning (SSPC SP10): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.
8. Surface Preparation of Concrete (SSPC-SP13): Removal of protrusions, laitance and efflorescence, existing coatings, form-release agents, and surface contamination by detergent or steam cleaning, abrasive blasting, water jetting, or impact or power tool methods as appropriate for the condition of the surface and the requirements of the coating system.
9. Surface Preparation (SSPC-SP16): Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

3.9 FERROUS METAL SURFACE PREPARATION (UNGALVANIZED)

A. The minimum abrasive blasting surface preparation shall be as indicated in the coating system schedules included at the end of this Section. Where there is a conflict between these requirements and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.

B. Oil, grease, welding fluxes, and other surface contaminants shall be removed by solvent cleaning per SSPC SP1 - Solvent Cleaning prior to blast cleaning.

C. Round or chamfer all sharp edges and grind smooth burrs and surface defects and weld splatter prior to blast cleaning.

D. Surfaces shall be cleaned of dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming, or another approved method prior to painting.

E. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.

F. Damaged or defective coating shall be removed by the blast cleaning to meet the clean surface requirements before recoating.

G. If the required abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC SP2 or SSPC SP3 may be used as per manufacturers recommendations.

H. Shop-applied coatings of unknown composition shall be completely removed before the indicated coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC SP1 before the abrasive blast cleaning has been started.

I. Shop primed equipment shall be solvent-cleaned in the field before finish coats are applied.

J. Exposed ductile iron pipe shall be given a shop coat of rust-inhibitive primer conforming to these specifications. Abrasive blasting of the asphaltic coating on ductile iron pipe will not be allowed.

3.10 FERROUS METAL SURFACE PREPARATION (GALVANIZED)

A. Galvanized ferrous metal shall be alkaline cleaned per SSPC SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system, followed by blast cleaning per SSPC SP16.

B. Pretreatment coatings of surfaces shall be in accordance with the printed recommendations of the coating manufacturer.

3.11 CONCRETE BLOCK MASONRY SURFACE PREPARATION

A. Surface preparation shall not begin until at least 30 Days after the masonry has been placed.

B. Oil, grease, and form release and curing compounds shall be removed by detergent cleaning per SSPC SP1 before abrasive blast cleaning.

C. Concrete block masonry surfaces to be coated shall be abrasive blast cleaned to remove existing coatings, laitance, deteriorated concrete, and to roughen the surface equivalent to the surface recommended by manufacturer.

D. If acid etching is required by the coating application instructions, the treatment shall be made after abrasive blasting. After etching, rinse surfaces with water and test the pH. The pH shall be between neutral and 8.

E. Surfaces shall be clean and as recommended by the coating manufacturer before coating is started.

F. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model BD-2100, or equal.

3.12 CAST-IN-PLACE CONCRETE SURFACE PREPARATION

A. Concrete surfaces to receive protective coating shall be cast with a Smooth Form Finish in accordance with ACI 301. Surfaces shall not be rubbed, sacked, troweled or otherwise finished in any manner that will obscure or cover the parent concrete surface with materials other than materials as specified in this Section.

B. All surfaces must be clean, dry and free of oil, grease and other contaminants, prior to preparation in accordance with NACE No. 6/SSPC-SP13. Concrete surfaces must be sound and capable of supporting the corrosion protection lining system.

C. Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers, existing coatings, and other contaminants and to provide the recommended ICRI-CSP Profile.

D. Level or grind concrete substrates to produce a uniform and smooth surface, including removal of sharp edges, ridges, form fins, and other concrete protrusions.

E. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model BD-2100, or equal.

3.13 SHOP COATING REQUIREMENTS

A. Unless otherwise indicated, items of equipment or parts of equipment which are not submerged in service shall be shop-primed and then finish-coated in the field after installation with the indicated or selected color. The methods, materials, application equipment, and other details of shop painting shall comply with this Section. If the shop primer requires topcoating within a specific period of time, the equipment shall be finish coated in the shop and then be touched up after installation.

B. Items of equipment or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have surface preparation and coating performed in the field.

C. For certain pieces of equipment, it may be undesirable or impractical to apply finish coatings in the field. Such equipment shall be primed and finish coated in the shop and touched up in the field with the identical material after installation. CONTRACTOR shall require the manufacturer of each such piece of equipment to certify as part of its Shop

Drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the Shop Drawings for the equipment.

D. For certain small pieces of equipment, the manufacturer may have a standard coating system that is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the Shop Drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.

E. Shop-painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 2 months before being topcoated, or less time if recommended by the coating manufacturer.

F. CONTRACTOR shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment Shop Drawings.

G. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions.

3.14 APPLICATION

A. General

1. Schedule inspection with ENGINEER in advance for cleaned surfaces and all coats prior to each succeeding coat.
2. Apply coatings in accordance with the paint manufacturer’s recommendations and these specifications, whichever is more stringent. Allow sufficient time between coats to assure thorough drying of previously applied paint.
3. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same day.
4. Special attention shall be given to materials that will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.
5. Finish coats, including touch-up and damage repair coats shall be applied in a manner that will present a uniform texture and color matched appearance.
6. Non-buried steel piping shall be abrasive blast cleaned and primed before installation.
7. Finish coats shall be applied after concrete, masonry, and equipment installation is complete, and the working areas are clean and dust free.

3.15 CURING OF COATINGS

A. CONTRACTOR shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the most stringent, prior to placing the completed coating system into service.

B. In the case of enclosed areas, forced air ventilation, using heated air, if necessary, may be required until the coatings have fully cured.

3.16 SHOP AND FIELD OBSERVATION AND TESTING

A. CONTRACTOR shall give ENGINEER a minimum of 3 Days advance notice of the start of any field surface preparation or coating application, and a minimum of 7 Days advance notice of the start of any surface preparation activity in the shop.

B. Observation by ENGINEER, or the waiver of inspection of any particular portion of the work, shall not relieve CONTRACTOR of its responsibility to perform the work in accordance with these Specifications.

C. CONTRACTOR shall furnish inspection devices in good working condition for the detection of holidays and measurement of dry film thicknesses of coatings. Dry-film thickness gauges shall be made available for ENGINEER's use while coating is being done, until final acceptance of such coatings. CONTRACTOR shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of ENGINEER.

D. CONTRACTOR shall test for continuity (holiday test) all coated surfaces inside reservoirs, other surfaces that will be submerged in water or other liquids, surfaces that are enclosed in a vapor space in such structures, and surfaces coated with any of the submerged and severe service coating systems. Areas that contain discontinuities shall be marked and repaired or recoated in accordance with the coating manufacturers' printed instructions and then be retested.

1. Coatings with thickness exceeding 20-mils total DFT: Pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the required coating thickness.
2. Coatings with thickness of 20-mils or less total DFT: Tinker & Rasor Model M1 nondestructive type holiday detector, K-D Bird Dog, or equal shall be used. The unit shall operate at less than 75 volts. For thicknesses between 10- and 20-mils, a nonsudsing type wetting agent, such as Kodak Photo-Flo or equal, shall be added to the water prior to wetting the detector sponge.

E. On ferrous and non-ferrous the dry film coating thickness shall be measured in accordance with the SSPC PA 2 using a magnetic type dry film thickness gauge such as Mikrotest Model FM, Elcometer Model 111/1EZ, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.

F. Evaluation of blast cleaned surface preparation will be based upon comparison of the blasted surfaces with the standard samples available from SSPC and NACE, such as using NACE standards TM-01-70 and TM-01-75.

G. Visually inspect concrete, nonferrous metal, plastic, drywall, and wood surfaces to ensure proper and complete coverage has been attained.

3.17 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at the end of each day.

B. Upon completion of the work, remove staging, scaffolding, and containers from the site or destroy in a legal manner.

C. Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

D. Damages due to overspray on buildings, vehicles, trees, or other surfaces not specified to be painted would be the responsibility of CONTRACTOR.

3.18 MANUFACTURER' SERVICES

A. Furnish paint manufacturer's representative to visit jobsite at intervals during surface preparation and painting as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions and these specifications, and as may be necessary to resolve field problems attributable to, or associated with, manufacturer's products furnished under this Contract.

- END OF SECTION –

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SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall provide fire protection equipment and appurtenant work, complete and in place, according to the Contract Documents.

B. If more than one fire extinguisher or other fire protection equipment is required, provide products from a single manufacturer.

1.2 RELATED WORK

A. Related work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM E 814 Standard Test Method for Fire Tests of Penetration Firestop Systems

C. NATIONAL FIRE PROTECTION ASSOCIATION PUBLICATIONS (NFPA)

1. NFPA No. 10 Standard for Portable Fire Extinguishers

D. INTERNATIONAL FIRE CODE (IFC)

1.4 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures

B. Submit manufacturer’s literature, installation instructions, and fire protection equipment details.

PART 2 PRODUCTS

2.1 GENERAL

A. Fire protection equipment shall comply with the IFC, NFPA Pamphlet No. 10, and the manufacturer’s recommendations.

2.2 MATERIALS

A. Fire Extinguisher Designated FE-1: FE-1 fire extinguishers shall be 10 pound minimum capacity, A.B.C. dry-chemical type, with minimum UL rating of 4A:80BC.

B. Fire Extinguisher Designated FE-2: FE-2 fire extinguishers shall be 20 pound minimum capacity, A.B.C. dry-chemical type, with minimum UL rating of 20A:120BC.

C. Fire Extinguisher Designated FE-3: FE-3 fire extinguishers shall be 10 pound minimum capacity, carbon dioxide type, with minimum UL rating of 10B:C.

D. Fire Extinguisher Designated FE-4: FE-4 fire extinguishers shall be 5 pound minimum capacity, A.B.C. dry-chemical type, with minimum UL rating of 2A:10BC.

E. Fire Extinguisher Cabinet (FEC) shall be semi-recessed stainless steel cabinet with stainless steel door and frame, and projecting, convex, butyrate plastic, canopy type viewing door cover. The size shall be as necessary to hold the fire extinguisher indicated at the cabinet location. Fire-rated cabinets conforming to ASTM E 814 shall be used in fire-rated walls.

F. Mounting brackets shall be specially designed for fire extinguisher.

G. Other materials not specifically shown on the Contract Drawings or listed in the specifications but required for a complete and proper installation shall be as selected by CONTRACTOR, subject to approval by ENGINEER.

H. Fire protection equipment shall be manufactured by **Larsen's Manufacturing, Amerex Corporation, Potter-Roemer**, or approved equal.

PART 3 EXECUTION

3.1 DELIVERY AND STORAGE

A. Fire protection equipment shall be delivered to the site in unbroken packages or containers bearing the manufacturer's label with product description and rating.

B. Products shall be carefully stored in an area that is protected from deleterious elements as recommended by the manufacturer. Storage shall be in a manner that will prevent damage to the material and finish of the equipment.

3.2 INSTALLATION

A. All equipment shall be mounted and installed as per NFPA Pamphlet No. 10 and the manufacturer recommendations unless otherwise directed by the Fire Marshall. Coordinate final location and mounting heights with the fire Marshall prior to installation.

B. Fire extinguishers shall be provided with and installed on brackets or brackets within cabinets. CONTRACTOR shall provide blocking and other reinforcing in walls to support the fire extinguishers.

- END OF SECTION –

SECTION 22 10 10
PLUMBING PIPING AND SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. CONTRACTOR shall furnish and install plumbing piping and specialties, complete and operable, as indicated on the Contract Drawings and in accordance with the Contract Documents.

B. Plumbing piping and specialties include piping, pipe hangers, sleeves, supports, brackets, valves, drains, cleanouts, hose bibs, yard hydrants, and related items.

1.2 RELATED WORK

A. Related work specified in other Sections includes but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 05 45 00 Mechanical Metal Supports
3. Section 09 90 00 Painting and Finishes
4. Section 33 05 03 Copper Pipe
5. Section 33 05 26 Utility Identification
6. Section 33 12 00 Mechanical Appurtenances
7. Section 33 13 00 Pipeline Testing and Disinfection
8. Section 40 05 13.19 Stainless Steel Process Piping

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

1. B31.1 Power Piping

C. AMERICAN STANDARDS FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 74 Standard Specification for Cast Iron Soil Pipe and Fittings
2. ASTM B 43 Standards for Seamless Red Brass Pipe

D. CAST IRON SOIL PIPE INSTITUTE (CISPI)

1. CISPI 301 Standard Specification for Hub-less Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

E. INTERNATIONAL MECHANICAL CODE (IMC)

F. INTERNATIONAL PLUMBING CODE (IPC)

G. FACTORY MUTUAL INSURANCE COMPANY (FM GLOBAL)

1. FM 1680 Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/Commercial and Residential

1.4 PIPING SYSTEM LAYOUTS

A. Piping system drawings are diagrammatic and are intended to show the approximate location of equipment and piping. Verify dimensions, whether in figures or scaled, in the field. CONTRACTOR is responsible for the installation of complete and workable systems whether completely detailed on the plans or not.

B. Ascertain locations of apparatus, fixtures, equipment, and piping in the field, and layout work accordingly. ENGINEER reserves the right to make minor changes in location of piping and equipment up to the time of installation without additional cost to OWNER.

1.5 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit general arrangement drawings of system components.

C. Submit product catalog cut sheets and other manufacturer information.

1.6 REQUIREMENTS OF REGULATORY AGENCIES

A. Install work per applicable provisions of codes, rules, regulations, statutes, and ordinances of authorities having jurisdiction.

PART 2 PRODUCTS

2.1 GENERAL

A. Plumbing piping and specialties shall be as recommended by the manufacturer for the intended use.

B. Any pipe, plumbing fitting or fixture, solder, or flux used in the installation or repair of any potable water system shall be “lead free” except where necessary for the repair of leaded joints of cast iron pipes.

2.2 PIPING AND FITTINGS

A. Cast iron sanitary, storm, vent pipe and fittings shall be manufactured in accordance with ASTM A 74.

B. Hub-less cast iron soil pipe and fittings with **Camp-All** type pipe couplings, or approved equal, shall be used for above ground sanitary, storm, and vent piping where approved for use by local authorities.

C. Hub-less cast iron soil pipe and fittings shall meet CISPI Standard 301.

D. Pipe couplings shall have high-torque capacity and shall meet FM Standard 1680.

E. Copper tubing and fittings for potable water shall be in accordance with Section 33 05 03 – Copper Pipe.

F. Brass piping shall match iron pipe size standards and meet ASTM B 43 Standards for Seamless Red Brass Pipe.

G. Stainless Steel Pipe shall be Type 304 Stainless Steel, unless otherwise specified, and shall be in accordance with Section 40 05 13.19 – Stainless Steel Process Pipe.

2.3 PIPE HANGERS AND SUPPORTS

A. Pipe hangers and supports shall meet the requirements of IMC Section 305 Pipe Support, Section 05 45 00 – Mechanical Metal Supports, and the following. If there is a discrepancy in the requirements of these documents the more stringent requirement shall apply.

B. Properly support, suspend, or anchor all piping and fittings to prevent sagging, over stressing, or longitudinal movement of piping, and to prevent thrust or loads on or against other equipment.

C. Support horizontal piping on adjustable split steel ring or clevis hangers. The following schedule shows minimum spacing.

1. Steel, Brass and Copper:
   a. 1-1/4" and smaller — 6'-0" on center
   b. 1-1/2" thru 3" — 8'-0" on center
   c. 4" and larger — 12'-0" on center

2. PVC, CPVC, AND ABS:
   a. 1" and smaller — 4'-0" on center
   b. 1-1/4" thru 2" — 5'-0" on center
   c. 2-1/2" thru 4" — 6'-0" on center
   d. 5" and larger — 8'-0" on center

D. Support insulated piping with pipe saddles and hangers that fit on outside of insulation. Do not compress or damage pipe insulation with hangers or supports.

E. Provide all rigid hangers with a means of vertical adjustment after erection.

F. Use copper or copper plated hangers for supporting uninsulated copper pipe.

G. All vertical and horizontal piping supports shall be fiberglass **EnduroStrut by Enduro Systems, Inc**., or approved equal.

H. Perforated strap hangers or wire supports will not be permitted.

2.4 INSERTS

A. Furnish and set inserts in concrete forms; provide reinforcing rods for pipe sizes over 3 inches or equivalent.

B. Furnish concrete inserts as follows: Black, malleable iron, universal type for threaded connections with lateral adjustment. Inserts shall be galvanized unless noted otherwise on the Drawings.

2.5 INSULATION

A. Hot water piping, valves, fittings, and exposed horizontal sanitary, storm, and vent piping shall be provided with one-inch thick insulation.

B. Covering valves, flanges, fittings, and ends of insulation with pre-molded high- and low-temperature PVC fitting cover, end cap, or similar pre-formed unit. The pre-formed unit covers shall be sized to receive the same thickness insulation as used in adjacent ping.

C. Exposed supply and drain piping for lavatories shall be insulated under the wash basins in order to prevent burns and abrasions to handicapped persons. Removeable insulated covers shall be **Handy-Shield Type by Plumberex Specialty Products**, or approved equal.

2.6 SHIELDS

A. Provide shields to protect insulation in all areas.

B. Provide approved galvanized form shields to isolate pipes in contact with hangers and supports.

C. Furnish low compressive insolation protector shields. Size the shields per the manufacturer's recommendations.

2.7 SLEEVES

A. Where pipes pass through floors, footings, foundations, walls, or ceilings, furnish and install pipe sleeves. Sleeves for concealed piping shall be of Schedule 40 galvanized steel pipe one size larger than the pipe passing through. For exposed piping Schedule 40 black steel pipe installed so as to be completely covered by escutcheons. Extend sleeves through floors 1/2 inch above finish floor.

2.8 JOINTS

A. For screwed pipe make ends with sharp, clean tapered threads using Teflon tape on the 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 for the ASME B31.1.

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 mechanical pipe couplings and fittings.

E. For no-hub cast iron soil pipe use double screw joint neoprene coupler.

2.9 UNIONS

A. Furnish and install unions for each valve or piece of equipment to permit easy installation and removal of equipment.

2.10 VALVES

A. Water shutoff valves shall be the gate or ball type as designated on the drawings, except on fixture supply piping where globe style valves shall be used.

B. Hose Bibs shall be provided where indicated on the Drawings. The hose nipple shall be a female iron pipe thread inlet with hose thread outlet. Hose bibs shall be 3/4-inch size unless noted otherwise on the Drawings.

C. Gate and ball valves shall be in accordance with Section 33 12 00 – Mechanical Appurtenances.

2.11 FLOOR DRAINS IN CONCRETE FLOORS

A. Floor drains in concrete floors shall be constructed of cast iron of the size indicated on the Drawings and provided with sediment buckets.

B. Each floor drain located on an upper floor shall have a clamping collar with 4 pound sheet lead flashing 12 inches minimum all around. Where flashing does not comply with local code use epoxy waterproofing membrane.

C. Floor drains shall be **Z520-Y by Zurn Industries, 32100-AE-81 by Josam Company, Figure 2350 by Jay R Smith Mfg. Co.**, or approved equal.

2.12 FLOOR CLEANOUTS

A. Cleanouts in concrete floors shall be heavy plugs with tapered shoulders against heavy brass plugs.

B. Cleanout shall have a minimum diameter of 3-inches.

C. Floor cleanouts shall be fabricated from cast iron with gas and watertight ABS tapered thread plug.

D. Floor cleanout shall be **Z1400 by Zurn Industries, 55000 Series by Josam Company, 4237 Series by Jay R Smith Mfg. Co.**, or approved equal.

2.13 NON-FREEZE WALL HYDRANTS

A. Non-freeze wall hydrants shall be concealed non-freeze key operated wall hydrant with nickel brass or stainless-steel box and door, chrome plated hydrant face, integral vacuum breaker, 3/4-inch hose connection, all bronze head, seat casting and internal working parts, bronze wall casing, and loose key. Non-freeze wall hydrants shall have a maximum operating pressure 125 psi. Manufacturer shall be **Watts HY-725, Woodward B65, Zurn Z1320-EZ, Jay R Smith 5509QT,** or approved equal.

PART 3 EXECUTION

3.1 PREPARATION

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, sprinkler, or mechanical items.

B. Hang or support piping materials from roof support system whenever possible.

C. Do not cut any structural members for installation of piping.

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. Provide reinforcement rod in concrete for inserts carrying pipe over 3 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 squared 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 1 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. Support all piping and make adequate provisions for expansion, contraction, slope and anchorage.

B. The use of pipe hooks, chains, or perforated metal for pipe support will not be permitted.

C. Suspend all piping in the building as indicated.

D. Install hangers to provide minimum 1/2-inch clear space between finished covering and adjacent work.

E. Place a hanger within 1 foot of each horizontal elbow.

F. Use hangers which are vertically adjustable 1-1/2 inch minimum after piping is erected.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Where practical, support riser piping independently of connected horizontal piping.

3.5 PIPING INSTALLATION

A. Cut piping accurately for fabrication to measurements established at the construction site and work into place without springing 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 doors, windows, or access openings. Provide unions in the piping at connections to all equipment. Unions must be accessible.

E. 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.

F. Install all piping systems so they can easily be drained. Provide anti-siphon hose bibbs at low points on water lines.

G. Slope all soil and waste lines within the building at 1/4 inch per foot fall in the direction of flow unless indicated otherwise.

3.6 PRIMING AND COATING

A. Prime coat exposed steel hangers and supports and hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces in accordance with Section 09 90 00 – Painting and Finishes.

3.7 PIPE LABELING

A. Exposed pipe shall be labeled in accordance with Utah State Regulation R309-525-8, Section 33 05 26 – Utility Identification, and the IPC.

1. Labeling shall include direction arrows for flow.

3.8 DISINFECTION AND TESTING

A. CONTRACTOR shall perform such tests as are required by local ordinances and codes in the presence of the local governing authority inspector to show that piping is tight, leak free, and otherwise satisfactory, and shall perform such tests as ENGINEER may direct to ensure that fixtures and equipment operate properly.

B. Disinfect potable water piping in accordance with Section 33 13 00 - Pipeline Testing and Disinfection.

C. Test all potable water piping.

D. Repair defects which develop under tests promptly and repeat tests. No caulking or screwed joints, cracks, or holes will be permitted. Replace pipe or fitting or both with new material when repairing leaks in screwed joints.

E. Repair leaks in copper tubing by melting out joint, thoroughly cleaning both tubing and fitting, and resoldering.

- END OF SECTION -

SECTION 26 05 00
ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION

A. It is the intent of this part of the Contract Documents to cover all work and materials necessary for erecting complete, ready for continuous use, a tested and working electrical system, substantially as indicated on the Plans and as hereinafter specified.

1.2 GENERAL PROVISIONS

A. Minimum sizes of equipment, electric devices, etc., are indicated but it is not intended to show every offset and fitting, nor every structural or mechanical difficulty that will be encountered during the installation of the work.

B. All work indicated on the Plans is approximately to scale, but actual dimensions and detailed drawings should be followed as closely as field conditions permit. Field verification of scale dimensions on Plans is directed since actual locations, distances, levels, etc. will be governed by field conditions.

C. Discrepancies indicated on different Plans, between Plans and actual field conditions, or between Plans and Contract Documents shall be promptly brought to the attention of ENGINEER for a decision.

D. The alignment of equipment and conduit shall be varied due to architectural changes, or to avoid work of other trades, without extra expense to OWNER.

E. CONTRACTOR shall furnish and install all parts and pieces necessary to the installation of equipment in accordance with the best practice of the trade and in conformance with the requirements of these Contract Documents.

F. All items not specifically mentioned in these Contract Documents or noted on the Plans or accepted shop drawings, but which are obviously necessary to make a complete working installation, shall be deemed to be included herein.

G. CONTRACTOR shall lay out and install electrical work prior to placing floors and walls. He shall furnish and install all sleeves and openings through floors and walls required for passage of all conduits. Sleeves shall be rigidly supported and suitably packed or sealed to prevent ingress of wet concrete.

H. CONTRACTOR shall furnish and install all inserts and hangers required to support conduits and other electrical equipment. If the inserts, hangers, sleeves, etc. are improperly placed or installed, CONTRACTOR shall do all necessary work, at his own expense, to rectify the errors.

I. All electrical equipment shall be capable of operating successfully at full-rated load, without failure, at an ambient air temperature of 40 degrees C, and specifically rated for an altitude of 4500 feet.

J. CONTRACTOR shall submit shop drawings, data and details to ENGINEER on all controls, fixtures, wiring, electrical equipment, conduit, etc. for review and acceptance prior to use of any components in the work.

K. All materials, equipment, and parts comprising any unit or part thereof specified or indicated on the Plans shall be new and unused, of current manufacture, and of highest grade consistent to the state of the art. Damaged materials, equipment and parts are not considered to be new and unused and will not be accepted.

1.3 REGULATIONS AND CODES

A. Electrical work, including connection to electrical equipment integral with mechanical equipment, shall be performed in accordance with the latest published regulations of each of the following as well as all State and local codes.

1. NATIONAL ELECTRICAL CODE (NEC)
2. NATIONAL ELECTRICAL SAFETY CODE (NESC)
3. INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)
4. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
5. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
6. INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
7. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
8. NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)
9. FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)
10. UNDERWRITERS' LABORATORIES, INC. (UL).

1.4 COORDINATION OF THE ELECTRICAL SYSTEM

A. CONTRACTOR shall verify all actual equipment and motor full-load and locked-rotor current ratings. The necessary minimum equipment, wire, and conduit sizes are indicated on the Plans. If CONTRACTOR furnishes equipment of different ratings, CONTRACTOR shall coordinate the actual current rating of equipment furnished with the branch circuit conductor size, the overcurrent protection, the controller size, the motor starter, and the branch circuit overcurrent protection. The branch circuit conductors shall have a carrying capacity of not less than 125 percent of the actual full-load current rating. The size of the branch circuit conductors shall be such that the voltage drop from the overcurrent protection devices up to the equipment shall not be greater than 2 percent when the equipment is running at full-load and rated voltage.

1.5 TEST

A. The electrical work shall be free from improper grounds and from short circuits. The correctness of the wiring shall be verified first by visual comparison of the conductor connections with connection diagrams. Individual circuit continuity checks shall next be made by using electrical circuit testers. Last, the correctness of the wiring shall be verified by the actual electrical operation of the electrical and mechanical devices. Any deviation from the wiring indicated on the Plans or accepted drawings shall be corrected and indicated on the Plans.

1.6 CONFORMS TO RECORD DOCUMENTS DRAWINGS

A. Prior to completion of the Contract, CONTRACTOR shall furnish ENGINEER with a set of electrical plans marked with any changes, deviations or additions to any part of the electrical work.

B. Each conductor shall be identified as required by the Contract Documents. This identification shall be indicated on the record documents drawings to enable rapid and accurate circuit tracing by maintenance personnel.

1.7 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Where indicated on the Plans and where required by applicable codes, CONTRACTOR shall furnish and install nameplates which shall be black lamicoid with white letters. The nameplates shall be fastened to the various devices with round head brass screws. Each disconnect means for service, feeder, branch, or equipment conductors shall have nameplates indicating its purpose. All nameplates shall have 3/8-inch high lettering.

2.2 AUTOMATIC EQUIPMENT WARNING SIGNS

A. Permanent warning signs shall be mounted at all mechanical equipment which may be started automatically or from remote locations. Signs shall be in accordance with OSHA regulations and shall be suitable for exterior use. The warning signs shall be fastened with round head brass screws or bolts, located and mounted in a manner acceptable to ENGINEER.

B. Warning signs shall be 7 inches high by 10 inches wide, colored yellow and black, on not less than 18 gauge vitreous enameling stock. Sign shall read:

CAUTION
THIS EQUIPMENT STARTS
AUTOMATICALLY
BY REMOTE CONTROL

PART 3 EXECUTION - Not Used

- END OF SECTION -

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SECTION 26 05 05
ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 DESCRIPTION

A. This section includes general electrical equipment used to complete the electrical system.

1.2 RELATED SECTIONS

A. Related work specified in other sections includes but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 26 05 00 Electrical General Requirements
3. Section 26 05 13 Conductors and Cables
4. Section 26 05 33 Conduit and Raceways
5. Section 26 05 34 Electrical Boxes and Fittings

1.3 SUBMITTALS

A. Submittals will be required for all electrical equipment and shall be made in accordance with Section 01 33 00, CONTRACTOR's Submittals.

PART 2 MATERIALS

2.1 LIGHTING SWITCHES

A. Manufacturers:

1. **Hubbell 1221i (ivory), 1221W (white)**
2. **P&S 20AC1-I (vvory), 20AC1W (white)**
3. **Leviton 1221-2I (ivory), 1221-2W (white)**
4. Or approved equal

B. Specification Grade: Snap switches shall have the number of poles as indicated on the drawings, ivory, rated at 20 ampere.

C. Device Cover Plates:

1. Indoor Industrial Areas: Stainless steel cover plates shall be utilized.
2. Outdoor: Weatherproof cover plates.
3. Indoor in chlorine rooms: Ivory plastic cover plates.

2.2 TRANSFORMERS - DRY TYPE

A. Manufacturers:

1. **Acme Electric Corp**.
2. **Eaton**
3. **Federal Pacific Transformer Corp.**
4. **Hevi-Duty Electric**
5. **General Electric Co.**
6. **Siemens, Inc.**
7. **Square D Co.**
8. Or approved equal.

B. Transformers shall be of the premium high efficiency quiet type and shall be installed where indicated on the Plans. The primary winding of the transformers shall have two 2-1/2 percent taps above and below normal.

C. The transformers shall have a BIL of 10 kV with a temperature class of 185 degrees C for transformers up to 25 kVA and a temperature class of 220 degrees C for transformers rated at 30 kVA and larger.

D. The sound level shall not exceed 44 dBa measured at 5 feet from the transformers after installation. Core and coil assemblies 30 kVA and larger shall be mounted on rubber vibration isolators designed specifically to reduce 120 HZ sound and multiple harmonics.

2.3 ENCLOSURES

A. Manufacturers:

1. **Hammond Manufacturing,**
2. **Nvent Hoffman, Inc.**
3. **Rittal North America, LLC**
4. Or approved equal.

B. This specification includes enclosures to house electrical controls, instruments, terminal blocks, etc. If not indicated otherwise they shall be NEMA 12 for indoor and NEMA 3R for outdoor installations.

C. A rolled lip shall be provided around three sides of the door and around all sides of the enclosure opening. The gasket shall be attached with oil-resistant adhesive and held in place with steel retaining strips. Exterior hardware, such as clamps, screws, and hinge pins, shall be of stainless steel for outdoor installations. A hasp and staple shall be provided for padlocking. Each enclosure shall have a print pocket.

D. Enclosures shall be from 14 gauge steel with seams that are continuously welded. Doors shall have full length piano hinges with the door removable by pulling the hinge pin. They shall be as manufactured by Hoffman, Fischer & Porter, or equal.

E. Finish - Steel: Finish shall be white enamel interior, light grey enamel, ANSI 61 exterior, over phosphatized surfaces. Special finishes and colors shall be furnished for wet locations. Plans should be checked for special conditions.

2.4 DISCONNECT SWITCHES (INDIVIDUAL)

A. Manufacturers:

1. **Eaton.**
2. **General Electric Co.**
3. **Siemens, Inc.**
4. **Square D Co.**
5. Or approved equal.

B. Disconnect switches shall be heavy-duty safety switches with a quick-make, quick-break operating mechanism, full cover interlock and indicator handle. The disconnect switches shall be furnished with fuses of the size indicated on the Plans. One set of spare fuses shall be furnished for each fused disconnect switch.

2.5 CIRCUIT BREAKERS - LOW VOLTAGE (INDIVIDUAL)

A. All circuit breaker frame and trip ratings shall be as indicated on the Plans, except that they shall be coordinated with the ratings of the equipment actually furnished and shall be modified where necessary to suit this equipment. Circuit breakers to be used in motor control centers shall be as indicated on the Plans. When no indication of type is given on the Plans, the following shall govern:

1. Circuit breakers protecting motors rated 7.5 horsepower or less shall be motor circuit protectors, all other circuit breakers shall be molded case circuit breakers.

B. Manufacturers:

1. **Eaton**
2. **General Electric**
3. **Siemens**
4. **Square D Company**
5. Or approved equal.

2.6 FULL-VOLTAGE, NON-REVERSING MOTOR CONTROLLERS

A. GENERAL

1. Provide each motor with a suitable controller and devices that will function as specified for the respective motors and meeting NEMA ICS 2, the NEC, and UL.
2. Provide each motor controller with thermal overload protection in all ungrounded phases. Use protection consisting of thermal overload relays meeting NEMA ICS 2 which are sensitive to motor current and mounted within the motor controller, or a combination of thermal protectors embedded within the motor windings and controller-mounted overload relays, as indicated. Use overload protection devices of the inverse-time-limit type.
3. Provide controller-mounted overload relays of the manual-reset type with externally operated reset button when used without motor thermal protectors; when used in conjunction with thermal protectors, provide the automatic reset

type. Select and install overload relay heaters after the actual nameplate full-load current rating of the motor has been determined.

4. Install and connect any required thermal protector monitoring relay provided by motor manufacturer in motor-control circuit and provide manual reset function. Fuse thermal-protector circuits according to the manufacturer's recommendations.
5. The Booster Pump controller shall be provided with two sets of thermal overload devices, rated for the full load current of the existing motors. The controller shall have a selection switch on the front selecting which thermal overload will be in service.

B. FULL VOLTAGE MAGNETIC STARTERS

1. Provide starters meeting NEMA ICA 2, Class A, with the rating and enclosure shown.
2. Supply individual control power transformers where indicated. The transformers shall have sufficient capacity to serve the connected load and limit voltage regulation to 10-percent during contact or pickup. Fuse one side of the secondary winding and ground the other side. Provide primary, current limiting fuses on all control power transformers.
3. Provide a panel type voltmeter, nominal 4-1/2 inch model with 3-phase, OFF four position selector switch.
4. Provide a panel type ammeter, nominal 4-1/2 inch model with 3-phase, OFF four position selector switch, C.T.'s with proper ratio.
5. For nonhazardous, indoor, dry locations, provide heavy-duty, indicating lights, selector switches, and stations. Utilize General Electric Type CR 104P, or equivalent by Square D, Cutler-Hammer, or other acceptable manufacturer. Acceptable manufacturer. The use of other manufacturer's names referenced to materials herein, shall indicate the quality of material to be provided.

2.7 FUSES, 0-600 VOLTS

A. Provide a complete set of current-limiting fuses wherever fuses are indicated. Supply a set of six spare fuses of each type and each current rating installed. Utilize fuses that fit mountings specified with switches and which provide features rejecting Class H fuses. Provide the following types:

1. For 0- to 600-volt motor and transformer circuits, 0- to 600 amps, UL Class RK-1 with time delay, Bussmann Type LPS-RK, Shawmut Type A6D, or equal.
2. For 0- to 250-volt motor and transformer circuits, 0- to 600 amps, UL Class RK-1 with time delay, Bussmann Type LPN-RK, Shawmut Type A2D-R, or equal.
3. For 0- to 600-volt feeder and service circuits, 0 to 600 amps, UL Class RK-1, Bussmann Type KTS-R Shawmut Type A6K-R, or equal.
4. For 0- to 250-volt feeder and service circuits, 0 to 600 amps, UL Class RK-1, Bussmann Type KTN-R, Shawmut Type A2K-R, or equal.

2.8 MODULAR OVERLOAD RELAYS

A. Where called for on the Plans, modular overload relays shall be provided with the motor starters. The modular overload relays shall be 3-pole solid state devices set

by one plug-in heater and shall protect all 3 phase of the motor in ambient temperatures ranging from -20 degrees to +70 degrees C.

B. The jam modules shall plug in the modular overload relays and shall provide for instantaneous trip of the overload relay should the current exceed a preset value at any time after the motor has accelerated. The modules shall be adjustable to any value between the 150 percent and 400 percent of the motor full-load current.

C. The underload modules shall plug in the MOR and shall provide for overload relay trip whenever the current falls below a set value after the motor has accelerated. The modules shall be adjustable between 50 percent and 90 percent of the full load value of the motor full load current.

2.9 LIGHTING

A. Lighting fixtures shall be as described below and as indicated on the Plans.

B. Fixtures shall include lamps, ballasts, poles, mounting hardware, etc. to provide complete operating units.

C. Fluorescent fixtures shall be rapid start type.

D. Catalog data including applicable coefficients of utilization tables, isolux chart of illumination on a horizontal plane, beam efficiency, horizontal and vertical beam spread, and beam lumens shall be submitted to the ENGINEER for review and acceptance for all fixtures before fixtures are manufactured. Substitutions will be permitted only if acceptable to the ENGINEER.

E. Light Emitting Diode(LED) Lighting

1. The LED Fixture shall consist of a LED Luminaire Assembly, LED Driver and mounting hardware.
2. LED Fixture requirements are as described below:
    a. The input to the LED Lighting Fixture shall be 120 to 277VAC (±10%), 60HZ or as indicated in the Contract Document.
    b. Correlated Color Temperature (CCT) shall be minimum 4000K or as indicated in the Contract Document.
    c. Color Rendering Index (CRI) shall be 70.
    d. A minimum of 50,000 operating hours before reaching the L70 lumen output degradations point without catastrophic failure, or as indicated in the Contract Document.
    e. Conform with UL 8750.
    f. Compliance to FCC CFR Section 15.
3. LED Luminaire Assembly
    a. Definition: Luminaire Assembly is the LED assembly without LED driver.
    b. Input voltage shall be 24VDC, 36VDC or as indicated in the Contract Document.
    c. CCT, CRI, Minimum life and UL conformity requirements are as defined in above article LED Lighting Fixture.
4. LED Driver

a. Must operate input voltage between 120VAC to 277VAC (±10%).
b. Operating frequency must be 60Hz.
c. Must be rated to operate between -40ºC to +50ºC.
d. Must have a minimum efficiency of 85%.
e. Self protected including short circuit protection.
f. Compliance to FCC CFR Section 15.
g. Driver must have a Power Factor (PF) of 0.90.

F. Types and ratings: As shown on "Lighting Fixture Schedule" on Drawings.

2.10 LIGHTING AND POWER DISTRIBUTION PANELBOARDS

A. Circuit Breaker Lighting Panelboards, 240 Volt Maximum

1. Manufacturers:
   a. **Eaton**
   b. **General Electric Co.**
   c. **Siemens**
   d. **Square D Company**
   e. Or approved equal.

B. Circuit Breaker Lighting Panelboards, 480Y/277 Volt Maximum

1. Manufacturers:
   a. Cutler-Hammer Co.
   b. General Electric Co.
   c. Siemens
   d. Square D Company, NF
   e. Or approved equal.

C. General: Provide circuit breaker panelboards meeting standards established by UL, NEMA PB 1, and the NEC. Where used as service entrance equipment, provide panels UL labeled for that use. Furnish panels with fully rated short circuit current equipment rating. Series connected equipment ratings are not acceptable. Provide panels rated for connection to an electric system having an available amperes rms symmetrical short current of 65,000 at 480Y/277 volts. Provide panelboards and circuit breakers suitable for use with 75 degrees C wire at full NEC 75 degrees C ampacity.

D. Cabinets: Furnish boxes large enough to provide a minimum wiring gutter space on both sides and top and bottom of 4-inches by 4-inches minimum. Provide flush or surface mounted boxes as indicated manufactured with reinforced steel frame and code-gauge, hot-dip galvanized sheet steel. Utilize front trim the same size as the box for surface mounted panelboards and 3/4-inch larger all around than the box for flush mounted panelboards. Provide sheet steel fronts finished with prime coat of rust inhibitor and the manufacturer's standard baked enamel or lacquer finish and utilizing adjustable clamps as the means for fastening the front to the boxes. Utilize fronts having doors with concealed hinges and flush type lock and catch device. Provide multipoint locking devices for all doors over 30 inches in height. Key all locks alike, and furnish two milled type keys with each lock. Furnish on door interior a

metal directory frame with transparent plastic face and enclosed directory card. Furnish an engraved, laminate plastic nameplate screwed (no adhesives) to the cabinet exterior face indicating the panelboard designation, service voltage, and phases. Nameplates are described in this section.

E. Interiors:

1. Utilize panelboard interiors that are factory assembled complete with circuit breakers as indicated. Furnish circuit breakers in positions where diagram or schedule indicates SPARE. Furnish only complete provisions for future circuit breakers where diagram indicates SPACE, and cover the resulting opening in the cabinet front with an easily removable metal cover. Utilize panelboards with interiors designed so that circuit breakers can be replaced without removing the main bus.
2. Provide bus bars of copper and full sized throughout their length. Make complete provisions for mounting future circuit breakers throughout the full length of the bus provided regardless of the number of units and spaces called for. Provide all machining, drilling, or tapping required to add or change circuit breakers in the future. Bolt together and rigidly support bus bars and connection straps on molded insulators.
3. Furnish an insulated neutral bus bar rated the same as the phase bus bars and having at least one terminal screw for each branch circuit. Furnish a copper ground bus bar installed on the panelboard frame, bonded to the box, and containing at least one terminal screw for each circuit. Provide solderless main lugs for main, neutral, and ground bus bars. Provide lugs and connection point on phase, neutral, and ground busses suitable for either copper or aluminum conductors.

F. CIRCUIT BREAKERS

1. Furnish indicating type molded circuit breakers providing ON/OFF and TRIPPED positions of the operating handle. Furnish thermal magnetic, quick-make, quick-break circuit breakers which are noninterchangeable in accordance with the NEC. Do not use tandem or dual circuit breakers in normal single-pole spaces. Do not use single-pole circuit breakers with handle ties where multiple circuit breakers are indicated. Utilize multipole circuit breakers designed so that on overload on one pole automatically causes all poles to open. Provide circuit breakers meeting requirements of NEMA AB 1. Install bolt-on circuit breakers in all panelboards.

2.11 CONTROL PANELS

A. Enclosure Manufacturers:

1. **Hammond Manufacturing,**
2. **Nvent Hoffman, Inc.**
3. **Rittal North America, LLC**
4. Or approved equal.

B. ENCLOSURES:

1. This specification includes enclosures to house electrical controls, instruments, terminal blocks, etc. If not indicated otherwise they shall be NEMA 12 for indoor and NEMA 3R for outdoor installations.
2. A rolled lip shall be provided around three sides of the door and around all sides of the enclosure opening. The gasket shall be attached with oil-resistant adhesive and held in place with steel retaining strips. Exterior hardware, such as clamps, screws, and hinge pins, shall be of stainless steel for outdoor installations. A hasp and staple shall be provided for padlocking. Each enclosure shall have a print pocket.
3. Enclosures shall be from 14 gauge steel with seams that are continuously welded. Doors shall have full length piano hinges with the door removable by pulling the hinge pin. They shall be as manufactured by Hoffman, Fischer & Porter, or equal.
4. Finish - Steel: Finish shall be white enamel interior, light grey enamel, ANSI 61 exterior, over phosphatized surfaces. Special finishes and colors shall be furnished for wet locations. Plans should be checked for special conditions.

C. PILOT DEVICES:

1. Manufacturers:
   a. **Allen-Bradley, Bulletin 800T, 30 mm**
   b. **Eaton**
   c. **Square D, Type K, 30 mm - Class 9001**
   d. Or equal.
2. Indicating lights, pushbuttons and selector switches shall be miniature oiltight units. Contact blocks in control circuits shall be NEMA ICS, B150, rated 5 amperes inductive at 120 volts AC. Contact blocks for signal circuits shall be rated 0.06 amperes at 30 volts AC or DC and shall be hermetically sealed and reed switches. Pilot lights for 120 volt AC circuits shall be LED type. Where group lamp test circuits are not specified, individual pilot light assemblies shall be "push-to-test" type. Pilot lights shall be capable of being changed from the front of the panel without special tools.

D. TERMINAL BLOCKS:

1. Manufacturers:
   a. **Allen-Bradley**
   b. **Buchanan**
   c. **Eaton**
   d. **Entrelec (ABB) M4/6**
   e. **Square D Co.**
   f. **Weidmuller**
   g. Or equal
2. Terminal blocks shall be of the size required for conductors therein and a minimum of 50 percent spares shall be provided in each terminal box.

E. FUSE BLOCKS:

1. Manufacturers:
   a. **Entrelec (ABB), M10/13.SF2**
   b. Or approved equal.
2. DIN rail mounted.
3. Terminals shall accommodate 22-10 AWG solid or stranded wires.
4. Provide terminals rated for 600 VAC/VDC and 15 amperes.
5. Device shall be UL listed.

F. TIMING RELAYS:

1. Manufacturer:
   a. **Allen-Bradley,**
   b. **Square D Company**
   c. Approved equal.
2. Timing relays shall be heavy-duty industrial 600 volt, 10 amperes.

G. CONTROL RELAYS:

1. Manufacturer:
   a. **Allen-Bradley**
   b. **Idec RH series**
   c. Or equal.
2. Control relays shall be general purpose “midget” relays, 10 ampere contact rating, with 1, 2, 3 or 4 Form C contacts as shown on the drawings.
3. Relay shall be provided with blade style terminals.
4. Provide LED indicator light with relay.
5. Provide a standard DIN rail mount relay socket.
6. Relay life expectancy shall be in excess of 500,000 operations at 120 VAC.
7. Device shall be UL listed.

H. DIN RAIL CIRCUIT BREAKERS

1. Manufacturer/Model:
   a. **Eaton/FAZ-NA**
   b. **LS Electric**
   c. Approved Equal.
2. DIN Rail mounted.
3. Trip Characteristics: UL C or D.
4. UL Listed under UL 489.
5. Dual rated for AC or DC applications.
6. Single-pole, two-pole or three-pole models.
7. Current limiting design.
8. Thermal-magnetic overcurrent protection.
9. Trip-free design.

I. DIN-RAIL DUPLEX RECEPTACLE

1. Manufacturer/Model:

a. **Phoenix Contact/EM-DUO**
b. Approved Equal.

2. Color: Ivory.
3. UL: 508
4. Voltage: 125 VAC
5. Amps: 15A.
6. Mounting: Din rail.

J. DC POWER SUPPLY/CHARGER

1. Manufacturer/Model:
   a. **Altronix/SMP5**
   b. Or Approved Equal
2. Unit shall convert low voltage AC input into 6VDC, 12 VDC or 24 VDC output.
3. Input Voltage: 16 VAC to 28 VAC.
4. Output
   a. Voltage: 6VDC, 12 VDC or 24 VDC selectable
   b. Current: 4A continuous max.
   c. Other: Short circuit and thermal overload protection. Filtered and regulated.
5. Backup-Battery: Sealed lead acid or gel type
6. Indicators:
   a. Input: Input voltage is present.
   b. DC Output: Powered.

K. Programmable Logic Controller (PLC)

1. Manufacturer/Model:
   a. **Emmerson RX3i Series Industrial PLC** with a slot rack and appropriate I/O modules to accommodate project requirements.
   b. No equal.
2. Programming Software: Provide to Springville City, (1) licensed copy of programming software.
3. Provide a full print-out of the complete and final program in the O&M Manual.

L. Operator Touchscreen:

1. Manufacturer/Model:
   a. **Automation Direct/C-More 8-Inch color**
   b. Approved equal.
2. Communications Ports:
   a. Ethernet comm port
   b. USB programming port.
3. Programming Software: Provide to Springville City, (1) licensed copy of C-More programming software.

2.12 INSTRUMENTATION

A. PRESSURE TRANSMITTER

1. Manufacturer/Model:
   a. Rosemont "Smart", 3051 Cat No. 3051T, Range: 0-150 psig, stainless steel.
   b. No equals.
2. An electronic pressure measurement device tailored to the installation as shown on the Drawings and suitable for the planned application shall be installed. The system shall include a pressure transducer with integral diaphragm seal to be installed in the station discharge piping. The pressure transmitter shall operate on 24 VDC, and shall provide a 4-20 mA DC signal to the level controller.
3. The unit shall measure system pressure and have a 4-20 mA DC signal output which includes a digital signal based on HART protocol.
4. The equipment shall feature programming and diagnostics.

B. TEMPERATURE TRANSMITTER

1. Manufacturer/Model:
   a. **Pribusin, Inc/TWTS-5**
   b. Or approved equal
2. Loop powered two-wire temperature sensor/transmitter that mounts on a single-gang outlet box. Provide 4-20 mA DC output.
3. Range: 0 to +150 deg F., Accuracy: +/- 1 Deg, C or +/- 2 Deg F.

C. LEVEL ELEMENT AND TRANSMITTER, ULTRASONIC

1. Manufacturer/Model:
   a. **Siemens (Miltronics)/TheProbe**
   b. Or approved equal.
2. General:
   a. Function: Provide continuous non-contacting level measurement with output proportional to level being sensed.
   b. Type: Ultrasonic.
   c. Parts: Combined level element and transmitter.
3. Service:
   a. Medium: Liquids, slurries, solids, granulated solids.
   b. Pressure: Atmospheric.
   c. Temperature Range: Level element shall be capable of operating in range of minus 40 to 200 degrees F, while transmitter shall be capable of operating from -5 to 140 degrees F.
4. Performance:
   a. Range: 0-33 feet.
   b. Zero Reference: As noted.
   c. Accuracy: Plus or minus 0.25 percent of range or 6 mm, whichever is greater, for analog output signal.
   d. Resolution: 2 mm or 0. 1 percent of range, whichever is greater.
5. Signal Interface:

a. Transmitter Output: 4 to 20 mA dc output for load impedance of 0 to 600 ohms. Output shall also be reversible, 4 to 20 mA over range selection.
b. Power Supply: Unit shall operate on 24VDC power, unless otherwise noted.

6. Element:
   a. Type: Shall be of a waterproof/weatherproof design for outdoor installation.
   b. Process Connection: 3/4-inch NPT, unless otherwise noted.
7. Transmitter:
   a. Transmitter shall be mounted in a NEMA 4 enclosure, unless otherwise noted, suitable for mounting in wet well as shown.

2.13 PROCESS SWITCHES

A. LEVEL SWITCH - FLOAT

1. Manufacturer/Model:
   a. **IMO Industries, Inc. Gems Sensors Division, 1702.**
   b. Or approved equal.
2. Stem: 316 Stainless steel
3. Float: Buna N
4. Operating Temperature:
   a. Water: to 180-degrees F.
5. Minimum Liquid Specific Gravity: .65
6. Pressure (MAX): 150 PSI
7. Switch Rating: 20 VA
8. Electrical Termination: No. 22 AWG, 24-inches long, Polymeric Lead Wires.
9. Selectable Normally Open (NO) or Normally Closed (NC) by inverting float on unit stem.

B. PRESSURE SWITCH

1. Manufacturer:
   a. **Mercoid: Model** DAW-33-153-7
   b. No equal.
2. Brass bourdon tube material
3. Pressure: 5-150 psig
4. Minimum Deadband (psig): 6.
5. Switch: SPDT, closes on increase pressure, 10A120 VAC, Adjustable Deadband.
6. Application:
   a. Pump High Discharge Pressure.

2.14 MISCELLANEOUS

A. HATCH POSITION SWITCH

1. Manufacturer:
   a. **Square D Company**
   b. Or approved equal.

2. Heavy duty turret head lever arm type switch. Provide a offset type lever arm with sufficient length to contact hatch lid.
3. Rated NEMA 6P
4. Rated: 120 VAC, 6 amps.
5. Application:
   a. Roof Hatches

B. MAGNETIC DOOR SWITCH (MAN-DOOR)

1. Manufacturer
   a. **Sentrol 2505A**
   b. Substitutions: Refer to Section 01600 - Product Requirements
2. Provide a gray Normally Open (NO) magnetic door switch, where the switch closes when the magnet engages. Provide appropriate hardware to install on door.

C. ALARM LIGHT

1. Manufacturer/Model:
   a. **Federal Pacific/FB2PST**
   b. Or approved equal.
2. Power: 120VAC
3. Lens Color: Red.
4. Tube: 10,000 hour strobe.
5. Suitable for indoor or outdoor use.
6. UL Listed.

PART 3 INSTALLATION

A. Installation shall be as per manufacturers specifications.

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SECTION 26 05 13
CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Installation of wires or cables required for power distribution, service, feeders, and branch circuits.

B. Related work includes but is not limited to,

1. Section 31 23 15 - Excavation and Backfill for Buried Pipelines

1.2 REFERENCES

A. NFPA 70: National Electrical Code.

B. UL: Underwriters' Laboratories, Inc.

1.3 SUBMITTALS

A. Field Test Data: Submit megohmmeter test data for circuits under 600 volts.

PART 2 PRODUCTS

2.1 MATERIALS

A. Building Conductors: Copper, 600 Volt insulation, THW.

B. Branch Circuit Conductors and All Conductors #3 AWG and Smaller: Copper conductor, with TW, THHN, or THWN insulation #10 AWG and smaller, and THW larger than #10 AWG, where ambient temperature conditions exceed 140 deg. F.

1. Size all conductors per NFPA 70.
2. Minimum size to be #12 AWG.
3. Stranded conductors for #8 AWG and larger.
4. For outlets to fixtures, and in fixture channels (in dry areas); THHN insulated conductor.
5. In damp locations, under slabs, on exterior provide THWN.

C. Provide permanent plastic name-tag indicating load feed.

D. Use type XHHW conductors for water pumping and regulator stations.

E. Cable Supports: OZ cable supports for vertical risers, type as required by application.

2.2 INSTRUMENTATION

A. Instrumentation cable shall have the number of twisted pairs indicated on the Plans and shall be insulated for not less than 600 volts. Unless otherwise indicated, conductor size shall be as shown on the drawings, minimum.

B. The jacket shall be flame retardant Flamenal or Okoseal, 90 degrees C temperature rating. The cable shield shall be minimum of 2.3 mil aluminum or copper tape overlapped to provide 100 percent coverage and a tinned copper drain wire.

C. The conductors shall be bare soft annealed copper, Class B, 7 strand minimum concentric lay with Okoseal or Vulkene, 15 mils nominal thickness, nylon jacket, 4 mil nominal thickness, 90 degrees C temperature rating. One conductor within each pair shall be numerically identified.

2.3 COLOR AND CODING OF CONDUCTORS

A. 208Y/120 volt.

1. A-Phase - Black
2. B-Phase - Red
3. C- Phase - Blue
4. Neutral - White
5. Ground - Green

B. 480Y/277 volt.

1. A-Phase - Brown
2. B-Phase - Orange
3. C- Phase - Yellow
4. Neutral - White
5. Ground - Green

2.4 MODBUS RS485 CABLE

A. Manufacturers/Model

1. Belden 9841
2. Or approved equal

B. Provide low-capacitance computer cable for EIA RS-485 signal transmission. Cable shall be AWG#24 stranded (7x32), with polyethylene insulation, twisted-pairs with overall shield (100% coverage) and #24 AWG drain wire.

2.5 VFD CONDUCTORS

A. Manufacturers:

1. **Belden 29534 (350 kcMIL)**
2. **Belden 29504 (AWG#6)**

3. Approved Equal

B. Provide 3 conductor plus (3) symmetrical bare copper circuit conductors plus (2) spiral copper tape shields (100% coverage) with PVC insulation, XLPE insulation. Provide a 100% foil plus dual copper tape shield. Cable shall be sun and oil resistant.

C. Cable shall be suitable for Variable Frequency Drives.

D. Cable shall be suitable for indoor installation.

2.6 ETHERNET CABLE

A. Ethernet, Cat 6

1. Manufacturer:
   a. **Belden 7953A**
   b. Or Approved Equal.

B. 4 pair Category 6 shielded twisted pair cable. Constructed with #23 AWG solid bare copper conductors polyethylene or polypropylene insulation, and a black sunlight resistant PVC jacket with ripcord under the jacket for use in general communications applications.

C. Characteristics:

1. Jacket Diameter: 0.258-inches.
2. Jacket Material: PP (Polypropylene)
3. Cable Weight: 44 lbs/1000ft.
4. Temperature Rating: -40 to 75-deg C
5. Conductor Color Code:
   a. Pair 1 - Blue & White/Blue
   b. Pair 2 - Orange & White/Orange
   c. Pair 3 - Green & White/Green
   d. Pair 4 - Brown & White/Brown

PART 3 EXECUTION

3.1 INSTALLATION

A. Make conductor length for parallel feeders identical.

B. Lace or clip groups of feeder conductors at distribution center, pull-boxes, and wireway. Neatly arrange wiring within cabinets, junction boxes, fixtures, etc.

C. Provide copper grounding conductors and straps.

D. Install wire and cable in code conforming raceway.

E. Use non-detrimental wire pulling lubricant for pulling No. 4 AWG and larger wire.

F. Install wire in conduit runs after concrete and masonry work is complete and after moisture is swabbed from conduits.

G. Color code conductors to designate neutral conductor and phase.

H. Furnish necessary reels, reel jacks, and other pulling aids required to prevent damage to wires and cable.

I. Splicing:

1. Install wires and cables continuous without splices from sources of supply to distribution equipment and from source of supply to motor, lighting, or power outlet.
2. Do not use pull boxes for making splices.
3. Do not install splices in conduits.

J. Install all wiring per NFPA 70.

K. Use of cable with more conductors then specified; CONTRACTOR's option. When done, tape off and labeled extra conductors as spares.

3.2 CONDUCTOR CONNECTIONS

A. Use approved pressure type solderless connectors and lugs for service entrance, feeder, equipment connections and terminal posts.

B. Use connectors of a type compatible to conductors, locations, and load.

C. Make neutral connection and taps individually in order to prevent the possibility of an "open-neutral".

D. Make branch circuit connections with UL approved solderless connectors. Do not depend solely upon a single insulating material to secure connection as well as to insulate it.

E. After first either silverplating the bars or applying suitable non¡oxidizing agents, bolt buss bar connections with adequate nonferrous bolts, washers, and lockwashers.

F. Insulate joints and taps with patented or molded plastic insulators. Use tapes compatible .with conductor jackets, temperature, and other conditions.

3.3 SPECIAL WIRING

A. Special Systems: Furnish and install equipment, materials, labor, services, and accessories required for completion of any special systems of an electrical nature, but not classified otherwise herein, that may be indicated. Applicable portions of NFPA 70 also apply.

3.4 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW

A. Prior to energization, test cable and wire for continuity of circuit for short circuits. Megger all circuit of 100 amp and greater rating.

B. Correct malfunctions.

C. Submit record of megaohmmeter readings to ENGINEER.

3.5 IDENTIFICATION OF FEEDERS

A. Affix a marker stamped or embossed on each cable at each entry to and exit for each manhole, pullhole, pullbox, cable tray switchgear and switch, identifying circuit, i.e. "MCCI", "PANEL L" "NO 1" etc.

B. Identification letters to be 1/8 inch size minimum.

C. Markers to be rigid, noncorrosive, attached to feeder cables with feeder identification.

D. Nylon straps to be used to tie the markers.

- END OF SECTION -

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SECTION 26 05 33
RACEWAY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible or rigid conduits. couplings. supports, and nonmetallic ducts.

B. Related work includes bud is not limited to,

1. Section 31 23 15 Excavation and Backfill for Buried Pipelines.

1.2 REFERENCES

A. ANSI C80.1: Rigid Steel Conduit - Zinc-Coated.

B. ANSI C80.3: Electrical Metallic Tubing - Zinc-Coated.

C. FS W-F-406: Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible.

D. FS WW-C-566: Conduit, Metal, Flexible.

E. NEMA TC6: PVC and ABS Plastic Utilities Duct for Underground Installation.

F. NEMA TC9: Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.

G. NFPA 70: National Electric Code.

H. UL: Underwriters' Laboratories, Inc.

PART 2 PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. General: Provide metal conduit. tubing and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4 inch.

B. Rigid Metal Conduit (RMC): ANSI C80.1.

C. Intermediate Metal Conduit (IMC): ANSI C80.1.

D. Rigid and Intermediate Steel Conduit Fittings: Provide fully threaded malleable steel couplings; raintight and concrete tight where required by application. Provide double locknuts and metal bushings at conduit termination, use OZ type B bushings on conduits 1-1/4 inch and larger.

E. Electrical Metallic Tubing (EMT): ANSI C80. 3.

F. EMT Fittings: Provide insulated throat non-indenter type malleable steel fittings; concrete tight where required by application. Install OZ type B bushings on conduits 1-1/4 inches and larger.

G. Flexible Metal Conduit (FMC): FS WW-C-566, Zinc-coated steel.

H. Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 1, Style A.

I. Liquid Tight Flexible Metal Conduit: Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).

J. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type1, Class 3, Style G.

K. Expansion Fittings: OZ Type AX, or equivalent to suit application.

2.2 NON-METALLIC CONDUIT AND DUCTS

A. General: Minimum trade size: 3/4 inch.

B. Underground PVC Plastic Utilities Duct: NEMA TC6, Type I for encased burial in concrete, Type II for direct burial.

C. Duct Fittings: NEMA TC9, match to duct type and material.

2.3 CONDUIT, TUBING, AND DUCT ACCESSORIES

A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing. Provide manufactured spacers in all duct bank runs.

2.4 LOCKNUTS, BUSHINGS, CONNECTORS, COUPLINGS, AND SUPPORTS

A. General: Provide malleable bushings, except that plastic bushings may be used in lieu of phenolic-lined malleable bushings where "insulating bushings" are required.

B. Provide "double-locknut" system (2 locknuts) throughout, each being tightened wrench tight as to effectively bond outlet box or cabinet to conduit.

C. Sealing Bushing: OZ Type FSK, WSK, or CSMI as required by application. Provide OZ type CSB internal sealing bushings.

D. Provide insulated-through type ground bushing of the malleable type.

E. Provide connectors or couplings that are proper for the conduit they are used with. Make watertight when required.

F. Provide cadmium plated or galvanized fittings.

G. Provide fittings with die-cut threads unless approved otherwise.

H. EMT connectors used with #4 and larger cable shall have throat liners of suitable plastic insulation.

2.5 CONDUIT OUTLET BOXES

A. Refer to Section 26 05 34.

2.6 SCHEDULE OF LOCATIONS

A. Concrete floor, sidewalk and wall penetrations: PVC Coated Galvanized steel conduit.

B. Exposed: Galvanized steel conduit.

C. For underground conduit use rigid, threaded, galvanized steel conduit, or solvent welded PVC conduit.

D. Make connections to motors and equipment with PVC jacketed flexible conduit and liquid tight connectors. Provide 1/2-inch minimum size for motor connections.

E. Provide flexible conduit for fixture and control wiring with sufficient length of flexible conduit to avoid transmission of vibration.

PART 3 EXECUTION

3.1 PREPARATION

A. Excavate; Section 31 23 15 - Excavation and Backfill for Buried Pipelines.

3.2 INSTALLATION

A. Install conduit concealed in all areas, excluding mechanical and electrical rooms, connections to motors, and connections to surface cabinets.

B. For exposed runs attach surface-mounted conduit with clamps.

C. Coordinate installation of conduit in masonry work.

D. Unless indicated otherwise, do not install conduit larger than 2-1/2 inches in concrete slabs. Provide a minimum concrete cover around conduits of 2-inches.

E. Install conduit free from dents and bruises. Plug ends to prevent entry of dirt and moisture.

F. Clean out conduit before installation of conductor.

G. Alter conduit routing to avoid structural obstructions, minimizing crossovers.

H. Fill end of conduit with fiberglass where conduits leave heated area and enters unheated area.

I. Provide flashing and pitch pockets, making watertight joints where conduits pass through roof or waterproofing membranes.

J. Install UL approved expansion fittings complete with grounding jumpers where conduits cross building expansion joints. Provide bends or offsets in conduit adjacent to building expansion joints where conduit is installed above suspended buildings.

K. Route all exposed conduits parallel or perpendicular to building lines.

L. Make interconnections between different types of raceways with manufactured fittings approved by UL.

M. Size raceways per NFPA 70 tables. Do not reduce from any size indicated.

N. Do not exceed sizes permitted in slabs or walls.

O. Do not exceed the number of bends allowed in conduit by NFPA 70.

P. Make joints wrench tight or otherwise with minimum resistance tothe flow of fault currents.

Q. Use furred spaces and chases to an advantage in concealing conduits.

R. Make field bends only where needed and then carefully to minimize wire pulling tensions and for best appearance in exposed runs.

S. Test conduit runs with lignum vitale ball (mandrel) of 85-percent of conduit diameter.

T. Cut conduit with hacksaw or other approved pipe cutting tool and ream ends to clean out all burrs before connecting.

U. Keep conduits at least 6-inches away from steam or hot water pipes, breaching, and boilers, but in no case permit conductors to reach higher than rated temperatures. Avoid traps in runs and slope conduit to drain.

V. Fasten raceways securely in place. Firmly fasten conduit within 3-feet of each outlet, junction box, cabinet, or fitting. Support metallic conduit, rigid (heavy wall) and EMT at least every 10-feet. Support rigid nonmetallic conduit in strict accordance with NFPA70. Use raceway fasteners designed for the purpose.

3.3 SPECIAL CONDUIT FITTINGS

A. Use special conduit fittings as required or indicated. Use UL approved fittings suitable for location and usage made.

B. At expansion joints use special fittings if cast in concrete slabs.

C. Building Expansion Joints: Where surface conduits, raceways, panels, or light fixtures, span building expansion joints, make satisfactory arrangements to provide the movement provided for in building structure plus or minus nominal joint width.

3.4 PULL BOXES, WIREWAYS, AND GUTTERS

A. Furnish as indicated, plus any such items required to assemble conduits and other raceways. Provide Section 26 05 34 pull boxes as dictated by wire pulling requirements. Unless indicated otherwise face into secondary or unfinished rooms.

B. Construction: Code gage galvanized sheet steel and sized strictly in conformance with NFPA 70 requirements.

C. Finish: Free of burrs, sharp edges, un reamed holes, and sharp-pointed screw or bolts. Paint both inside and out.

D. Coating: When mounted direct to concrete or masonry walls that are below grade or where there will be sweating or other moisture present on wall surface, coat backs of boxes with a heavy coat of black asphalt paint before mounting.

E. Protection: Adequate provisions for preventing damage to conductors either during pulling in or from weights and tensions when in place.

F. Weatherproof, rain-tight, or special type when indicated or when required by NFPA 70.

3.5 ANCHORS, FASTENERS, AND MISCELLANEOUS SUPPORTS

A. Use compatible anchors in roof or ceiling slabs of concrete from which a load is suspended and anchors used to fasten heavy equipment without lead in their construction.

B. Make exposed conduit fastenings with one-piece, malleable conduit clamps. Two-hole, galvanized sheet metal pipe straps may be used on all concealed installations.

C. Use companion bases or backs with conduit clamps when conduit is exposed to weather or continuous moisture.

D. Use ring type hangers on individual runs of conduit 3-inches and larger if suspended, complete with threaded rods. Use adjustable turnbuckles when specified or otherwise as an option.

E. Support multiple runs of suspended conduits from trapeze style hangers suspended with rigid threaded steel rods and with suitable conduit clamps or straps of the same make as cross channels used.

F. Mount multiple runs of conduit on ceiling or wall surfaces.

G. Do not hang or support electrical equipment and materials from roof decks.

- END OF SECTION -

SECTION 26 05 34
ELECTRICAL BOXES AND FITTINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Types of electrical boxes and electrical fitting work.

1.2 REFERENCES

A. NEMA OS 1: Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

B. NEMA OS 2: Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

C. NFPA 70: National Electric Code.

D. UL: Underwriters' Laboratories, Inc.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70 as applicable for installation of electrical boxes and fittings.

B. Comply with NEMA OS 1 and NEMA OS 2 as applicable for outlet boxes, device boxes, covers and box supports.

C. Provide electrical boxes and fittings which have been UL-listed and labeled.

PART 2 PRODUCTS

2.1 INTERIOR OUTLET BOXES

A. One piece, cast iron or cast aluminum outlet wiring boxes, of types shapes and sizes, including box depths, to suit each respective location and installation. If of aluminum, essentially "copper free". Do not use on conduits of dissimilar metals, except with written permission.

B. Construct with threaded screw holes with corrosion-resistant screws for securing box and covers and wiring devices.

C. Minimum depth 1-1/4 inches or 2-1/8 inch depth for boxes with 3 or more conduit entries.

D. Use in combination with factory or field bends when indicated or advised. Complete outlet bodies with mounting brackets, hangers, extension rings, fixture studs, cable clamps, metal straps, gaskets, cover, hubs, reducers, and other accessories.

2.2 WEATHERPROOF OUTLET BOX

A. Corrosion-resistant cast-metal of types, shapes and sizes (including depth) required.

B. Threaded conduit ends, cast-metal face plates with spring hinged waterproof caps suitably configured for each application, with faceplate gaskets and corrosion-resistant fasteners.

2.3 JUNCTION AND PULL BOXES

A. Building Structure Type: Code-gage sheet steel with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with galvanized steel bolts, nuts and accessories.

B. Buried Type: Pre-cast concrete with screw-on traffic rated cast iron covers; of types, shapes and sizes to suit each respective location and installation; equipped with stainless steel bolts, nuts and accessories.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.

B. Provide knockout closures to cap unused knockout holes where blanks have been removed.

3.2 INSTALLATION

A. Install where indicated, complying with manufacturer's written instruction, applicable requirements of NFPA 70 and NEMA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Install coverplates for all boxes; weatherproof outlets for interior and exterior locations exposed to weather or moisture.

C. Install boxes and fittings to ensure ready accessibility of electrical wiring. Install recessed boxes with face of box or ring flush with adjacent surface.

D. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum l0-inches of conduit between them.

- END OF SECTION -

SECTION 26 09 26
PANELBOARD

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical distribution panelboards.

B. Connections between fixtures, equipment, and panelboards.

1.2 REFERENCES

A. NEMA 1: Instructions for Safe Installation. Operation and Maintenance of Panelboards Rated 600 Volts or Less.

B. NEMA 250: Enclosures for Electrical Equipment (1000 Volt Maximum).

C. NFPA 70: National Electrical Code.

D. UL: Underwriters' Laboratories Inc.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer data including specifications, installation instructions and general recommendations, for each type of panelboard required.

B. Shop Drawings. Submit showing accurately scaled layouts of enclosures and required individual panelboard devices. Show circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.

1.4 QUALITY ASSURANCE

A. Construct panelboards to NEMA 1 and NEMA 250 Standards and provide UL labels.

B. Comply with NFPA 70 pertaining to installation of wiring and equipment in hazardous locations.

C. Make all grounding tight and secure throughout.

PART 2 PRODUCTS

2.1 PANELBOARD - GENERAL

A. Provide panel boards of the same make and key alike with a master key arrangement.

B. Use dead front panelboards with one-piece cabinets constructed from code gage

steel. Cabinets shall have knockouts and minimum gutter space of 4- inches on all sides.

C. Interior bus shall be tin-plated copper.

D. Provide branches with automatic circuit breakers. thermal-magnetic type, unless indicated otherwise. Multi-pole breakers shall automatically open all poles when an overload occurs in any pole. Branch circuit breakers used for switching duty shall be UL listed as SWD type. Ground fault circuit interrupter protection as required by NFPA 70 shall be provided by ground fault circuit interrupting breakers. Circuit breakers shall have positive trip indication as well as clear "off" and "on" indication.

E. Use factory assembled panelboards with amp rating units indicated. Provide spare units and blank spaces as indicated. Main circuit breaker or lugs only as indicated.

F. Affix large, permanent individual numbers to each breaker on panel board face in a uniform position. Number starting at the top, with odd numbers used in sequence down left hand side and even numbers used in sequence down right hand side.

G. Use fronts manufactured with code gage steel, finished with rust inhibiting primer and baked enamel finish and manufacturer's standard color. Provide doors with flush tumbler type locks. Provide a circuit directory frame and card with a clear plastic covering inside the door.

H. Furnish locking clips for" off" position only, with" on" trip free travel and installed in all circuits so indicated.

I. Label panel with black phenolic or acceptable alternate engraved nameplate with 1/4 inch high lettering on the interior of each panelboard; including panel name and voltage. Provide red nameplate on emergency system panels.

J. For outside locations use a NEMA 3R cabinet.

2.2 PANELBOARD - 480 VOLT

A. Voltage: 480Y/277 volts, 3 phase, 4 wire, S/N, equipped with automatic circuit breaker.

B. Circuit Breakers: Minimum interrupting capacity of 22,000 amps at 277 volts. Use breakers that are UL rated for use as switches.

C. Locking Clips: 5 minimum per panel.

2.3 PANELBOARD - 208 VOLT

A. Voltage: 208Y/120 volts, 3 phase, 4 wire, S/N, equipped with automatic circuit breakers.

B. Circuit Breakers: Minimum interrupting capacity of 10,000 amps at 120 volts.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide mounting brackets, bus bar drillings and filler pieces for unused spaces.

B. Prepare and affix typewritten directory to inside cover of panelboard indicating loads controlled by each circuit.

C. Install per NFPA 70, NEMA. manufacturer's instructions and authorities having jurisdiction.

- END OF SECTION -

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SECTION 26 21 16
LOW-VOLTAGE UNDERGROUND ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes arrangement with Utility Company for permanent electric service; payment of Utility Company charges for service; service provisions; and utility metering equipment.

B. Related Work in other Sections includes, but is not limited to:

1. Section 03 30 00 Cast-In-Place Concrete

1.2 REFERENCES

A. National Electrical Contractors Association

1. NECA Standard of Installation.

B. American National Standards Institute

1. NFPA 70 - National Electrical Code.
2. NFPA 72 - National Electrical Safety Code.

C. National Electrical Manufacturers Association

1. Pub/No. AB 1: Molded Case Circuit Breakers
2. Stds Pub/No. AB 3: Molded Case Circuit Breakers and Their Application.
3. Stds Pub/No. KS 1: Enclosed Switches
4. Stds Pub/No. PB 2: Deadfront Distribution Switchboards.
5. Stds Pub/No. PB 2.2: Application Guide for Ground fault Protective Devices for Equipment.
6. Stds Pub/No. SG 3: Low-Voltage Power Circuit Breakers.
7. Stds Pub/No. SG 4: Alternating-Current High-Voltage Circuit Breakers.
8. Stds Pub/No. SG 5: Power Switchgear Assemblies.

1.3 SYSTEM DESCRIPTION

A. Utility Company: Springville City Power

B. System Characteristics: 400 Amps 480Y/277 volts, three phase, four wire, 60 Hertz.

C. Service Entrance: Underground.

D. Underground Service Provisions:

1. Utility Raceway Connection: Utility Company's terminal pole.

2. Utility Service-Entrance Conductor Connection: Utility Company's pad-vault mounted transformer.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal procedures.

B. Submit Utility Company prepared drawings.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Utility Company written requirements.

B. Maintain one copy of each document on site.

1.6 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings. Coordinate with Power Company for final location of equipment.

1.7 COORDINATION

A. Coordinate with utility company, relocation of overhead or underground lines interfering with construction. Where power lines are to be relocated, include costs in this contract.

B. Contact utility company regarding charges related to service installation. Include utility charges in this contract.

C. Utility charges for service installation will be paid by Owner and are not part of this contract.

PART 2 PRODUCTS

2.1 UTILITY METER

A. Furnished by Utility Company.

2.2 UTILITY METER BASE

A. Manufacturers:

1. **Circle AW.**
2. **Milbank.**
3. **Square D Company.**
4. Approved equal.

B. Product Description: Meter base ring type, EUSERC approved, with a space for utility provided test switch. Meter base shall comply with Springville City Power regulations.

2.3 CURRENT TRANSFORMER CABINET

A. Manufacturers:

1. **Circle AW.**
2. **Milbank.**
3. **Square D.**
4. Approved equal.

B. Size: 36 inches wide x 48 inches high x 11 inches deep. If Line and Load enter on the bottom a larger enclosure will be required. Comply with Springville City Power regulations.

C. Include provisions for padlocking and sealing.

2.4 TRANSFORMER PAD

A. Cast-in-Place Concrete as shown on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify service equipment is ready to be connected and energized.

3.2 INSTALLATION

A. Install service entrance conduits to building service entrance equipment. Utility Company will connect service lateral conductors to service entrance conductors

B. Install concrete pad for transformer, in accordance with Springville City Power regulations.

- END OF SECTION -

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SECTION 26 29 23
VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes enclosed variable frequency controllers.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 75 50 Project Closeout
3. Section 26 06 05 Electrical Equipment
4. Section 26 05 13 Conductors and Cables

1.3 REFERENCES

A. IEEE C62.41 (Institute of Electrical and Electronics ENGINEER's) - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. NEMA FU 1 (National Electrical Manufacturers Association) - Fuses.

C. NEMA ICS 3.1 (National Electrical Manufacturers Association) - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.

D. NEMA ICS 7 (National Electrical Manufacturers Association) - Industrial Control and Systems:
   1. Speed Drives.

E. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NETA ATS (International Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTALS

A. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

B. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings dimensions, and enclosure details.

C. Test Reports: Indicate field test and inspection procedures and test results.

D. Manufacturers Field Reports: Indicate start-up inspection findings.

E. Five copies, plus the number of copies the CONTRACTOR wishes returned, shall be submitted to the ENGINEER for approval.

F. Manufacturer's warranty.

1.5 SUBMITTED AT SHIPMENT

A. Include system manuals, complete with wiring diagrams, schematics, operating, and maintenance instructions, shall be provided with the VFD and VFD systems at the time of shipment, on both hard and digital copies.

1.6 CLOSEOUT SUB MITTALS

A. Section 01 78 50 - Project Closeout.

B. Operation and Maintenance Data: Submit instructions complying with NEMA ICS 3.1. Include procedures for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions. Include routing preventive maintenance schedule.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience and service facilities within 100 miles of the project.

1.8 STANDARDS

A. The VFD shall be UL listed and not require external fuses except where input power is supplied from multiple transformer secondaries.

B. All VFD and VFD systems shall be designed in accordance with applicable portions of NEMA standards, and panel build ups manufactured by a UL508 listed manufacturer.

C. The VFD shall be compatible with the installation requirements of interpretive codes such as National Electric Code (NEC) and Occupational Safety & Health Act (OSHA).

D. The VFD shall be capable of operating in compliance with IEEE 519-2014.

E. The VFD shall meet IEC 612 00-2 for vibration levels.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy

canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 26 05 00 - Electrical General Requirements.

B. Conform to NEMA ICS 7 service conditions during and after installation of variable frequency controllers.

1.11 WARRANTY

A. Equipment furnished under this Section shall be guaranteed against defective parts and workmanship for 1 year from date of Final Acceptance of the system and shall in include labor and travel time for necessary repairs at the job site.

B. The manufacturer shall provide the service of a factory-trained service representative to verify the correctness of the CONTRACTOR’s completed installation; to check all electronic circuitry and mechanical components to assure their proper function; and to make all necessary measurements in and around the unit to ensure proper operation. A minimum of 1-day startup service shall be provided. The manufacturer shall provide through the CONTRACTOR to OWNER a written certification that the installation is complete, correct and properly calibrated.

1.12 MAINTENANCE SERVICE

A. Provide service and maintenance of variable frequency controller for one year from Date of Substantial Completion.

1.13 MAINTENANCE MATERIALS

A. Supply two of each air filter.

B. Provide three of each fuse size and type.

PART 2 PRODUCTS

2.1 VARIABLE FREQUENCY CONTROLLER

A. Manufacturers:

1. **Mitsubishi**
2. **Square D, Altivar Process 630 Drive**
3. No Equals

B. Product Description: NEMA ICS 7, enclosed 6 pulse variable frequency controller suitable for operating the indicated loads. Select unspecified features and options in accordance with NEMA ICS 3.1.

2.2 RATINGS

A. Rated Input Voltage: 480 Volts, three phase, 60 Hertz. The VFD shall be able to withstand voltage variations of -15% to +10% without tripping or affecting VFD performance.

B. Motor Nameplate Voltage: 460 Volts, three phase 60 Hertz.

C. Motor Nameplate Horse power: 200 horsepower design B.

D. Displacement Power Factor: Between 1.0 and 0.95 lagging over entire range of operating speed and load.

E. Operating Ambient: 0 degrees C to 50 degrees C.

F. Relative Humidity: 5 to 95 percent non-condensing.

G. Minimum Efficiency at Full Load: 96 percent.

H. Elevation: The VFD shall be suitable for operations up to 4,500 feet.

2.3 DESIGN FEATURES

A. Employ microprocessor-based inverter logic isolated from power circuits.

B. Employ pulse-width-modulated inverter system.

C. Design for ability to operate controller with motor disconnected from output.

D. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

E. The VFD shall be capable of 4 different acceleration and different deceleration rates, each rate independently adjustable from 0.01 to 3600 seconds. Selectable accel/decel patterns to include linear, S-curve, and non-linear for variable torque loads.

F. The VFD shall have the capability of determining motor characteristics to optimize its operation with the use of pre-programmed motor data information or self-tuning operation. Self-tuning is to be available with or without the motor coupled to the load. Tuning shall also include an online mode that automatically and dynamically compensates the VFD regulator for changes in motor temperature.

2.4 INDICATORS AND MANUAL CONTROLS

A. Input Signal: 4 - 20 mA DC.

B. Display:

1. Provide integral LCD display to indicate output voltage, output frequency, output current, fault codes and drive status.
2. Upon a fault condition, the LCD shall display VFD output current, voltage, frequency, torque, DC link voltage, operating hours, I/O terminal status, and temperature at the time of fault. The last four (4) faults will be stored in memory and selectively be displayed on the LCD.

C. Indicator Lights:

1. Provide an indicator light to indicate VFD failure.

D. The drive shall have a built-in keypad that is installed on the outside cover and shall include Forward/Reverse/Stop/Jog keys, Drive reset key and Reference increment/decrement keys.

E. Volts Per Hertz Adjustment: Plus or minus 10 percent.

F. Current Limit Adjustment: 60 - 110 percent of rated.

G. Acceleration Rate Adjustment: 0.5 - 30 seconds.

H. Deceleration Rate Adjustment: 1 - 30 seconds.

I. HAND-OFF -AUTOMATIC selector switch and manual speed control.

J. Control Power Source: Integral control transformer.

2.5 SAFETIES AND INTERLOCKS

A. Includes undervoltage release.

B. Door Interlocks: Mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

C. Safety Interlocks: Terminals for remote contact to inhibit starting under both manual and automatic mode.

D. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.

E. The VFD shall be able to automatically reset up to ten (10) times after over-current, over-voltage, overheating, and overload faults. Reset attempts and reset intervals must be programmable.

F. Disconnecting Means: Integral circuit breaker on the line side of each controller.

2.6 VFD INPUT/OUTPUT PARAMETERS

A. The VFD shall accept and follow a selectable external frequency reference of either analog 0-5 VDC, 0-10 VDC, 4-20m A with signal inversion.

B. The VFD shall maintain the output frequency to within 0.2% of reference when the reference is analog, and to within .01% of reference when the reference is digital (Speed level inputs from keypad, contact closure, digital interface, or serial communication).

C. The VFD shall have a reference filter to reduce noise in the analog signals and a low noise control power supply system.

D. The VFD shall accept inputs from external dry contacts for the following functions:

1. Run forward command
2. Run reverse command
3. Multi-step frequency selection
4. Acceleration/Deceleration time selection
5. Stop command
6. Coast to stop command
7. Alarm reset
8. Trip command (external fault)
9. Jogging operation
10. Frequency reference selection (2)
11. DC brake command
12. Torque limits (2)
13. Switching operation between line and inverter (50 and 60 Hz)
14. Speed Increase command
15. Speed Decrease command
16. Write enable for keypad
17. PID control cancel
18. Inverse mode changeover
19. Interlock signal
20. Serial communications enable
21. Universal DI
22. Pick up start mode
23. Forced stop command
24. Forced stop command with Deceleration time

E. The frequency reference shall be from, selectively, an external speed potentiometer, external analog signals (0-5 VDC, 0-10 VDC, 4 to 20mA with signal inversion), from the built in keypad, or from serial communication.

1. The VFD shall provide five selectable digital outputs indicating the following:
    a. Inverter running
    b. Frequency equivalence signal
    c. Frequency level detection
    d. Torque polarity
    e. Torque limiting

f. Auto-restarting
g. Overload early warning
h. Keypad operation mode
i. Inverter stopping
j. Ready input
k. Line/Inverter changeover
l. Motor 2 / Motor 1
m. Auxiliary terminal
n. Time-up signal
o. Cycle completion time
p. Stage No Indication (1, 2, and 4)
q. Alarm Indication (1, 2, 4, and 8)
r. Fan operation signal
s. Auto resetting
t. Universal DO
u. Overheat early warning
v. Second frequency level detection
w. Second overload early warning
x. Terminal C1 off signal

2.7 PROTECTIVE AND DIAGNOSTIC FEATURES

A. When a fault occurs, the VFD shall have a controlled shut down sequence. A Form C relay fault output shall be available. The reason for the fault condition shall be enunciated on the LED display, and the LCD graphic screen shall display the current, temperature, frequency, and voltage at the time of the fault as well as potential reasons for the condition. The VFD shall monitor, sense, and display the following fault conditions:

1. Over-current during acceleration
2. Over-current during deceleration
3. Over-current during constant speed operation
4. Ground fault
5. Input phase loss
6. Fuse blown
7. Over-voltage during acceleration
8. Over-voltage during deceleration
9. Over-voltage during constant speed operation
10. Under-voltage
11. Overheating of heatsink
12. External thermal relay
13. Over-temperature of internal air
14. Overheating at Dynamic Braking circuit
15. Motor 1 overload
16. Motor 2 overload
17. Inverter unit overload
18. Over-speed
19. Memory Error
20. Keypad panel communication error
21. CPU error

22. Option error
23. Operational procedure error
24. Output wiring error / Impedance imbalance
25. Modbus-RTU error

B. The VFD shall have a selectable Torque Limiting function for both motoring and braking that will sense an overload condition and will reduce frequency and current temporarily until the load reaches acceptable levels. If the overload condition is not settled in the proper amount of time, the Drive will trip on overload. The Torque Limiting shall be programmable from 20-150% of Drive rated motor torque (30 HP and below) and from 20-150% of Drive rated motor torque (40 HP and above), with 1% resolution.

C. The VFD shall have a selectable electronic inverse time thermal overload function as required by NEC and UL Standard 991 for an AC Induction Motor (Refer to applicable codes for specific installation requirements). The overload shall be programmable from 20 - 135% of Drive rated current.

D. The VFD shall have an over-voltage protection function that operates if supply voltage rises above rated value or by motor's regeneration.

E. The VFD shall treat short circuits in either the output load or the output module as an over-current.

F. If the VFD heat sink temperature exceeds approximately 100-degrees C, the Drive will shut down on over temperature fault.

G. The VFD shall provide output ground fault protection.

H. The VFD shall provide LED indication of DC bus voltage, which, when lit, will signify to maintenance people the presence of potentially dangerous voltage.

2.8 VFD CONSTRUCTION

A. The VFD shall be a sinusoidal PWM type Drive with sensor-less vector control capability. The VFD Supplier shall provide open chassis, IP20, NEMA 1 enclosures at all ratings as required for the application. Drive shall be of modular construction for ease of access to control and power wiring, and maintenance. It shall consist of the following general components:

1. Full wave diode AC/DC rectifier, to eliminate line voltage notching of the three phase source and maintain an input displacement power factor of 0.95 or greater, regardless of speed or load. SCR front ends with gate firing electronics are unacceptable.
2. DC link capacitors standard, DC link reactor available at all ratings, standard on systems 100HP+.
3. Input surge protection performed by internal MOV'S (metal oxide varistors) or devices providing equal protection.
4. Insulated Gate Bipolar Transistor (IGB T) power section. The power section control shall use vector dispersal pulse width modulated (PWM) control and

fourth generation soft switching IGBTs to reduce noise and allow longer cable length from VFD to motor without the need for output filters.

5. The VFD shall be microprocessor based and fully transistorized with a 32 bit MCU and 33 MIPS processing speed.
6. Separate control and power terminal boards, with option plug shall be provided by the VFD to allow for remote operation.
7. The VFD shall have an RS485 serial communications port as a standard with options for communicating with recognized industry standard device level networks such as Ethernet or Modbus Plus. A universal ethernet adapter shall be provided as an interface with the serial communications port.
8. The VFD shall have a Keypad capable of copying, uploading and downloading Drive function codes.

2.9 INPUT FILTER

A. Harmonic Filter: Provide a Matrix Harmonic Filter to reduce the harmonic currents going back into the utility power grid and power system. The total harmonic voltage distortion factor (DF) at the main 480 volt bus for voltage shall be less than 5 percent.

B. The filter shall include a contactor that shall de-energize the capacitors when the drive is less than 30% output.

2.10 PROCESS ALARM SWITCH

A. Manufacturer/Model:

1. CR Magnetics/CR3595.
2. Or approved equal.

B. Description - Provide a process alarm switch to monitor the VFD output Hz. When the control loop exceeds the set point the relay becomes energized and the on-board LED illuminates.

C. Input Power: 24 VDC.

D. Output: Form C Relay, 10A at 125 VAC.

E. Process variable: 4-20 mA DC

F. DIN Rail mounting.

2.11 SURGE PROTECTIVE DEVICE

A. TVSS Manufacturer:
1. **Eaton**
2. **Raycap**
3. **Square D**
4. Or Approved equal.

B. This Section describes the materials and installation requirements for an integrated Transient Voltage Surge Suppressor (TVSS), also referred to as Surge Protective Device (SPD), inside VFD enclosure. These devices are used to protect AC electrical circuits from the effect of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and or capacitive load switching.

C. References

1. UL 1449 Second Edition 2005 - Transient Voltage Surge Suppressors
2. UL 1283 - Electromagnetic Interference Filters
3. ANSI/IEEE C62.41.1-2002 - IEEE Guide on the Surge Environment in Low Voltage (1000 V and Less) AC Power Circuits; C62.41.2-2002 - IEEE Recommended Practice on Characterization of Surge Voltages in Low Voltage AC Power Circuits; and C62.45-2002 - IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
4. NEC 2017 Article 285

D. Internal TVSS

1. TVSS shall be Listed in accordance with UL 1449 Second Edition 2005 and UL 1283, Electromagnetic Interference Filters.
2. Integrated surge protective devices (SPD) shall be Component Recognized in accordance with UL 1449 Second Edition, Revision 2/9/2005 Section 37.3 and 37.4 at the standard's highest short-circuit current rating (SCCR) of 200 kA, including intermediate level of fault current testing that will be effective 2/9/2007.
3. TVSS shall be tested with the ANSI/IE EE Category C High exposure waveform (20kV -1.2/50s, 10kA-8/20s).
4. TVSS shall provide suppression for all modes of protection: L-N, L-G, and N-G in WYE systems.
5. Recommended TVSS ratings:
    a. Minimum surge current rating shall be 90 kA per phase (80 kA per mode) for service entrance and 80 k A per phase (40 kA per mod e) for distribution applications.
    b. UL 14 49 clamping voltage must not exceed the following: 480Y/277
    c. Pulse life test: Capable of protecting against and surviving 5000 ANSI/IE EE Category C High transients without failure or degradation of clamping voltage by more than 10%.
6. TVSS shall be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
7. TVSS shall be constructed of one self-contained suppression module per phase.
8. Visible indication of proper TVSS connection and operation shall be provided. The indicator lights shall indicate which phase as well as which module is fully operable. The status of each TVSS module shall be monitored on the front cove r of the enclosure as well as on the module. A push-to-test button shall be provided to test each phase indicator. Push-to-test button shall activate a state change of dry contacts for testing purposes.
9. TVSS shall be equipped with an audible alarm which shall activate when any

one of the surge current modules has reached an end-of-life condition. An alarm on/off switch shall be provided to silence the alarm. The switches and alarm shall be located on the front cover of the enclosure.

10. A connector shall be provided along with dry contacts (normally open or normally closed) to allow connection to a remote monitor or other system. The output of the dry contacts shall indicate an end-of-life condition for the complete TVSS or module.
11. Terminals shall be provided for necessary power and ground connections.
12. The TVSS shall be equipped the following optional items:
    a. A transient voltage surge counter shall be located on the diagnostic panel on the front cover of the enclosure. The counter shall be equipped with a manual reset and battery backup to retain memory upon loss of AC power.

E. TVSS shall have a warranty for a period of ten (10) years from date of Final Acceptance. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by the irrespective field service division.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that the building environment can be maintained within the service conditions required by the manufacturer.

3.2 INSTALLATION

A. Install in accordance with NEMA ICS 3.1.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Select and install overload heater elements in motor controllers to match installed motor characteristics.

D. Provide engraved plastic nameplates under the provisions of Section 26 05 00.

E. Motor Data: Neatly type label inside controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.

F. Ground and bond controller under the provisions of Section 26 05 26.

3.3 QUALITY ASSURANCE

A. All VFD's shall be 100 % factory tested to ensure proper performance upon delivery.

B. VFD's installed in panels shall be 100% factory tested as a system by the VFD supplier.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.16 and NEMA ICS 3.1.

3.5 MANUFACTURER'S FIELD SERVICES

A. Prepare and startup variable frequency controller.

B. VFD operational and maintenance training and startup service shall be provided by the VFD supplier. The VFD vendor shall have factory trained personnel at field locations convenient to the installation site, available for trouble shooting and/or startup assistance 24/7.

C. Coordinate factory startup with the VFD, motor and Motor Protector factory representatives.

D. Coordinate VFD settings and the Backup Power Generator so that the facility operates as intended on both utility power and on backup generator power.

3.6 DEMONSTRATION AND TRAINING

A. Provide 4 hours of instruction each for 6 persons, to be conducted at Project Site with manufacturer's representative.

3.7 WARRANTY

A. The VFD vendor shall provide a warranty for material and workmanship, for a period of twenty-four months after start-up.

B. Warranty and non-warranty service shall be available in-house and in the field. There shall be authorized service centers locally available within 4 hours.

3.8 SPARE PARTS

A. Provide a list of all spare parts to the OWNER at Substantial Completion.

- END OF SECTION -

SECTION 31 05 19
GEOSYNTHETICS

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the manufacturing and installation of geosynthetics.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 31 22 00 Site Grading
3. Section 31 23 15 Excavation and Backfill for Buried Pipelines

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text to by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. B16.1/ASTM D 751	Standard Test Methods for Coated Fabrics
2. ASTM D 1777	Standard Test Method for Thickness of Textile Materials
3. ASTM D 3786	Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method
4. ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
5. ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
6. ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
7. ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
8. ASTM D 5034	Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
9. ASTM D 5035	Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
10. ASTM D 5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Quality Control Certificates shall be provided at a minimum frequency of one (1) per every hundred thousand (100,000) square feet of geosynthetics produced consecutively, and which is supplied to the project. These certificates shall be supplied only for the individual rolls of geosynthetics sampled and tested by the Manufacturer or his

representative. An individual Quality Control Certificate shall be provided for each roll of geosynthetics provided to the project, which was not produced consecutively within the hundred thousand (100,000) square foot lot. Quality Control Certificates shall be submitted two (2) weeks prior to installation of geosynthetics and shall state that the geosynthetics meets the requirements of these specifications for:

1. Mass per Unit Area
2. Grab Tensile Strength
3. Mullen Burst Strength
4. Equivalent Opening Size

C. Geosynthetics shall not be accepted and/or incorporated into the project without the approved quality control documentation.

D. Certification stating that all geosynthetics is furnished by one manufacturer shall be submitted two (2) weeks prior to installation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage and handling of the geosynthetics shall be the responsibility of CONTRACTOR.

B. During shipment, handling and storage, the geosynthetics shall be protected from ultraviolet light exposure, precipitation, or other inundation, mud, dirt, dust, puncture, cutting or any other damage or deleterious conditions. To that effect, geosynthetics rolls shall be shipped and stored in relatively opaque and watertight wrappings. An opaque tarp shall be placed over all rolls where the outer wraps are removed or damaged and where the geotextile is exposed. CONTRACTOR shall be responsible for the replacement of damaged or unacceptable materials at no cost to OWNER.

C. Storage of Materials: A storage area shall be provided on site by OWNER. The storage of geosynthetic materials shall be the responsibility of CONTRACTOR until the completed installation is accepted by ENGINEER.

D. Damaged Geosynthetics: Damaged geosynthetic materials shall be repaired, if possible, in accordance with these specifications, or shall be replaced at no additional cost to OWNER.

PART 2 PRODUCTS

2.1 GEOSYNTHETICS (FILTER FABRIC)

A. The geosynthetics shall be 10-ounce (or heavier) non-woven filter fabric.

B. Geosynthetics shall be provided in rolls.

C. Each roll of geosynthetics shall be externally labeled or tagged to provide product identification sufficient for field determination as well as inventory and quality control purposes. Each roll shall be labeled with the name of manufacturer, roll number, physical dimensions (length and width) and the material type. Any roll of geosynthetics from which the labeling has been removed or has become illegible, shall not be used, but shall be removed from the site and replaced at the expense of CONTRACTOR.

D. The geosynthetics shall be sampled, tested, and certified by the manufacturer for the following properties:

MATERIAL PROPERTIES FOR NON-WOVEN GEOTEXTILE FILTER FABRIC		
Property	Specification	ASTM Test Method
Mass per Unit Area (min)	10.0 oz./S.Y.	D-5261
Grab Tensile Strength (min)	250 lbs.	D-4632
Elongation at Break	50 %	D-4632
Tear Strength (min)	100 lbs	D-4533
Apparent Opening Size (maximum U.S. Sieve size)	100 mesh	D-4751

E. Filter Fabric shall be **Mirafi 1100N by TenCate, 250NW by U.S. Fabrics**, or approved equal.

PART 3 EXECUTION

3.1 DEPLOYMENT

A. Prior to deployment, CONTRACTOR shall inspect each roll of geosynthetics to verify that the roll has a valid Quality Control Certificate and that has been previously approved by ENGINEER.

B. Adjacent rolls shall be joined by overlapping the edges a minimum of twelve (12) inches.

C. The overlap shall be glued, sewn or otherwise fastened or secured at intervals no greater than two feet along a line through the midpoint of the overlap. Additional fasteners shall be installed as necessary to prevent slippage of the geosynthetics regardless of location.

D. CONTRACTOR shall visually inspect the geosynthetics during deployment for holes, tears or improperly formed geosynthetics. Defective areas shall be repaired or removed and replaced by CONTRACTOR at no additional cost to OWNER.

E. Smoking shall not be permitted on the geosynthetics.

F. CONTRACTOR shall be responsible to provide adequate loading (e.g., sand bags or similar items that will not damage the underlying geosynthetic) to prevent movement of the geosynthetics. Any damage to the geosynthetics shall be repaired at CONTRACTOR's expense.

G. The geosynthetics shall not be exposed to the sun and elements for more than 72 hours unless the filter fabric has ultraviolet inhibitors. Fabric with ultraviolet inhibitors shall not be exposed for a period in excess of the manufacturer's recommendations, in which case manufacturer shall provide prior to product delivery.

H. Any damage to the geosynthetics during installation or any fabric that has been exposed to the sun or elements for longer than the 72 hours, or as specified by the manufacturer, shall be replaced by CONTRACTOR at no additional cost to OWNER.

I. CONTRACTOR shall be responsible to observe placement of geosynthetics. CONTRACTOR shall provide a daily inventory of all geosynthetics deployed to ENGINEER.

3.2 REPAIRS

A. Any holes, tears or defective areas in the geosynthetics shall be repaired by patching with same type of geosynthetics. The patch shall extend a minimum of twelve (12) inches in all directions beyond the area to be repaired. The patch shall be secured in place by gluing, sewing, or securing the fabric as per these specifications.

- END OF SECTION -

SECTION 31 05 20
SPRING COLLECTION GEOMEMBRANE

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish and install flexible geomembrane lining in the areas shown on the Contract Drawings. All work shall be done in strict accordance with the Contract Drawings, these Specifications and membrane lining fabricator's approved shop drawings.

B. CONTRACTOR shall supply all labor, equipment, materials, and appurtenances for the complete installation of a geomembrane liner in the areas shown.

C. Sufficient geomembrane material shall be furnished to cover all lined areas, including seam overlaps and anchor trenches. One percent (minimum) shall be added to the length of each panel to allow for shrink and wrinkles. The liner shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation.

1.2 RELATED WORK

A. Related work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 31 22 00 Site Grading

1.3 REFERENCES

A. The latest edition of the following publications form a part of these specifications to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D 471 Standard Test Method for Rubber Property—Effect of Liquids
2. ASTM D 751 Standard Test Methods for Coated Fabrics
3. ASTM D 4437 Standard Practice for Nondestructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes
4. ASTM D 4833 Standard Test Method for Index Puncture Resistance of
5. ASTM G 153 Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

C. NATIONAL SANITATION FOUNDATION (NSF)

1. NSF 61 Drinking Water System Components – Health Effects

1.4 DEFINITIONS

A. Bridging: When the geomembrane is not in contact with the underlying material. Normally occurs at the side slope toe, sumps, and leachate withdrawal pipe trenches.

B. Gap: Repair made over a defective seam in a geomembrane.

C. CONTRACTOR: The person, firm or corporation with whom OWNER has entered into the Agreement.

D. Geomembrane Manufacturer: The party responsible for producing geomembrane sheets from resin, and for providing the materials warranty upon completion of the project.

E. Geomembrane Subsurface: Material surface upon which geomembrane will be placed.

F. Installer: The party responsible for field handling, transporting, storing, deploying, seaming, temporary restraining (against wind), and installing the geomembrane.

G. Panel: The unit area of geomembrane that will be seamed in the field. A panel is identified as a sheet or portion of a sheet that is larger than five lineal feet.

H. Patch: Repair made over a hole or other defect in the geomembrane.

I. Sheet: The unit area of geomembrane which has been factory seamed and delivered to the site.

J. Subgrade: The soil layer which immediately underlies the geomembrane

1.5 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Prior to ordering liner material, CONTRACTOR shall submit the following for ENGINEER's approval:

1. Specification sheet giving full details of minimum physical properties and test methods used and site seaming methods.
2. Shop drawings with a proposed panel layout to cover the lined area shown, with proposed size, number, position, and sequence of placing all sheets and indicating the location and direction of all field joints and penetrations. Shop drawings shall also show complete details and/or methods for anchoring, field joints, seals at existing structures, etc.
3. Four 8-inch x 10-inch samples of the material proposed for the lining.
4. Certification in accordance with Paragraph 1.8.A.
5. A list of similar projects completed in which the manufactured material has been successfully used. The list shall provide sufficient detail to satisfy the experience requirements of Paragraph 1.6.
6. Placement of the lining shall not commence until the shop drawings and details have been reviewed by ENGINEER.

C. Liners shall not be accepted and/or incorporated into the project without the approved quality control documentation.

D. Certification stating that all geosynthetics is furnished by one manufacturer shall be submitted two (2) weeks prior to installation.

1.6 QUALIFICATIONS

A. Qualifications of Manufacturer: The manufacturer shall have at least five years continuous experience in manufacturing geomembrane liners and/or experience totaling not less than 5 million square feet of manufactured geomembranes.

B. Qualifications of Installation Contractor: The Installation Contractor shall be the manufacturer, or a dealer trained to install the manufacturer's material and shall have experience of not less than 2 projects and not less than 5,000 square feet of successfully installed geomembranes for similar type projects.

1.7 DELIVERY, STORAGE AND HANDLING

A. Storage and handling of the geomembrane shall be the responsibility of CONTRACTOR.

B. During shipment, handling and storage, the geomembrane shall be protected from ultraviolet light exposure, precipitation, or other inundation, mud, dirt, dust, puncture, cutting or any other damage or deleterious conditions. To that effect, geomembrane rolls shall be shipped and stored in relatively opaque and watertight wrappings. An opaque tarp shall be placed over all rolls where the outer wraps are removed or damaged and where the geomembrane is exposed. CONTRACTOR shall be responsible for the replacement of damaged or unacceptable materials at no cost to OWNER.

C. Storage of Materials: A storage area shall be provided on site by OWNER. The storage of geomembrane materials shall be the responsibility of CONTRACTOR. The geomembrane shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage.

D. Damaged Geomembranes: Damaged geomembrane materials shall be repaired, if possible, in accordance with these specifications, or shall be replaced at no additional cost to OWNER.

E. On Site Handling - CONTRACTOR shall use appropriate handling equipment to load, move or deploy geomembrane sheets. CONTRACTOR shall assume all responsibility to insure that all local, state and federal safety rules and regulations are followed.

1.8 QUALITY ASSURANCE

A. All resins and additives used in the fabrication of the geomembrane shall be sampled, tested, and pass a pre-approval process before being eligible for use. All roll goods shall be inspected for defects and impurities. Geomembrane thickness shall be measured for each roll. The geomembrane shall be tested by its manufacturer for the listed properties provided in the table in Part 2. A log shall be maintained showing the testing date, time and results. Any rolls not meeting the visual inspection or requirements of the specification shall be rejected. Certification that the material has been inspected, tested, and meets all requirements as well as test results shall be made available to ENGINEER upon request.

1.9 WARRANTY

A. CONTRACTOR shall procure and provide copies of the manufacturer's warranty for the lining system and all appurtenances. The warranty shall cover materials for a pro-rated period of 10 years from the date of OWNER's acceptance of the project. The warranty must specifically include effects of ultraviolet irradiation and the normal wear and aging associated with installation in the environmental conditions similar to central Utah. Workmanship of installation shall be warranted for one year on a 100% basis. Should defects or premature loss of use within the scope of the above warranty occur, repair and/or replacement of damaged material shall be performed at no cost to OWNER.

PART 2 PRODUCTS

2.1 GEOMEMBRANE LINER

A. The surface of the geomembrane liner shall not have striations, roughness, pinholes, or bubbles and shall be free of holes, thin spots, blisters, undispersed raw materials, or any contamination by foreign matter.

B. Each sheet of geomembrane shall be externally labeled or tagged to provide product identification sufficient for field identification as well as inventory and quality control purposes. Each sheet shall be labeled with the name of manufacturer, sheet number, physical dimensions (length and width) and the material thickness. Any sheet from which the labeling has been removed or has become illegible shall not be used, but shall be removed from the site and replaced at the expense of CONTRACTOR.

C. Materials: The geomembrane shall be polyester, or Ethylene Interpolymer Alloy (EIA), fabric reinforced, and manufactured as a polymer coated fabric liner. Water cut-off mastic and sealant shall be as recommended by the liner manufacturer or fabricator.

D. The geomembrane shall be manufactured from high quality resins produced in the United States and shall be compounded and manufactured specifically for the intended purpose. Carbon black shall be added to the resin if the resin is not compounded for ultra-violet resistance. Reprocessed materials will not be acceptable.

E. The geomembrane shall have a minimum 22.5 feet seamless width.

F. The geomembrane shall be NSF 61 certified.

G. The finished product shall be uniform in color, thickness, and surface texture and shall meet the following minimum average specifications. If the geomembrane is not readily available in the thickness shown, CONTRACTOR will provide the next size thicker geomembrane for installation.

MATERIAL PROPERTIES FOR GEOMEMBRANE		
Property	ASTM Test Method	Test Value
Thickness (minimum)	ASTM D 751	40 mils
Basic Fabric Weight	ASTM D 751	6.5 oz/sy
Tear Strength	ASTM D 751 (Trap)	40/55 lbf min
Breaking Yield Strength	ASTM D 751 (Grab)	550/550 lbf min
Hydrostatic Resistance	ASTM D 751	800 psi min
Weathering Resistance	Carbon Arc ASTM G 153	8,000 hours min
Water Absorption	ASTM D 471 (Section 12 – 7 days)	0.025 kg.sm @ 70º F
Wicking	ASTM D 751	1*8” max
Bursting Strength	ASTM D 751 (Ball Tip)	750 lbf min
Puncture Resistance	ASTM D 4833	274 lbs min
Elongation @ Yield Break		20% min

H. Geomembrane manufacturer shall be **Seaman Corporation**, or approved equal.

PART 3 EXECUTION

3.1 DEPLOYMENT

A. General: The geomembrane shall be installed in accordance with the Manufacturer’s written instructions and the following Specifications and approved procedures submitted with the shop drawings. If there is a discrepancy between the Manufacturer’s installation instructions and these Specifications, the more stringent requirement shall apply.

B. Subgrade Inspection: The Installation Contractor shall, on a daily basis, approve the surface on which the geomembrane will be installed. The surface shall be smooth, clean and free of foreign material, sharp objects, frost, standing water or excessive moisture. Installation shall proceed only if the surface conditions are found satisfactory.

C. Prior to deployment, CONTRACTOR shall inspect each roll of geomembrane to verify that the roll has a valid Quality Control Certificate and that has been previously approved by ENGINEER.

D. CONTRACTOR shall visually inspect the liner during deployment for holes, tears or improperly formed liner. Defective areas shall be repaired or removed and replaced by CONTRACTOR at no additional cost to OWNER.

E. Seaming of panels and repairs will only be permitted under weather conditions allowing such work, and within the warranty limits imposed by the liner manufacturer.

F. Panels shall be positioned to minimize handling.

G. The Installer shall not deploy more panels in one day than can be seamed during that same day.

H. The liner shall be installed in a relaxed manner and free of tension and stress. In areas where grade transitions occur, bridging of the liner shall not be allowed.

I. After deployment, but prior to seaming, the Installer shall inspect each panel for damage caused by placement operations and/or wind. Damaged sections shall be marked and repaired, or removed and replaced by the Installer at no additional cost to OWNER.

J. CONTRACTOR shall be responsible to provide adequate loading (e.g., sand bags or similar items that will not damage the underlying liner) to prevent movement of the liner. Any damage to the liner shall be repaired at CONTRACTOR's expense.

K. The liner shall not be exposed to the sun and elements for more than 72 hours unless the liner has ultraviolet inhibitors. Liner with ultraviolet inhibitors shall not be exposed for a period in excess of the manufacturer's recommendations, in which case manufacturer shall provide prior to product delivery.

L. Any damage to the liner during installation or any liner that has been exposed to the sun or elements for longer than the 72 hours, or as specified by the manufacturer, shall be replaced by CONTRACTOR at no additional cost to OWNER.

M. CONTRACTOR shall be responsible to observe placement of the liner. CONTRACTOR shall provide a daily inventory of all liners deployed to ENGINEER.

N. Field Seams: The sheets shall be of such lengths and widths and shall be placed in such a manner as to minimize field seaming. On side slopes, seams shall be oriented in the general direction of maximum slope, i.e., oriented down, not across the slope.

1. Liner Field Seams: The approved seaming process is fusion welding. Extrusion welding shall be allowed only in rare instances when fusion welding is not feasible and shall be approved in advance by the ENGINEER. Liner panels must have a finished overlap of 4 inches for fusion welding and 6 inches for extrusion welding. Cleaning solvents may not be used unless the product is approved by the liner manufacturer.

O. Anchor Trench: The liner shall be placed and secured in an earth anchor trench as indicated in the Contract Drawings. The installer shall coordinate with the earthwork contractor regarding excavation and backfilling of the anchor trench. Care shall be taken when backfilling the trenches to prevent any damage to the liner. If damage occurs, it shall be repaired prior to backfilling.

3.2 METHOD OF PLACEMENT

A. Vehicular traffic shall not be allowed directly on the liner.

B. The method used to unroll and/or unfold the geomembrane shall not cause scratches or crimps in the liner and shall not damage the support soil or previously deployed geosynthetics.

C. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage the geomembrane.

D. Smoking shall not be permitted on the liner.

E. The method used to place the liner shall minimize wrinkles and waves.

F. Any damage to the geomembrane caused by wind or other weather related causes shall be repaired by the liner Installer, at the CONTRACTOR's expense.

G. Any damage caused by temporary loading on the geomembrane or by permanent anchorage, which is not in accordance with the design, shall be repaired by and at the expense of the liner Installer.

H. Folds in the geomembrane shall be removed at the time of deployment, and prior to seaming.

3.3 NON-DESTRUCTIVE FIELD TESTING

A. All field seams shall be non-destructively tested by CONTRACTOR and observed by ENGINEER over their full length using an air lance test, or other method approved by ENGINEER.

B. Air Lance Testing (ASTM D 4437)

1. The equipment shall consist of the following:
   a. An air pump equipped with a pressure gage capable of generating and supplying eighty (80) psi;
   b. A rubber hose with fittings and connections;
   c. A 3/16" diameter nozzle.
2. Test Procedures
   a. All seams shall be allowed to cure for a minimum time period as specified by the manufacturer prior to air lance testing.
   b. All bonded seams shall be checked using a minimum of 55 psi.
   c. The air stream shall be directed at the edge of the seam, no more than two (2) inches from the seam edge.
   d. If the seam strength is not adequate, the seam shall be repaired in accordance with this Specification and then non-destructively retested.

3.4 INSPECTION AND REPAIRS

A. All seals to penetrations as well as all seams and non-seam areas of the liner shall be inspected for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the liner shall be clean at the time of inspection. Each suspect location shall be non-destructively tested as appropriate and repaired accordingly.

B. Any holes, tears or defective areas in the liner shall be repaired by patching with same type of liner. The patch shall extend a minimum of twelve (12) inches in all directions beyond the area to be repaired. Defective seams shall be cap stripped or replaced. Any wrinkles shall be smoothed out.

3.5 CLEANING

A. The liner shall be cleaned immediately prior to covering the liner with subsequent geosynthetics or other materials so that the liner may be observed for damage and/or required repairs. The liner shall be cleaned of dirt, grease, and debris. Cleaning shall also include removal of snow or ice from the liner. Cleaning methods may include sweeping the liner using brooms, spraying the liner with water (as long as provisions are made for removing water immediately from the pad area), blowing with air, or any other ENGINEER approved methods.

B. Care must be exercised with any cleaning method which requires the use of hoses, fittings, etc., to prevent damage to the geomembrane. All fittings must be wrapped such that sharp edges will not damage the liner.

C. Any damage caused to the geomembrane during cleaning or identified after the liner has been cleaned shall be repaired in accordance with these Specifications at no additional expense to the OWNER.

3.6 OWNER ACCEPTANCE

A. The installer shall retain all ownership and responsibility for the liner until acceptance by OWNER. Final acceptance will occur when the following conditions are met:

1. Installation is finished.
2. Verification of the adequacy of all field seams and repairs is complete.

- END OF SECTION –

SECTION 31 11 00
CLEARING, GRUBBING, AND STRIPPING

PART 1 GENERAL

1.1 SUMMARY

A. This Work shall consist of removing and disposing of all trees; shrubs; brush; stumps; windfalls; roots; and other vegetation, including dead and decayed matter; and debris that exist within the designated construction limits, borrow areas, and soil stockpile areas and which are not specifically designated to remain.

B. CONTRACTOR shall coordinate with ENGINEER and OWNER prior to removing any trees on the Site. All trees and woody vegetation shall be completely removed as described below within the spring collection area to receive the geomembrane and clay liner system.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 22 00 Measurement and Payment

1.3 DEFINITIONS

A. Clearing: Clearing operations shall consist of cutting, removing, and disposing of trees, shrubs, bushes, windfalls and other vegetation within the construction limits, borrow areas, and soil stockpile areas. All brush shall be cut off within six inches of the ground surface.

B. Grubbing: Grubbing operations shall consist of removing and disposing of stumps, roots, debris deleterious materials, and other remains (such as organic and metallic materials) which if left in place would interfere with proper performance or completion of the contemplated work, would impair its subsequent use or form obstructions therein. Organic material from clearing or grubbing operations shall not be incorporated in fill or backfill.

C. Stripping: Stripping operations shall consist of removing all soil material containing sod, grass, or other vegetation and topsoil to a minimum depth of six (6) inches from all areas that will receive fill or over all trenches in field or spring collection areas.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 CLEARING

A. All trees, stumps, shrubs, bushes, windfalls and other vegetation (except such trees and vegetation as may be indicated or directed by ENGINEER or OWNER to be left standing) shall be cut off to within six inches of the ground surface and shall be removed from the construction limits. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by such means as the circumstances require.

3.2 GRUBBING

A. All stumps, roots, debris, debris, and other organic or metallic materials not suitable for foundations shall be removed completely from the construction limits, borrow areas and soil stockpile areas. Unless otherwise permitted by ENGINEER, stumps shall be removed completely. If any stumps are permitted to remain, they shall be cut off not more than six inches above the ground.

3.3 STRIPPING

A. Soil material containing sod, grass, or other vegetation and topsoil shall be removed to a minimum depth of six (6) inches from all areas to receive fill from the area within lines 5 feet minimum outside all foundation walls, over all trenches, and from beneath pavement and curb and gutter areas. The stripped material shall be deposited in such locations as are acceptable to ENGINEER. Topsoil shall be placed over designated areas to be landscaped, and over all trench areas (outside of paved areas).

B. All areas to be seeded shall have a minimum thickness of 3 inches (or thicker if required elsewhere in these documents or on the Contract Drawings) of topsoil.

3.4 DISPOSAL

A. Open burning of combustible materials will not be allowed.

B. All trees, timber, stumps, roots, debris, shrubs, bushes, and other vegetation removed during the clearing and grubbing operations shall be removed from the project site and disposed of by CONTRACTOR subject to specific regulations imposed by laws and ordinances and in a manner that will not create a public nuisance nor result in unsightly conditions. CONTRACTOR shall assume full responsibility for acceptable disposition of the material as well as for any damages resulting from his disposal operations.

- END OF SECTION -

SECTION 31 22 00
SITE GRADING

PART 1 GENERAL

1.1 SUMMARY

A. This Work consists of site grading and related activities.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 45 00 Quality Control and Materials Testing
2. Section 01 50 00 Temporary Construction Utilities & Environmental Controls
3. Section 31 23 15 Excavation and Backfill for Buried Pipelines
4. Section 31 23 23 Excavation and Backfill for Structures
5. Section 32 11 23 Untreated Base Course

1.3 REFERENCES

A. The latest edition of the following publications form a part of these Specifications to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3)
2. ASTM D 2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

PART 2 PRODUCTS

2.1 EMBANKMENT MATERIAL

A. Embankment materials are defined as those complying with ASTM D2487, the Unified Soil Classification System (USCS) of CL, ML, SM, SC, SP or combinations of these materials.

B. Embankment material shall be free from frozen lumps, rocks larger than 6 inches in the larger dimension, roots, trash, lumber, or organic material. Suitability of material for embankment in accordance with these criteria will be as determined by ENGINEER.

C. It is not anticipated that CONTRACTOR will be required to furnish additional quantities of embankment fill material from off-site sources to supplement material available from on-site excavations. However, if required, CONTRACTOR shall not borrow materials from adjacent private or public lands without providing to OWNER written verification of such approval from the appropriate landowner or agency. CONTRACTOR shall be responsible for all costs associated with providing additional quantities of embankment fill as may be required to complete the work described herein and as shown on the Contract Drawings.

PART 3 EXECUTION

3.1 GENERAL

A. Grading shall produce uniform grades or slopes between spot elevations or contours shown.

B. Areas of construction activity shall be left in condition of uniform grade, blending into pre-existing contours and concealing, as much as possible, evidence of construction activity by back dragging or raking to conceal tire marks. Revegetation shall not be performed until the subgrade is acceptable to OWNER.

C. Unless otherwise directed by OWNER, all excess excavated materials shall be removed from the site and disposed of by CONTRACTOR. CONTRACTOR shall restore stockpile area to pre-existing condition.

3.2 SITE PREPARATION

A. Prior to placement of embankment fill, loose or disturbed soil shall be removed and replaced with compacted structural fill or disturbed soil shall be properly compacted.

B. Prior to placement of embankment fill, the top 6-inches, or as noted on the Contract Drawings, of the subgrade shall be scarified and compacted to 95% minimum Modified Proctor density as determined by ASTM D1557.

C. Embankment shall include the placement of materials to raise the existing grade to the established elevations indicated and the construction of driving surfaces.

D. Embankment material shall be placed in no more than 8-inch loose lifts for heavy equipment, and 4-inch loose lifts for hand operated equipment.

E. All embankment fill material shall be placed and compacted to 95% minimum Modified Proctor Density as determined by ASTM D1557. Embankment under roadways, to a minimum depth of four feet, shall be compacted to 96% minimum as determined by ASTM D1557.

F. Where the moisture content is not suitable and/or sufficient compaction has not been obtained, the fill shall be reconditioned to an approved moisture content and recompacted to the minimum required compaction, unless recommended otherwise by the Soils Testing Agency, prior to placing any additional fill material.

G. Unless otherwise specified, CONTRACTOR shall be responsible for arranging for the placing and compacting of approved fill material in accordance with these Specifications. If the Soils Testing Agency should determine that CONTRACTOR is failing to meet the minimum requirements, CONTRACTOR shall stop operations and make adjustments as necessary to produce a satisfactorily compacted fill at no additional cost to OWNER.

3.3 GRADING

A. The final grade of all completed areas shall be between plus and minus one-tenth (± 0.1) of a foot from the grade designated on the Contract Drawings.

- END OF SECTION -

SECTION 31 22 16
FINE GRADING

PART 1 GENERAL

1.1 SUMMARY

A. The Fine Grading Work, includes, but is not limited to:

1. Perform fine grading work required to prepare site for landscape finish grading and soil preparation as described in Contract Documents.
2. Furnishing of conditioner to stockpiled topsoil.

1.2 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text to by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

1.3 QUALITY ASSURANCE

A. Pre-Installation Conference: Participate in pre-installation conference.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 PROTECTION

A. Do not commence work of this Section until site grading tolerances are met.

B. Surface Preparation:

1. Before placing topsoil, dig out weeds from planting areas by their roots and remove from site. Remove rocks larger than 1-inch in size and foreign matter such as building rubble, wire, cans, sticks, concrete, etc.
2. Remove imported paving base material present in planting areas down to natural sub-grade or other material acceptable to ENGINEER.

3.2 PERFORMANCE

A. Interface with Other Work: Do not commence work of this Section until site grading tolerances are met.

B. Site Tolerances:

1. Maximum variation from required grades shall be 1/10 of one foot.

2. To allow for final finish grades of planting areas, sub-grade elevations in landscape areas, before placing topsoil are:
   a. Seed Areas: 5 1/2 inches below top of walk or curb.

C. Do not expose or damage existing shrub or tree roots designated to remain.

D. Distribute approved imported topsoil as required. Remove organic material, rocks, clods greater than 1-inch in any dimension, and other objectionable materials.

E. Slope grade away from structure for 12 feet minimum from walls at slope of 1/2 inch in 12 inches minimum unless otherwise noted. Direct surface drainage in manner indicated on Contract Drawings by molding surface to facilitate natural run-off of water. Fill low spots and pockets with specified fill material and grade to drain properly.

- END OF SECTION -

SECTION 31 23 15
EXCAVATION AND BACKFILL FOR BURIED PIPELINES

PART 1 GENERAL

1.1 SUMMARY

A. This item shall consist of excavating all pipeline trenches to the lines and grades indicated on the Contract Drawings or as directed by ENGINEER in the field, and the backfilling of all pipeline trenches. Excavation shall include the removal of all materials of whatever nature encountered to the depths shown on the Contract Drawings, or as modified in the Field by ENGINEER.

1.2 RELATED SECTIONS

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 45 00 Quality Control & Materials Testing
3. Section 01 50 00 Temporary Construction Utilities and Environmental Controls
4. Section 31 23 19 Dewatering
5. Section 31 23 23 Excavation and Backfill for Structures
6. Section 33 05 05 Ductile Iron Pipe
7. Section 33 05 07 Polyvinyl Chloride (PVC) Pressure Pipe, Rubber Joints (AWWA C900)

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referred. The publications are referred to in the text by basic designation only.

B. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

1. M 145 Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
2. T 27 Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
3. T 88 Standard Method of Test for Particle Size Analysis of Soils
4. T 96 Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
5. T 180 Standard Method of Test for Moisture Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18 in (457 mm) Drop
6. T 191 Standard Method of Test for Density of Soil In Place by the Sand Cone Method
7. T 205 Density of Soil In-Place by the Rubber-Balloon Method
8. T 238 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
9. T 239 Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
10. T 310 Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
2. C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
3. D 422 Standard Test Method for Particle Size Analysis of Soils
4. D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3)
5. D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone method
6. D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft3)
7. D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity -Flow Applications
8. D 2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
9. D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.4 DEFINITIONS

A. Degree of Compaction: Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

B. Pipe Zone: That zone in an Excavation which supports, surrounds, and extends to 12 inches above the top of the pipe barrel. Specifically, 6 inches below the bottom (where rock, hard pan, boulders, etc. are encountered), 12 inches above the top of the pipe, and 1 foot laterally beyond both sides of the pipe, unless noted otherwise on the Contract Drawings.

C. Trench Zone Backfill: That zone in an Excavation which begins 12 inches above the top of the pipe barrel and extends to the natural surface level or the finished grade indicated on the Plans.

D. Unyielding Material: Unyielding material shall consist of rock and gravelly soils with stones greater than 12 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

E. Unstable Material: Unstable material shall consist of materials too wet to allow backfill compaction or to properly support the utility pipe, conduit, or appurtenant structures.

F. Rock: Solid mineral material which cannot be removed with equipment reasonably expected to be used in the Work without cutting, drilling or blasting. Minimum equipment size, in good running order, shall be similar to a **Komatsu 300, Caterpillar 320 or 330**, or equal.

1.5 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 - Submittal Procedures:

1. Copies of Field Density Test reports shall be submitted to ENGINEER at the beginning of each workday for the previous day's testing of subgrades, embankments and backfill Materials.
2. Copies of all Laboratory Test Reports shall be submitted to ENGINEER within 24 hours of the completion of the test.
3. Submit gradations and proctors for Pipe Zone Material and Trench Zone Backfill.
4. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

1.6 SITE CONDITIONS

A. Unsuitable Weather Limitations: CONTRACTOR shall not place, spread, or roll any fill material during unsuitable weather conditions. CONTRACTOR shall not resume operations until moisture content of material is satisfactory.

B. Weather Softened Subgrade: CONTRACTOR shall remove and replace at no additional cost to OWNER soft subgrade materials resulting from adverse weather conditions.

C. Protection of Graded Areas: CONTRACTOR shall protect all graded areas from traffic and erosion and shall keep these areas free of trash and debris. Work required to repair and reestablish grades in settled, eroded, and rutted areas shall be completed to specified tolerances at CONTRACTOR's expense.

D. Reconditioning Compacted Areas: All areas compacted to required specifications that become disturbed by subsequent construction operations or weather conditions shall be scarified, moisture conditioned, and re-compacted to the required density prior to further construction.

E. Grading: the final compacted surface of base course shall not vary more than 1/4 inch above or below design grade.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stabilization Material: Stabilization material shall consist of hard, durable particles of stone or gravel, screened, or crushed to the required size and gradation. The material shall be free from vegetation matter, lumps or balls of clay, or other deleterious matter and shall conform to the following gradation when tested in accordance with AASHTO T 27 or ASTM C 136.

1. Coarse material shall be crushed or washed, and fine material shall be wasted to meet the grading requirements set forth below. Note that if stabilization material is required, an 8 oz. non-woven filter fabric shall be placed between the stabilization material and the pipe zone material.

2. Coarse aggregate, retained on the No. 4 sieve, shall have a percentage of wear not greater than 40 percent when tested by the Los Angeles Test, AASHTO T-96 or ASTM C 131.

US Standard Sieve Size (Square Opening)	Percent By Weight Passing Screen
2-inch	100
1-1/2 inch	10 - 50
3/4-inch	0 - 5
No. 4	0 - 3

B. Pipe Zone Material: All material in the pipe zone shall be clean and free from alkali, salt, petroleum products, vegetative matter or other deleterious matter, slag, cinders, ashes and rubbish or other material that in the opinion of the ENGINEER may be objectionable or deleterious. “Squeegee” or any other flowable material shall not be permitted. Recycled concrete is not allowed within any public right-of-way. Pipe zone material shall conform to the following:

1. Waterline – Sand per the following gradation:

U.S. Standard Sieve Size (Square Opening)	Percent By Weight Passing Screen
3/8-inch	100
No. 100	1-10

2. Waterline – Controlled Low-Strength Material (Flowable Fill):
   a. Flowable Fill shall be per APWA Section 03 31 05 – Controlled Low Strength Material. Provide where indicated on the Contract Drawings.
3. Spring Collection Pipes – 3/4" Washed Drain Rock
   a. 3/4" Washed Drain Rock shall mee the requirements of Section 31 23 23 Excavation and Backfill for Structures.
   b. Drain rock shall be disinfected with a chlorine solution prior to installing in the trench.

C. Trench Zone Backfill: Trench zone backfill shall consist of imported fill material meeting the AASHTO A-1-a classification (AASHTO M145 or ASTM D3282), shall have a maximum particle size no greater than 3 inches in any dimension and shall be capable of meeting the compaction requirements. Trench zone backfill shall be free from alkali, salt, petroleum products, vegetative matter or other deleterious matter, slag, cinders, ashes and rubbish or other material that in the opinion of ENGINEER may be objectionable or deleterious. Gradation shall comply with the following:

US Standard Sieve Size (Square Opening)	Percent By Weight Passing Screen
3”	100
2”	80-95
1”	55-85
3/8”	40-70
No. 4	25-55
No. 10	20-50
No. 40	10-30
No. 200	2-15

D. Clay

1. Clay backfill used for the Burt Springs clay barrier shall be classification CL ASTM 2487, clean, homogenous, uniform and free of organic material, frozen material, debris and rocks. The clay shall have a minimum permeability of 1 x 10^{-5} cm/sec.

E. 1-1/2” Minus Washer Rock

1. 1-1/2” Minus Washed Rock shall consist of hard, durable particles of stone or gravel, screened, or crushed to the required size and gradation. The material shall be washed free from vegetation matter, lumps, or balls of clay, or other deleterious matter and shall conform to the following gradation when tested in accordance with AASHTO T-27 or ASTM C 136.

Sieve Size (Square Opening)	Percent By Weight Passing Screen
1-1/2 inch	100
3/4 inch	0-5
3/8 inch	0

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated. All excavated materials not intended for reuse shall be removed from the site and disposed of by the Contractor.

B. Rock Removal

1. CONTRACTOR shall cut away Rock at excavation bottom to form level bearing.
2. All shaled layers shall be removed to provide sound and unshattered base for foundations.
3. CONTRACTOR shall remove and legally dispose of excess excavated material and debris off-site unless indicated otherwise.

4. CONTRACTOR shall correct unauthorized Rock removal at no additional cost to OWNER.

3.2 SAFETY

A. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the latest requirements of OSHA Safety and Health Standards for Construction (29 CFR 1926). CONTRACTOR is responsible for assessing safety needs to meet such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods and construction practices so as to fully comply with all safety requirements.

B. CONTRACTOR is responsible for assessing needs related to confined space entry, as defined by OSHA. CONTRACTOR shall meet all such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods and construction practices so as to fully comply with all confined space safety requirements.

3.3 DEWATERING

A. Water removal shall be in accordance with Section 31 23 19 - Dewatering.

3.4 TRENCH WIDTH

A. The bottom of the trench shall have a minimum width equal to the outside diameter of the pipe plus 24-inches or as detailed on the Contract Drawings.

B. The width of the trench shall be ample to permit the pipe to be laid and jointed properly, and the backfill to be placed and compacted as specified. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting, and bracing, and the handling of special units as necessary.

3.5 TRENCH PREPARATION

A. Each trench shall be excavated so that the pipe can be laid to the alignment and grade as required. The trench wall shall be so braced that the workmen may work safely and efficiently. All trenches shall be drained so the pipe laying may take place in dewatered conditions.

B. Bottom Preparation

1. Where rock, hard pan, boulders or other material which might damage the pipe are encountered, the bottom of the trench shall be over excavated 4 inches below the required grade and replaced with Stabilization Material. Otherwise, the bottom of the trench shall be over excavated 6 inches or 1/12 the outside diameter of the pipe, whichever is greater, below the required grade and replaced with Pipe Zone Backfill.
2. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 1-inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

C. Removal of Unstable Material

1. Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed by ENGINEER and replaced to the proper grade with Stabilization Material. When removal of unstable material is required due to the fault or neglect of CONTRACTOR in his performance of the work, the resulting material shall be excavated and replaced by CONTRACTOR without additional cost to OWNER.

D. The trench bottom (at the level of the base of the pipe) shall be given a final trim using a string line, laser, or another method approved by ENGINEER for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Bell holes shall be provided at each joint to permit the jointing to be made properly. The trench grade shall permit the pipe spigot to be accurately centered in the preceding laid pipe joint, without lifting the pipe above the grade, and without exceeding the permissible joint deflection.

3.6 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.7 LAYING AND JOINING PIPE

A. Laying pipe: Provide proper facilities for lowering pipe sections into place. Dropping pipe will not be permitted. Place each section true to line and gradient in close and true contact with adjacent sections.

B. Joining pipe:

1. Use methods of joining conduit sections ensuring ends are fully entered and inner surfaces are flush and even. The equipment used to force the joints together must be adequate to overcome the gasket pressure involved. Pipe shall be installed in accordance with these specifications and the manufacturers written specifications.
2. Just prior to joining the pipes, both spigot and bell ends shall be thoroughly cleaned to remove all foreign substances which may have adhered to the bell and spigot surfaces. All dust and dirt shall be removed with a clean rag. An approved lubricant (recommended by the manufacturer), that is not injurious to the gasket, shall be applied in accordance with the manufacturer’s recommendations.

3. In the event any foreign material becomes embedded in the lubricant, or the lubricant becomes contaminated by water or other substances before the joint is started, the area affected shall be re-cleaned and new lubricant applied.
4. The pipe being joined shall be carefully moved into position, line and grade checked, and, as the spigot end is started into the bell of the section previously laid, the gasket shall be checked to insure uniform entry into the bell at all points. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Apply firm steady pressure either by hand or by bar and block assembly, until the spigot easily slips through the gasket. Care must be taken to ensure that the spigot is not over-inserted and that previously assembled pipe joints are not disturbed.

3.8 PIPELINE TRENCH BACKFILLING AND COMPACTION

A. Pipe Zone:

1. Pipe Zone Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise approved or specified. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be compacted to at least 95 percent of the maximum Modified Proctor density (ASTM D-1557), unless otherwise specified.
2. Replacement of Unyielding Material: Unyielding material removed from the bottom of the trench shall be replaced with Stabilization Material placed in layers not exceeding 6 inches loose thickness.
3. Replacement of Unstable Material: Unstable material removed from the bottom of the trench or excavation shall be replaced with Stabilization Material placed in layers not exceeding 6 inches loose thickness.
4. Where the pipe grade exceeds 30%, cohesive material shall be used in lieu of pipe bedding. The cohesive material shall be moistened to within 2% of optimum moisture and compacted as noted.
5. The relative density of the compacted cohesionless material shall not be less than 60% as determined by the Bureau of Reclamation Relative Density of Cohesionless Soil Test (Designation E-12) of the "Earth Manual."

B. Trench Zone Backfill: Trenches shall be backfilled to the grade shown with Trench Backfill material as specified.

1. Trench zone backfill in asphalted road shall consist of backfilling the trench from above the pipe zone up to underneath the noted recommended depth for untreated base course and asphalt or concrete of finished grade with Trench Backfill material compacted to 95 percent of maximum density (ASTM D-1557). Backfill shall be placed in layers not exceeding 6-inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise approved or specified.
2. Trench zone backfill in unimproved or landscaped areas shall consist of backfilling the trench from above the pipe zone to 8-inches below finished grade with Trench Backfill material compacted to 95 percent of maximum density (ASTM D-1557). Backfill from 8-inches below finished grade to finished grade shall consist of topsoil replacement in addition to replacement of all landscaped materials. Trench zone backfill shall be placed in layers not exceeding 8 inches loose thickness.

3. It shall be the responsibility of CONTRACTOR to be assured that the Trench Zone Backfill material is capable of being compacted to the degree specified. It shall be CONTRACTOR's responsibility to remove and dispose of all excess excavated material.

C. Final Backfill:

1. Unimproved and Landscaped Areas: The top 6-inches of the trench shall be filled with topsoil. Topsoil may be native material stripped prior to excavation of the trench. Backfill shall be deposited in layers of a maximum of 12-inch loose thickness and compacted to a minimum of 85 percent maximum density (ASTM D-1557). Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.
2. Roadways shall be completed with the type and thickness of materials (i.e., Untreated Road Base and Asphalt) as indicated or shown on the Contract Drawings

3.9 SPECIAL REQUIREMENTS

A. Special requirements for both excavation and backfill relating to the specific utilities from above the pipe zone to the natural surface level or the finished grade indicated on the Plans shall be placed and compacted as follows:

1. Where existing underground pipes or conduits larger than 3 inches in diameter and all sizes of sewer lines or sewer laterals cross the trench above the new work, the backfill from the bottom of the trench to 1 foot above the top of the intersecting pipe or conduit shall be pipe zone material compacted to 95 percent of maximum density (ASTM D-1557). The pipe zone material shall extend 2 feet on either side of the intersecting pipe or conduit to ensure that the material will remain in place while other backfill is placed.

B. The maximum trench length open at any given time shall not exceed 200 feet unless approved by ENGINEER and must be backfilled in a timely manner.

3.10 MAINTENANCE OF BACKFILL

A. All backfill shall be maintained in satisfactory condition, and all places showing signs of settlement shall be filled and maintained during the life of the Contract and for a period of one year following the day of final acceptance of all work performed under the Contract. When CONTRACTOR is notified by ENGINEER or OWNER that any backfill is hazardous, CONTRACTOR shall correct such hazardous condition at once. Any utility, road and/or parking surfacing damaged by such settlement shall be repaired by CONTRACTOR to the satisfaction of OWNER and ENGINEER. In addition, CONTRACTOR shall be responsible for the cost to OWNER of all claims for damage filed with the Court, actions brought against the said OWNER for, and on account of, such damage.

3.11 FINISH GRADING AND CLEANUP

A. CONTRACTOR shall grade the trench line to a smooth grade to affect a neat and workmanlike appearance of the trench line.

B. All tools, equipment and temporary structures shall be removed. All excess dirt and rubbish shall be removed from the site by CONTRACTOR.

C. CONTRACTOR shall restore the site to at least as good as original condition, including but not limited to final trench grade and restoration of affected public and private facilities whether in the public right-of-way or on private property. Any exception to this requirement must be in writing from ENGINEER for the job specific conditions.

3.12 COMPACTION TESTS

A. It shall be the responsibility of CONTRACTOR to accomplish the specified compaction for backfill, fill, and other earthwork. It shall be the responsibility of CONTRACTOR to control his operations by performing any additional tests necessary to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.

1. Testing of Backfill Materials
   a. Characteristics of backfill materials shall be determined in accordance with the requirements of Section 01 45 00 - Quality Control & Materials Testing.
   b. The CONTRACTOR shall demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:
      i) 50 linear feet of trench backfill.
   c. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.
   d. After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified quantities.
   e. Compliance tests may be made by ENGINEER to verify that compaction is meeting the requirements previously specified at no cost to CONTRACTOR.
   f. ENGINEER may require retesting of backfill that has settled from water penetration in the trench. CONTRACTOR shall remove the overburden above the level at which ENGI¬NEER wishes to test and shall backfill and recompact the excavation after the test is complete at no additional cost to the OWNER.
   g. If compaction fails to meet the specified requirements, CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by CONTRACTOR. CONTRACTOR's confirmation tests shall be performed in a manner acceptable to ENGINEER.

2. Field Density Tests

   a. Field density tests shall be made in accordance with ASTM D 1557.

- END OF SECTION –

SECTION 31 23 19
DEWATERING

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section provides specifications for dewatering systems and appurtenances to be used during construction as required to remove water and continuously maintain groundwater at a level at least 1-foot below the bottom of the excavation.

B. CONTRACTOR shall obtain all necessary permits for disposal of water removed from the excavation.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.3 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Before dewatering is commenced, CONTRACTOR shall provide information to ENGINEER outlining the method, installation and details of the proposed dewatering system. CONTRACTOR shall provide ENGINEER with plans setting forth details of the proposed dewatering systems. The dewatering system plans shall be of sufficient detail to indicate sizes of pumps, piping, appurtenances, the ultimate disposal point for water, and to indicate the overall completeness and effectiveness of the proposed system.

C. CONTRACTOR shall certify to OWNER that the design and implementation of the proposed dewatering system is sufficient to complete the Work.

D. Submit a plan to monitoring settlement of adjacent structures.

1.4 QUALITY CONTROL

A. CONTRACTOR shall be responsible to control the rate and effect of dewatering to avoid all settlement and subsidence.

B. Where critical structures exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement which may develop. CONTRACTOR is responsible for protecting adjacent structures from settlement. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of CONTRACTOR.

PART 2 PRODUCTS

2.1 MATERIALS

A. CONTRACTOR shall be responsible for selection of dewatering means, methods and materials.

B. Standby pumping equipment shall be maintained on the Site.

PART 3 EXECUTION

3.1 DESIGN AND IMPLEMENTATION

A. CONTRACTOR shall be responsible for complete design and implementation of the dewatering system.

B. CONTRACTOR shall be responsible for the design and implementation of any modifications that may be required to the initial design of the dewatering system (at no additional cost to OWNER) to provide a dewatering system that operates adequately to complete the Work.

C. CONTRACTOR shall furnish, install, operate and maintain all machinery, appliances, and equipment to maintain all excavations free from water during construction.

D. CONTRACTOR shall dispose of water so as to not cause damage to public or private property, or to cause a nuisance or menace to the public or violate the law.

E. CONTRACTOR shall be responsible to obtain groundwater discharge permits, if required.

F. CONTRACTOR shall install and operate the dewatering system so as to not cause damage or endanger adjacent structures or property.

G. The control of groundwater shall be such that softening of the bottom of excavations, or formation of "quick" conditions or "boils," does not occur. Dewatering systems shall be designed and operated so as to prevent removal and migration of the natural soils.

H. CONTRACTOR shall have sufficient stand-by equipment at the project site at all times to continuously maintain the dewatering program until Work necessitating dewatering is complete.

I. CONTRACTOR shall have on hand equipment and machinery in good working condition for emergencies and shall have personnel available for operation of such equipment and machinery.

J. CONTRACTOR shall control surface water to prevent entry into excavations.

- END OF SECTION -

SECTION 31 23 23
EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers excavating, backfilling, and compacting of disturbed areas for structures and roadways as directed by ENGINEER.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 45 00 Quality Control and Materials Testing
3. Section 01 45 23 Testing Agency Services
4. Section 01 50 00 Temporary Construction Utilities and Environmental Controls
5. Section 31 11 00 Clearing, Grubbing and Stripping
6. Section 31 23 15 Excavation and Backfill for Buried Pipelines
7. Section 31 23 19 Dewatering

1.3 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referred. The publications are referred to in the text by basic designation only.

B. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

1. M 145 Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
2. T 27 Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
3. T 88 Standard Method of Test for Particle Size Analysis of Soils
4. T 180 Standard Method of Test for Moisture Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18 in (457 mm) Drop
5. T 191 Standard Method of Test for Density of Soil In Place by the Sand Cone Method
6. T 310 Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. D 422 Standard Test Method for Particle Size Analysis of Soils
2. D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3)
3. D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone method
4. D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft3)
5. D 2487 Standard Practice for Classification of Soils for Engineering Purposes

(Unified Soil Classification System)

6. D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

D. The latest Edition of the Utah Department of Transportation Standard Specification for Road and Bridge Construction.

E. The latest Edition of the American Public Works Association (APWA) and Associated General Contractors of America Standard Plans and Standard Specifications.

1.4 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 Submittal Procedures:

1. Submit gradations and proctors for structural fill materials and backfill materials.

PART 2 PRODUCTS

2.1 WALL BACKFILL MATERIAL

A. Wall backfill material shall consist of native or import fill material meeting soils classifications A-1, A-2 or A-3 of AASHTO M 145, with a maximum particle size no greater than 4 inches in any dimension and shall be capable of meeting the compaction requirements.

1. Wall backfill material shall be free from frozen lumps, rocks larger than 6 inches in the largest dimension, roots, trash, lumber and organic material.

2.2 STRUCTURAL FILL

A. Structural fill material, if required, shall meet the following requirements.

1. Material shall be non-expansive granular soil with less than 35 percent passing the No. 200 sieve, with a liquid limit less than 30, and free from rocks larger than 4 inches in the largest dimension, frozen lumps, roots, trash, lumber and organic material. The natural soils may be used as structural fill where it meets the above stated criteria.

2.3 FLOOR SLAB FILL (Upper 4 inches)

A. Material shall be non-expansive granular soil with less than 5 percent passing the No. 200 sieve, and free from rocks larger than 2 inches in the largest dimension, frozen lumps, roots, trash, lumber and organic material. The natural soils may be used as fill for the first 4 inches directly under the slab where it meets the above stated criteria.

2.4 FLOOR SLAB

A. Material shall be non-expansive granular soil with less than 50 percent passing the No. 200 sieve, with a liquid limit less than 30, and free from rocks larger than 6 inches in the largest dimension, frozen lumps, roots, trash, lumber and organic material. The natural soils may be used as fill below the first 4 inches under the slab where it meets the above stated criteria.

2.5 3/4" WASHED ROCK

A. 3/4" Washed Rock shall consist of hard, durable particles of stone or gravel, screened or crushed, to the required size and gradation. The material shall be free from vegetation matter, lumps or balls of clay, or other deleterious matter and shall conform to the following gradation when tested in accordance with AASHTO T 27 or ASTM C 136.

Sieve Size (Square Opening)	Percent By Weight Passing Screen
3/4-inch	100
3/8 inch	78-92
No. 4	0 - 50
No. 8	0 - 5
No. 200	0 - 3

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated. Excavated material not required or not satisfactory for backfill shall be removed from the site.

B. Excavations shall be braced and supported as needed to prevent the ground adjacent to the excavation from sliding or settling. Slides shall be promptly removed and corrected by CONTRACTOR.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with granular fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of 6 inches.

D. Remove approximately 4 to 6 feet of fill material below the Pump House prior to placing fill. The Geotechnical Engineer should observe the excavation to determine if the fill has been adequately removed. See the Geotechnical Investigation report for all excavation and fill requirements.

E. Place a non-woven filter fabric prior to placing the free draining gravel below the Pump House foundation and footings.

3.3 DEWATERING

A. Water removal shall be in accordance with Section 31 23 19 - Dewatering.

3.4 BACKFILL

A. Backfill material shall not be placed against concrete structures that have not been

properly cured. No backfill material shall be placed until concrete has cured for a minimum of 7 days or until the compressible strength is 3,400 psi, whichever is greater.

B. Backfill material shall be placed in no more than 6-inch loose lifts for compaction by hand operated machine compactors, and 8 inches loose lifts for other than hand operated machines.

C. Structural fill placed beneath foundations, footings or the floor slab shall be placed and compacted to at least 95% of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D 1557.

D. Backfill material shall be placed and compacted to at least 90 percent of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D-1557.

E. Where the moisture content is not suitable and/or sufficient compaction has not been obtained, the fill shall be reconditioned to an approved moisture content and re-compacted to the minimum required compaction prior to placing any additional fill material.

F. CONTRACTOR shall be responsible for arranging for the placing and compacting of approved fill material in accordance with these Specifications. If it is determined that CONTRACTOR is failing to meet the minimum requirements, CONTRACTOR shall stop operations and make adjustments as necessary to produce a satisfactorily compacted fill at no additional cost to OWNER.

G. Sufficient personnel, equipment, sumps or other means should be provided to maintain the site in an acceptable dry condition for the duration of this contract.

H. Excavations shall be so braced and supported as needed to prevent the ground, adjacent to the excavation, from sliding or settling. Localized slides or settlements shall be promptly removed and corrected by CONTRACTOR.

3.5 FINISHED GRADE

A. The finished subgrade and grade of the fill shall not vary more than 0.05 feet from the established grades and cross sections shown on the Contract Drawings.

3.6 COMPACTION TESTS

A. Compaction testing shall be provided and paid for in accordance with Section 01 45 00 – Quality Control and Materials Testing.

B. It shall be the responsibility of CONTRACTOR to accomplish the specified compaction for backfill, structural fill, Untreated Base Course and other earthwork. It shall be the responsibility of CONTRACTOR to control his operations by performing any additional tests necessary to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.

1. Testing of Backfill Materials

    a. Characteristics of backfill materials shall be determined in accordance with the requirements of Section 01 45 00.
    b. Contractor shall demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:

        1) One (1) test per 1.0 feet of backfill thickness placed per structure.

    c. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.
    d. After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified quantities.
    e. Quality Control tests may be made by ENGINEER to verify that compaction is meeting the requirements previously specified at no cost to CONTRACTOR. If ENGINEER requires retesting of backfill, CONTRACTOR shall remove the overburden above the level at which ENGINEER wishes to test and shall backfill and recompact the excavation after the test is complete at no additional cost to OWNER.
    f. If compaction fails to meet the specified requirements, CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid in accordance with Section 01 45 23 – Testing Agency Services. The confirmation tests shall be performed in a manner acceptable to ENGINEER. Frequency of confirmation tests for remedial work shall be double that amount specified for initial confirmation tests.

2. Field Density Tests

    a. Tests shall be performed in sufficient numbers to meet the requirements of Section 01 45 00 and to ensure that the specified density is obtained.

C. Field density tests shall be made in accordance with ASTM D1557 and ASTM D6938.

- END OF SECTION -

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SECTION 32 31 13
GALVANIZED CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. This section covers the furnishing of labor, materials and appurtenances necessary for installation of the galvanized chain link fence system defined herein. The manufacturer shall provide a total fence system including all components, panels, posts, gates, and hardware required.

1.2 RELATED WORK

A. Related Work specified in other sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 03 30 00 Cast-in-Place Concrete

1.3 REFERENCES

A. The latest edition of the following publications form a part of this specifications to the extent referenced. The publications are referred to in the text to by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 121 Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
2. ASTM A 392 Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
3. ASTM A 780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
4. ASTM A 824 Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link
5. ASTM F 552 Standard Terminology Relating to Chain Link Fencing
6. ASTM F 567 Standard Practice for Installation of Chain Link Fence
7. ASTM F 626 Standard Specification for Fence Fittings
8. ASTM F 900 Standard Specification for Industrial and Commercial Swing Gates
9. ASTM F1083 Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop drawings: Site plan showing layout of fence location with dimensions, location of gates and opening size, cleared area, elevation of fence, gates, footings and details of attachments.

C. Certifications: Manufacturers material certifications in compliance with the current ASTM specifications.

D. Domestic certifications: Material certifications, made in U.S.A., Buy American Act or Buy America when required.

E. Material samples: When required, provide representative samples of chain link fabric, framework and fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company headquartered in the United States having U.S. manufacturing facility/facilities specializing in manufacturing chain link fence products with at least 5 years' experience.

B. Fence contractor: Company with demonstrated successful experience installing similar projects and products in accordance with ASTM F 567 and have at least 5 years' experience.

C. Tolerances: Current published edition of ASTM specifications tolerances apply. ASTM specification tolerances supersede any conflicting tolerance.

1.7 WARRANTY

A. All structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 20 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wheatland Tube Co.,

B. Master Halco, Inc.,

C. Southwestern Wire, Inc.,

D. Or approved equal

2.2 GENERAL

A. Dimensions indicated herein for roll-formed pipe and H-sections are outside dimensions, excluding coatings.

B. Fence fabric height shall be 6 feet unless otherwise indicated.

C. Fencing materials shall be galvanized after fabrication.

2.3 STEEL FABRIC

A. Fence fabric shall be 9 gauge steel wire, 2-inch mesh, with top selvages knuckled and bottom selvages twisted and barbed.

B. Fabric shall be hot-dip galvanized per ASTM A 392, Class 2, 2.0 oz/ft² before weaving.

2.4 FRAMING AND ACCESSORIES

A. **Round steel pipe and rail:** Schedule 40 standard weight pipe, in accordance with ASTM F1083, 2.0 oz/ ft² hot dip galvanized zinc exterior and 2.0 oz/ft² hot dip galvanized zinc interior coating. Intermediate Strength Grade: Minimum yield strength 50,000 psi.

1. Line post shall be 2-3/8" outside diameter, 2.0 oz/ft² zinc coating.
2. End, Corner, Pull post 2-7/8" outside diameter, 2.0 oz/ft² zinc coating.
3. Top, brace, bottom and intermediate rails, 1.660" outside diameter, 2.0 oz/ft² zinc coating.

B. **Tension Wire:** Tension wire shall be located at the bottom of the fabric and shall consist of 7 gauge marcelled wire complying with ASTM A 824 and shall match the coating of the chain link fabric. Tension wire shall be interlaced with the fabric or attached to the fabric with wire ties at a spacing of no more than 18 inches apart.

C. **Barbed Wire Support Arms:** Support arms shall be manufacturer's standard fabrication with finish to match fence framework. Support arms shall be single 45 degree arm type and shall be capable of withstanding 250 pounds of downward pull.

D. **Barbed Wire:** Metallic coated steel barbed wire shall comply with ASTM A 121, Design Number 12-4-5-14R, double 12-1/2 gauge twisted strand wire, with 4 point 14 gauge round barbs spaced 5 inches on center. Match coating of the chain link fabric.

E. **Tension and Brace Bands:** Galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge (0.105 in.), minimum width of 3/4 inch and minimum zinc coating of 1.20 oz/ft². Secure bands with 5/16 inch galvanized steel carriage bolts.

F. **Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps, Rail Sleeves:** In compliance to ASTM F626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 oz/ft².

G. **Truss Rod Assembly:** In compliance with ASTM F626, 3/8 inch diameter steel truss rod with a pressed steel tightener, minimum zinc coating of 1.2 oz/ft², assembly capable of withstanding a tension of 2,000 lbs.

H. **Tension Bars:** Tension bars shall be in accordance with ASTM F626 and shall be galvanized steel one-piece length 2 inch less than the fabric height. Minimum zinc coating 1.2 oz. /ft². Bars for 2 inch mesh shall have a minimum cross section of 3/16 inch by 3/4 inch.

I. **Tie Wire and Hog Rings**: Galvanized minimum zinc coating 1.20 oz/ft², 9 gauge (0.148") steel wire in compliance with ASTM F626.

2.5 SWING GATES

A. **Swing Gates:** Galvanized steel pipe welded fabrication in compliance with ASTM F900. Gate frame members 1.900 inch outside diameter, ASTM F 1083 schedule 40 galvanized steel pipe. Frame members spaced no greater than 8 ft. apart vertically and horizontally. Welded joints protected by applying zinc-rich paint in accordance with ASTM Practice A 780. Positive locking gate latch, pressed steel galvanized after fabrication. Galvanized malleable iron or heavy gauge pressed steel post and frame hinges. Provide lockable drop bar and gate holdbacks with double gates. Match gate fabric to that of the fence system. Gateposts per ASTM F1083 schedule 40 galvanized steel pipe. The gatepost diameter from table 2.5.B.

B. Gateposts: Schedule 40 pipe in compliance with ASTM F1083.

Gate fabric height up to and including 6 ft.		
Gate leaf width	**Post Outside Diameter**	**Weight**
up to 4 ft.	2.375 in.	3.65 lb/ft
over 4 ft. to 10 ft.	2.875 in.	5.79 lb/ft
over 10 ft. to 18 ft.	4.000 in.	9.11 lb/ft
Gate fabric height over 6 ft. to 12 ft.		
Gate leaf width		
up to 6 ft.	2.875 in.	5.79 lb/ft
over 6 ft. to 12 ft.	4.000 in.	9.11 lb/ft
over 12 ft. to 18 ft.	6.625 in.	18.97 lb/ft
over 18 ft. to 24 ft.	8.625 in.	28.58 lb/ft

2.6 CONCRETE

A. Concrete for post footings shall have a 28-day compressive strength of 2,500 psi in accordance with Section 03 30 00 – Cast-in-Place Concrete.

PART 3 EXECUTION

3.1 FRAMEWORK INSTALLATION

A. Posts: Posts shall be set plumb in concrete footings in accordance with ASTM F567. Minimum footing depth, 24 inch plus an additional 3 inch depth for each 1 ft. increase in the fence height over 4 ft. or as indicated on the contract drawings whichever is greater. The minimum footing diameter shall be four times the largest cross section of the post up to a 4.00” dimension and three times the largest cross section of post greater than a 4.00” dimension or as indicated on the contract drawings, whichever is greater. Top of concrete footing to be at grade and crowned to shed water away from the post. Line posts installed at intervals not exceeding 10 ft. on center.

B. Top rail: When specified, install 21 ft. lengths of rail continuous thru the line post or barb arm loop top. Splice rail using top rail sleeves minimum 6 inches long. Rail shall be secured to the terminal post by a brace band and rail end. Bottom rail or intermediate rail shall be field cut and secured to the line posts using boulevard clamps or brace band with rail end. Fences 12 feet high or higher require mid rail.

C. Terminal posts: End, corner, pull and gate posts shall be braced and trussed for fence 6 ft. and higher and for fences 5 ft. in height not having a top rail. The horizontal brace rail and diagonal truss rod shall be installed in accordance with ASTM F567.

D. Tension wire: Shall be installed 4 inches up from the bottom of the fabric. Fences without top rail shall have a tension wire installed 4 inches down from the top of the fabric. Tension wire to be stretched taut, independently and prior to the fabric, between the terminal posts and secured to the terminal post using a brace band. Secure the tension wire to each line post with a tie wire. Install the top tension wire through the barb arm loop for fences having barbed wire and no top rail.

3.2 CHAIN LINK FABRIC INSTALLATION

A. Chain Link Fabric: Install fabric to outside of the framework. Attach fabric to the terminal post by threading the tension bar through the fabric; secure the tension bar to the terminal post with tension bands and 5/16 inch carriage bolts spaced no greater than 12 inches on center. Chain link fabric shall be stretched taut free of sag. Fabric to be secured to the line post with tie wires spaced no greater than 12 inches on center and to horizontal rail spaced no greater than18 inches on center. Secure fabric to the tension wire with hog rings spaced no greater than 18 inches on center.

1. Tie wire shall be wrapped 360 degrees around the post or rail and the two ends twisted together three full turns. Excess wire shall be cut off and bent over to prevent injury. The installed fabric shall have a ground clearance on no more than 2 inches.

3.3 GATE INSTALLATION

A. Swing Gates: Installation of swing gates and gateposts in compliance with ASTM F 567. Direction of swing shall be inward. Gates shall be plumb in the closed position having a bottom clearance of 3 inch, grade permitting. Hinge and latch offset opening space shall be no greater than 3 inches in the closed position. Double gate drop bar receivers shall be set in a concrete footing minimum 6 inch diameter 24 inch deep. Gate leaf holdbacks shall be installed for all double gates.

3.4 CLEAN UP

A. Clean Up: The area of the fence line shall be left neat and free of any debris caused by the installation of the fence.

- END OF SECTION –

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SECTION 33 05 03
COPPER PIPE

PART 1 GENERAL

1.1 SUMMARY

A. CONTRACTOR shall furnish and install all copper pipes, fittings, couplings, supports, joint materials and appurtenances as shown and specified, and as required for a complete and workable piping system.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 22 10 10 Plumbing Piping and Specialties
3. Section 33 12 00 Mechanical Appurtenances
4. Section 33 13 00 Pipeline Testing and Disinfection

1.3 MEASUREMENT AND PAYMENT

A. There shall be no separate measurement and payment for this section. Full compensation for Copper Pipe shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which Copper Pipe relates.

1.4 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM B88 Standard Specification for Seamless Copper Water Tube

C. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 800 Standard for Underground Service Line Valves and Fittings

D. INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

E. INTERNATIONAL PLUMBING CODE (IPC)

F. INTERNATIONAL MECHANICAL CODE (IMC)

1.5 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit catalog information on all fittings and valves shown on the Contract Drawings, referencing each item by number as shown on the Contract Drawings. Information shall indicate manufacturer specification compliance and dimensional data.

1.6 QUALITY ASSURANCE

A. Reject any pipe which does not conform to Contract Documents or is cracked, chipped, crushed, dented, kinked, or otherwise unacceptable.

PART 2 PRODUCTS

2.1 PIPE

A. The type and class of the pipe and fittings shall be as indicated on the Contract Drawings and shall be Type K copper for buried services lines and Type L copper for interior piping.

B. Type K and Type L copper pipe shall have smooth surfaces free from bumps. Type K shall also be flexible enough to be coiled. All piping shall have the capacity to function at design working pressures.

C. Copper pipe to be buried or encased in concrete shall be polyethylene coated or installed in a polyethylene sleeve. Polyethylene coated pipe shall have a coating thickness of 0.025 inches and shall be **Mueller Industries Streamline Plastic Coated Pipe**, or approved equal. Polyethylene sleeve shall be a minimum 6 mil thick and shall be **Northtown Polywrap C**, or approved equal. Color shall be blue for cold water, red for hot water, or purple for reclaimed water. Seal seam joints and around fittings with **Polyken #930**, or approved equal, adhesive tape.

2.2 CONNECTIONS AND FITTINGS

A. Connections shall be flared or compression type for service lines. All other connections for above ground and in interior to structures shall be hot 95-5 lead free soldered joints.

B. Connections for dissimilar piping shall include dielectric insulation unions.

C. Fittings shall conform to AWWA C-800 standards and shall be capable of operating at 150 psi.

PART 3 EXECUTION

3.1 INSTALLATION

A. Pipe shall be installed according to the manufacturers' instructions and per the requirements of the INTERNATIONAL PLUMBING CODE (IPC) and INTERNATIONAL MECHANICAL CODE (IMC). In case of a conflict between the two installation requirements the more stringent requirement shall apply.

B. The pipe shall be plugged at the end of each workday or period of suspension.

3.2 PRELIMINARY CLEANING AND FLUSHING

A. CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to ensure that any foreign materials do not remain in any of the piping.

3.3 TESTING OF PIPING

A. Source of Water: CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for pressure testing of the pipeline.

B. Testing Procedure:

1. Pipe shall be tested in accordance with the INTERNATIONAL PLUMBING CODE, Section 312 - Tests and Inspections.
2. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall repeat the pipeline testing until the pipeline passes the leakage test, all at no additional cost to OWNER.
3. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

3.4 DISINFECTION

A. For all potable water systems and where otherwise required all pipelines shall be disinfected in accordance with Section 33 13 00 – Pipeline Testing and Disinfection and approved before being allowed to be connected into a culinary system. Sewer pipelines do not require disinfection.

B. Source of Water: CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection of the water line system.

- END OF SECTION –

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SECTION 33 05 05
DUCTILE IRON PIPE

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install all pipe, fittings, closure pieces, supports, bolts, nuts, gaskets, jointing material, polyethylene wrap, marker tape, tracer wire, and appurtenances as shown and specified, and as required for a complete and workable piping system.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 01 50 30 Protection of Existing Utilities
3. Section 09 90 00 Painting and Finishes
4. Section 31 23 15 Excavation and Backfill for Pipelines
5. Section 33 12 00 Mechanical Appurtenances
6. Section 33 13 00 Pipeline Testing and Disinfection

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ASTM D 2041 Cast-Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250

C. AMERICAN STANDARDS FOR TESTING AND MATERIAL (ASTM)

1. ASTM A 193 Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
2. ASTM A 194 Standard Specification for Carbon Steel, Alloy Steel, and Stainless-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
3. ASTM A 283 Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
4. ASTM A 536 Standard Specification for Ductile Iron Castings

D. American Society of Mechanical Engineers (ASME)

1. ASME B1.1 Unified Inch Screw Threads, (UN And UNR Thread Form)
2. ASME B18.2.1 Square, Hex, Heavy Hex, And Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, And Lag Screws (Inch Series)
3. ASME B18.2.2 Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, And Coupling Nuts (Inch Series)

E. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 104 Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2. AWWA C 105 Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
3. AWWA C 110 Standards for Ductile-Iron and Gray-Iron Fittings, 3-inch Through 48-inch, for Water
4. AWWA C 111 Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. AWWA C 115 Standard for Flanged Ductile-Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges
6. AWWA C 150 Standard for the Thickness Design of Ductile-Iron Pipe
7. AWWA C 151 Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
8. AWWA C 153 Standard for Ductile-Iron Compact Fittings, 3-inch Through 64-inch for Water
9. AWWA C 219 Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
10. AWWA C 600 Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances
11. AWWA C 606 Standard for Grooved and Shouldered Joints
12. AWWA C 651 Standard for Disinfecting Water Mains
13. AWWA M 11 Steel Pipe – A Guide for Design and Installation

1.4 SUBMITTALS

A. Submit catalog information on all pipe, fittings, valves, couplings, gaskets, tapes, bolts and nuts, wraps, safety tapes, and tracer wires as shown on the Contract Drawings. Information shall indicate manufacture specification compliance and dimensional data.

B. Submit shop drawings on all fabricated piping and pipe supports.

C. Submit bolting patterns, procedures, and bolting equipment data, and calculations for target torque calculations.

D. Certified affidavit of compliance for pipe and fittings or other materials furnished under this Section and as specified in the referenced standards.

1.5 QUALITY ASSURANCE

A. Except as modified herein, materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.

PART 2 PRODUCTS

2.1 DUCTILE IRON PIPE

A. Ductile iron pipe shall conform to the requirements of the AWWA C151 and AWWA C150 and pipe must be certified for potable water use by the National Sanitation Foundation (NSF/ANSI 61) and must bear the logo "NSF-pw" or "NSF-61" indicating such certification. Pipe thickness rating shall be minimum Class 53 for pipe larger than 12" diameter, and Class 350 for pipe 12" diameter and smaller, unless otherwise noted on the Contract

Drawings. The pipe shall be provided with rubber gaskets, specials, and fittings as required. Nominal pipe laying lengths shall be 18-feet.

B. Buried Ductile Iron Pipe shall be encased with 8 mil (minimum), Group 2, Class C black polyethylene, conforming to the requirements of AWWA C105. All seams in the polyethylene encasement shall be taped with a minimum 12 mil adhesive tape, **Polyken #900**, **3M Scotchrap 51,** or approved equal, to completely seal the seam.

2.2 FITTINGS

A. MJ and Push-on fittings shall conform to the (AWWA C110 or C153), be NSF certified to ANSI/NSF 61 and shall be for a minimum rated working pressure of 150 psi.

B. Flanges shall conform to AWWA C110 AWWA C111, and ANSI B16.1, Class 125 and shall have either raised or plain faces, and shall have a minimum working pressure rating of 250 psi. For pipe sizes 24-inch and smaller, flanged joints may be rated for a maximum of 350 psi with the use of specially designed gaskets.

C. All buried fittings shall be completely coated with food grade grease, **Chevron FM Grease**, or approved equal, and shall be completely encased with 8 mil (minimum), Group 2, Class C polyethylene, conforming to AWWA C105 and color to match the pipe wrap. All seams in the polyethylene encasement shall be taped with a minimum 12 mil adhesive tape, **Polyken #900**, **3M Scotchrap 51,** or approved equal, to completely seal the seam.

2.3 DUCTILE IRON PIPE JOINTS

A. 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 joints shall conform to the requirements of AWWA C111.
2. Flanged joints shall conform to the requirements of AWWA C115.
3. Restrained joints shall conform to the requirements of AWWA C151. Restrained joints shall **be Flex-Ring, Field Flex-Ring, or Lok-Ring by American Ductile Iron Pipe, Field Lok, TR-Flex by U.S. Pipe**, or approved equal.
4. Joint restraining devices that impart point loads and/or wedging action on the pipe wall as a means of joint restraint shall not be allowed.

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED)

A. Mechanical-type couplings shall be provided where indicated on the Drawings and shall conform to the requirements of AWWA C606. Mechanical type couplings shall be designed for a water working pressure not less than the design pressure of the pipe on which they are to be installed. Mechanical-type couplings shall be **Victaulic Style 31 (flexible or rigid)**, or approved equal.

B. Gaskets shall be the flush seal type.

C. Mechanical-type couplings for equipment connections shall be provided with rigid grooved couplings or flexible type coupling with harness, unless thrust restraint is provided by other means.

D. Grooved fittings, couplings and valves shall be furnished from the same manufacturer as the coupling. Grooving tools shall be from the same manufacturer as the grooved components.

2.5 DISMANTLING JOINT

A. Provide dismantling joint were shown on the Contract Drawings. CONTRACTOR will not be allowed to substitute any other type of dismantling joint unless approved by ENGINEER. The coupling shall be rated as indicated on the Contract Drawings.

B. Dismantling joint bodies shall be fabricated from steel, ASTM A512 or A 513 or Ductile Iron ASTM A536, without pipe stop. The body shall not be 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 body 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. The follower ring shall be fabricated from steel, ASTM A576 or A36.

C. For dismantling joint installed in piping systems rated for positive pressure, the coupling shall be restrained with harness bolts or tie rods. Other means of restraining the coupling such as set screws will not be accepted. Harnesses shall be designed in accordance with AWWA Manual 11, or as indicated. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed.

D. Gaskets shall be composed of a rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions.

E. Dismantling joints shall be **Model 975 by Smith-Blair, Model 309 by JCM, Model DJ400 by Romac**, or approved equal.

2.6 GASKETS

A. Except as otherwise provided, gaskets for flanged joints shall be 1/8-inch thick rubber fabric. Class 250 or less flange gaskets shall be **Flange-Tyte by U.S. Pipe**, higher pressure joint gaskets shall be **Garlock BLUE-GARD Style 3000**, or approved equal. Wherever blind flanges are shown, the gaskets shall consist of 1/8-inch thick cloth-inserted rubber sheet which shall cover the entire inside surface of the blind flange and shall be cemented to the surface of the blind flange.

B. All buried fittings using steel bolts shall be coated with no-oxide wax and wrapped with polyethylene or as otherwise approved by ENGINEER.

2.7 BOLTS AND NUTS

A. Bolts and nuts shall be rated for the system working pressure with a minimum safety factor of three. Bolts and nuts buried, submerged, and inside vaults shall be Type 304 stainless steel. Bolts and nuts above grade, exposed or inside structures, shall be Type 304 stainless steel. Bolts and nuts in exposed to wastewater or in corrosive environments shall be Type 304 stainless steel.

B. All flange bolt lengths shall be selected by CONTRACTOR such that three full threads, as a minimum, protrude from the hex nut and washer after assembly.

C. Flange bolts shall have ASME B1.1, Class 2A threads, and be manufactured of ASTM A 193, Grade B7 steel. Bolts shall conform to ASME B18.2.1.

D. Flange nuts shall have Class 2A fit, and be manufactured of ASTM A 194, Grade 2H steel, having square or hex heavy dimensions in accordance with ASME B18.2.2.

E. Connection T-bolts for mechanical joint (MJ) fittings shall be Cor-Ten high strength, low alloy steel conforming to AWWA C111.

2.8 CEMENT MORTAR LINING

A. Ductile iron pipe and fittings shall be lined with cement mortar in accordance with the requirements of the AWWA C104 except that the lining thickness shall be not less than 1/8 of an inch. The pipe interior surfaces shall be smooth and free from factures, excessive crazing, and roughness.

2.9 THRUST BLOCKS/ RESTRAINTS

A. All fittings for pipe shall not have thrust blocks, but joint restraints for the adjacent pipe shall be provided for the distances indicated on the Contract Drawings. Joint restraint shall be provided for all bends, fittings, and valves regardless of pipe size or location. If noted on the Contract Drawings, thrust blocks shall be concrete as per OWNER's Standards.

B. Joint restraints may be tie rods, **TR Flex piping system as manufactured by US Pipe**, or approved equal, or a **Megalug system as manufactured by EBAA Iron**. Where the required pipeline deflection exceeds the recommended deflection of the TR Flex piping system, CONTRACTOR shall use Megalugs to achieve specified deflections.

C. Restrained joints shall be suitable for 250 psi test pressures.

2.10 SAFETY TAPE

A. Safety tape shall be a minimum of 3-inch wide by 5.0 mil overall thickness, with no less than a 0.35-gauge solid aluminum foil core. It shall be Safety Blue in color per American Public Works Association (APWA) National Color Code and shall be clearly labeled with the words "CAUTION POTABLE WATER LINE BELOW" or similar wording approved by ENGINEER. Safety tape shall be **MagnaTec by Empire Level Mfg Corp**, or approved equal.

2.11 TRACER WIRE

A. All piping (including service lines) shall be installed with 12-gauge solid copper THHN tracer wire for pipeline location purposes by means of an electronic line tracer.

1. The wires must be installed along the entire length of the pipe on the top, center of the pipe and be held in place with poly tape at all pipe joints and at 5-foot intervals.
2. Sections of wire shall be spliced together using approved splice caps and waterproof seals. Twisting the wires together is not acceptable.

2.12 PIPE COATINGS

A. All exposed piping, valves, and fittings including inside vaults and buildings shall be painted as specified in Section 09 90 00 – Painting and Finishes. Exposed piping, valves and fittings to be painted shall be primed by the manufacturer in preparation for painting. CONTRACTOR shall provide verification from the finish coating supplier that the field applied coatings are compatible with the manufacturer's prime coat. Pipe to be painted shall not have asphalt emulsion coating. The exterior of buried pipe and fittings shall be an asphaltic coating approximately one-mil thick.

PART 3 EXECUTION

3.1 INSTALLATION

A. Excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.

B. Ductile iron fittings shall be installed in accordance with the ANSI/AWWA C600. Inspect each pipe and fitting prior to installation to verify there is no damage and clean each pipe and fitting prior to installation.

C. Pipe shall be laid directly on the bedding material. Bell holes shall be formed at the ends of the pipe to prevent point loading.

D. No pipe shall be installed on a foundation into which frost has penetrated or at any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation before backfilling occurs.

E. Immediately before joining the pipe, the bell end of the pipe shall be thoroughly cleaned. The spigot end of the pipe and the inside surface of the gasket shall be cleaned and lubricated. The lubricant shall be non-toxic, shall not support bacteria growth, shall not be harmful to the gasket material, and shall be compliant with NSF/ANSI 61 requirements. The lubricant shall not impart a taste or odor to the water in the pipe. Tilting of the pipe to insert the spigot into the bell will not be permitted.

F. Buried Ductile Iron pipe shall be polyethylene encased in accordance with the requirements of AWWA C105 Method A. Remove all lumps of clay, mud, cinders, etc. on the pipe surface before installation of the encasement. During installation, soil or embedment material shall not be trapped between the pipe and the polyethylene. Cut polyethylene tube to a length at least 2 feet longer than the pipe section. Wrap shall overlap the adjacent pipe joint at least 1 foot. After assembling the pipe joint, overlap the joint with the polyethylene tube and secure to the pipe with adhesive tape completely around the seam. Overlap the joint on the previous pipe with the polyethylene tube and secure to the existing wrap with adhesive tape and completely seal the seam. Take up the slack width at the top of the pipe to make a snug but not tight fit along the barrel of the pipe and secure with poly tape at 5 foot intervals. For installations below the water table or wet areas, circumferential wraps of tape should be placed at 2 foot intervals along the barrel of the pipe prior to lowering the pipe into the trench.

G. All buried Ductile Iron fittings and valves shall be completely coated with food grade grease, **Chevron FM Grease**, or approved equal, and shall be encased with polyethylene wrap and installed in conformance with AWWA C105 standards. All seams in the

polyethylene encasement shall be taped with **Polyken #900, 3M Scotchrap 51,** adhesive tape, or approved equal, to completely seal the seam.

H. Repair punctures to the polyethylene wrap with adhesive tape. Repair cuts, tears, or damage to the polyethylene wrap with a tube cut open, wrapped around the pipe to cover the damaged area, and secure in place with **Polyken #900, 3M Scotchrap 51,** adhesive tape, or approved equal, to completely seal the seam.

I. Provide openings for branches, service taps, blowoffs, air valves, and similar appurtenances by cutting an "X" in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance, and repair the cut and any other damaged areas.

J. To make a direct tap, apply two or three wraps of adhesive tape completely around the polyethylene encased pipe to cover the area where the tapping machine and chain will be mounted. Install the corporation stop directly through the tape and polyethylene encasement. After the direct tap is completed, inspect for damage and repair if needed.

K. Where polyethylene wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of 3 feet. Secure the end with adhesive tape completely around the seam. Service lines with dissimilar metals shall be wrapped with polyethylene or approved dielectric tape for a minimum clear distance of 3 feet away from the ductile iron pipe.

L. Valves shall be handled in a manner to prevent damage to any part of the valve. CONTRACTOR shall adjust stem packing and operate each valve prior to installation to insure proper operation. Valves shall be installed so that the valve stems are plumb and, in the location, indicated on the drawings.

M. The pipe shall be plugged at the end of each work day or period of suspension.

N. Safety tracer tape shall be installed 12-inches below the ground surface along the entire length of pipeline.

O. Tracer wire shall be installed according to NESC standards and shall be brought up at valve boxes and fire hydrants as shown on the Contract Drawings. Tracer wire does not need to be brought up at shut-off valves for fire hydrants. When splicing a wire use a greased filled or approved connector. All splices should occur within a valve box. Wire is to be continuous underground. Underground splices may only be used by specific permission of OWNER and must be inspected before backfill. It is the responsibility of CONTRACTOR to ensure that the continuity test is performed by OWNER prior to any paving operations. Failures in the continuity are the responsibility of CONTRACTOR and shall be repaired by CONTRACTOR and verified by OWNER prior to any paving operations.

3.2 THRUST BLOCKS

A. Thrust blocks shall be installed only where indicated on the Contract Drawings.

B. Thrust blocks shall be constructed so that the bearing surface is in direct line with the major force created by the pipe or fitting.

C. Thrust blocks shall bear against solid undisturbed earth at the side and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints or the pipe or fitting.

D. Thrust blocks shall be sized and constructed per OWNER's Standards Drawings.

3.3 PRELIMINARY CLEANING AND FLUSHING

A. CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to ensure that sand, rocks, or other foreign material do not remain in any of the pipeline. If possible, the flushing shall be made with an open pipe end.

B. CONTRACTOR shall provide to ENGINEER a proposed schedule and method of flushing for review before the flushing starts.

3.4 BOLTING PROCEDURES FOR FLANGED JOINTS

A. Flange joints shall be assembled per the gasket manufacturer's instructions and as specified herein. Utilize calibrated bolting equipment capable of applying a measured torque to flange bolts during joining. Bolting patterns, procedures, and bolting equipment data shall be submitted prior to pipe fitting and bolting.

B. Gaskets, bolts, and anti-seize lubricant used in the bolting procedure shall be selected from those specified herein. Submit target torque calculations for each application. Calculations shall identify specific gasket (manufacturer, model, size, configuration, material), bolts (size and material), and anti-seize lubricant. The calculations shall document and take into consideration the pipe service, working and test pressures, pipe diameter, gasket data sheet, bolt material, gasket supplier-recommended assembly stress, and gasket-supplier recommended bolt stress. Calculations shall be stamped by a professional engineer. Target torque calculations shall be used in the assembly of bolted joints.

C. Flange bolts, nuts, and washers shall be visually inspected and cleaned prior to bolting. Lubricate bolts and nuts; if hardened washers are not used, lubricate the flange surface around the bolt holes. This lubricant must be removed by cleaning solvent prior to applying a coating system. Hand-tighten all nuts and bolts then tighten them to 10 to 20 percent of the target torque. The initial torque shall not exceed 20 percent of the target torque. The bolts shall be tightened according to the pattern included in AWWA Manual M11, Figure 12-3.

D. For flanges having 4 to 8 bolts there shall be three rounds of tightening, after hand tightening, to 30 percent, 60 percent and then 100 percent of the target torque. For flanges having 12 or more bolts there shall be four rounds of tightening, after hand tightening, to 20 percent, 40 percent, 80 percent and 100 percent of the target torque. At 100 percent of target torque the flange gap shall be measured at every other bolt to confirm uniformity. The bolts shall be re-tightened to the target torque 24 hours after completion of the initial bolting sequence.

3.5 TESTING OF PIPELINE

A. CONTRACTOR shall provide additional temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.

B. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for pressure testing of the pipeline.

C. Testing Procedure

1. Pipe shall be tested at a static pressure of 150 psi for 2 hours and in accordance with the AWWA C600 standards. Pipe shall be tested in segments such that the test pressure at the low point of the segment shall be 150 psi, and the minimum pressure at the high point in the segment shall be 130 psi.
2. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the excessive leakage, shall take corrective measures necessary to repair the leaks, and shall repeat the pipeline test, all at no additional cost to OWNER.
3. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

D. Pressure and Leak Test

1. CONTRACTOR shall test all piping either in sections or as a unit. The test shall be made by placing temporary bulkheads as needed in the pipe and filling the line slowly with water. Care shall be taken to see that all air vents are open during the filling. Bulkheads, valves, and connections shall be examined for leaks. If any leaks are found, corrective measures satisfactory to ENGINEER shall be taken. The test shall consist of holding a minimum pressure as shown on the Drawings in the section being tested for a minimum period of two hours using either pneumatic or hydraulic means to maintain the pressure. Suitable means shall be provided by CONTRACTOR for determining the quantity of water lost by leakage under the test pressure. The testing allowance is defined as the quantity of water that must be applied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. The maximum allowable leakage shall be defined as follows:

$$L = SD(P)1/2/148,000$$

L = Testing allowance (makeup water) in gallons per hour of test
S = Length of pipe in feet
D = Nominal diameter of pipe in inches
P = Average Test Pressure in pounds per square inch (gauge)

3.6 DISINFECTING

A. Disinfection shall be in accordance with Section 33 13 00 – Pipeline Testing and Disinfection.

3.7 PAINTING

A. All exposed piping including inside vaults shall be painted as specified in Section 09 90 00 – Painting and Finishes.

- END OF SECTION -

SECTION 33 05 07
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE, RUBBER JOINTS (AWWA C900)

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install all PVC pipe, fittings, closure pieces, supports, gaskets, jointing material and appurtenances as shown and specified, and as required for a complete and workable piping system.

B. This Section includes PVC pressure pipe meeting the requirements of AWWA C900. PVC pressure pipe with solved-welded, flanged, or threaded joints is included in Section 33 05 07.1 - PVC Pressure Pipe (ASTM D 1785, modified).

1.2 RELATED WORK

A. Related work specified in other sections:

1. Section 01 33 00 Submittal Procedures
2. Section 01 50 30 Protection of Existing Facilities
3. Section 31 23 15 Excavation and Backfill for Pipelines
4. Section 33 05 05 Ductile Iron Pipe
5. Section 33 12 00 Mechanical Appurtenances
6. Section 33 13 00 Pipeline Testing and Disinfection

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D 1784 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
2. ASTM D 3139 Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
3. ASTM F 477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

C. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 605 Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
2. AWWA C 651 Standard for Disinfecting Water Mains
3. AWWA C 900 Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 60-Inch for Water Transmission and Distribution

4. AWWA M 23 Manual of Water Supply Practices - PVC Pipe - Design and Installation

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

C. Submit shop drawings of pipe, fittings, and appurtenances showing compliance with this Section, and manufacturer’s literature on tracer wire and accessories.

D. Submit plan for commissioning the waterline, including but not limited to cleaning, pressure testing, and disinfection.

PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE

A. All polyvinyl chloride (PVC) pipe intended for use in public drinking water supply pipelines or in pressure pipeline systems shall be manufactured of material conforming to AWWA C900, ASTM D1784, and cell classification 12454 PVC materials for the size and class required. All PVC pipes must be certified for potable water use by the National Sanitation Foundation (ANSI/NSF 61) and must bear the logo "NSF-pw" or "NSF-61" indicating such certification. Standard laying lengths shall be 20-feet. Pipe sections shall be clearly marked to:

1. Identify manufacturer's name or trademark
2. Nominal pipe size and OD base
3. AWWA material code designation
4. Dimension ratio
5. AWWA pressure class
6. AWWA specification designation
7. Product record code

B. The PVC pipe shall be DR-18 (235 psi).

2.2 POLYVINYL CHLORIDE JOINTS

A. All joints and accessories shall be as manufactured and furnished by the pipe supplier. Joints shall be bell and spigot conforming to the requirements of ASTM D3139. Gaskets shall comply with the requirements of ASTM F477.

B. Deflection at the joint shall not exceed 1.0 degree for AWWA C900 pipe or the maximum deflection recommended by the pipe manufacturer. No deflection of the joint shall be allowed for joints that are over-inserted or not inserted to the assembly or stop mark.

2.3 FITTINGS

A. Fittings shall be in accordance with Section 33 05 05 – Ductile Iron Pipe.

2.4 THRUST BLOCKS/ RESTRAINTS

A. All fittings shall have proper restraints as noted for the type of installation required. Joint restraint shall be provided for all bends, fittings, and valves regardless of pipe size or location. Thrust blocks shall be provided where indicated on the Contract Drawings and shall be 3,000 psi concrete and size per the City Standard details.

B. Joint restraints may be **EBAA Iron Megalug Series 2000PV and Series 2200, Star Pipe Product Series 1100 Pipe Restrainers, Romac Industries RomaGrip for PVC Pipe or 470 Series Pipe Restraining System with tie rods**, or approved equal. (RESTRAINTS WITH A POINT LOADING ON THE PIPE WILL NOT BE ALLOWED ON PVC PIPE.)

C. Restrained joints shall be suitable for a minimum of 150 psi test pressures or the required project test pressure.

2.5 TRACER WIRE

A. All piping (including service lines) shall be installed with 12-gauge solid copper THHN tracer wire for pipeline location purposes by means of an electronic line tracer.

1. The wires must be installed along the entire length of the pipe on the top of the pipe and be held in place with ties or hitches spaced not more than 12-feet apart.
2. Sections of wire shall be spliced together using approved splice caps and waterproof seals or solder. Twisting the wires together is not acceptable.

PART 3 EXECUTION

3.1 INSTALLATION

A. Excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.

B. Polyvinyl Chloride (PVC) pipe shall be installed in accordance with AWWA Manual M23.

C. The pipe shall be plugged at the end of each workday, or period of work suspension.

D. Tracer wire shall be installed 3-inch minimum above pipe as required by the Drawings.

3.2 THRUST BLOCKS AND JOINT RESTRAINTS

A. Thrust blocks and/or joint restraints (as indicated on the Contract Drawings) shall be installed at points where the pipe changes direction such as: at all tees, elbows, wyes, caps, valves, hydrants, reducers, etc.

B. Thrust blocks shall be constructed so that the bearing surface is in direct line with the major force created by the pipe or fitting.

C. Thrust blocks shall bear against solid undisturbed earth at the side and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints or the pipe or fitting.

D. Thrust blocks shall be sized and constructed per the City' Standard Drawings.

3.3 PRELIMINARY CLEANING AND FLUSHING

A. CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to ensure that sand, rocks, or other foreign material are not left in any of the pipeline. If possible, the flushing shall be made with an open pipe end.

B. CONTRACTOR shall provide to ENGINEER a proposed schedule and method of flushing for review before the flushing starts.

3.4 TRACER WIRE TESTING

A. A continuity test shall be conducted by OWNER to verify the integrity of the tracer wire installed by CONTRACT. It is the responsibility of CONTRACTOR to ensure that the continuity test is performed by OWNER prior to any paving operations. Failures in the continuity are the responsibility of CONTRACTOR and shall be repaired by CONTRACTOR and verified by OWNER prior to any paving operations.

3.5 TESTING OF PIPELINE

A. CONTRACTOR shall provide temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.

B. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection and pressure testing of the pipeline.

C. Testing Procedure

1. PVC pipe shall be tested at a static pressure of 150 psi for 2 hours and in accordance with the AWWA C605 standards. Pipe shall be tested in segments such that the test pressure at the low point of the segment shall be 150 psi.
2. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the excessive leakage, shall take corrective measures necessary to repair the leaks, and shall repeat the pipeline test, all at no additional cost to OWNER.
3. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that the ENGINEER may be present during the test.

D. Pressure and Leak Test

1. CONTRACTOR shall test all piping either in sections or as a unit. The test shall be made by placing temporary bulkheads as needed in the pipe and filling the line slowly with water. Care shall be taken to see that all air vents are open during the filling. Bulkheads, valves, and connections shall be examined for leaks. If any leaks are found, corrective measures satisfactory to ENGINEER shall be taken. The test shall consist of holding a minimum pressure as shown on the Contract Drawings on the section being tested for a minimum period of two hours using either pneumatic or hydraulic means to maintain the pressure. Suitable means shall be provided by CONTRACTOR for determining the quantity of water lost by leakage under the test

pressure. The testing allowance is defined as the quantity of water that must be applied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. The maximum allowable leakage shall be defined as follows:

L = SD(P)1/2/148,000

L = Testing allowance (makeup water) in gallons per hour of test
S = Length of pipe in feet
D = Nominal diameter of pipe in inches
P = Average Test Pressure in pounds per square inch (gauge)

3.6 DISINFECTING

A. Disinfection shall be in accordance with Section 33 13 00 - Pipeline Testing and Disinfection.

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SECTION 33 05 07.1
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE
(ASTM D 1785, modified)

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install all PVC pressure pipe and appurtenances as shown and specified, and as required for a complete and workable piping system.

B. This Section includes PVC pressure pipe with solvent-welded, flanged, or threaded joints in accordance with ASTM D 1785 as modified herein. PVC pipe with bell and spigot joints is included in Section 33 05 07 - PVC Pressure Pipe, Rubber Joints (AWWA C900).

C. This Section includes slotted PVC Well Casing Pipe for the spring collection piping.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 05 45 00 Mechanical Metal Supports
3. Section 31 23 15 Excavation and Backfill for Pipelines
4. Section 33 05 07 PVC Pressure Pipe, Rubber Joints (AWWA C900)
5. Section 33 12 00 Mechanical Appurtenances
6. Section 33 13 00 Pipeline Testing and Disinfection

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI B 16.5 Pipe Flanges and Flanged Fittings Class 150

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D1784 Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
2. ASTM D 1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
3. ASTM D 2467 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
4. ASTM F 1498 Standard Specification for Taper Pipe Threads 60 Degrees for Thermoplastic Pipe and Fittings

D. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 605 Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
2. AWWA C 651 Standard for Disinfecting Water Mains
3. AWWA C 900 Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 12-Inch for Water Transmission and Distribution
4. AWWA C 905 Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 14-Inch through 48-inch
5. AWWA M 23 Manual of Water Supply Practices - PVC Pipe - Design and Installation

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

C. Submit shop drawings of pipe, fittings, and appurtenances showing compliance with this Section; and manufacturer’s literature on tracer wire and accessories.

D. Submit plan for commissioning the waterline, including but not limited to cleaning, pressure testing, and disinfection.

PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE

A. PVC pipe shall be made from new rigid unplasticized polyvinyl chloride and shall be normal impact Type 1, Grade 1, class 12454, listed as compliant with NSF Standard 61, unless otherwise indicated, in accordance with ASTM D 1785.

B. Pipe sections shall be clearly marked to:

1. Identify manufacturer's name or trademark
2. Nominal pipe size and OD base
3. ASTM material code designation
4. Schedule
5. Pressure class
6. ASTM specification designation
7. Product record code

C. The PVC pipe shall be schedule 80 for a maximum working pressure of 150 psi.

2.2 PIPE JOINTS

A. Pipe joints shall be solvent-welded type with solvent cement and primer as recommended by the pipe manufacturer for the chemical in the pipe.

B. Threaded joints that are necessary to match up to threaded valves or fittings shall be made up with appropriate thread sealant, either paste or tape.

C. Flanged joints shall be made with solvent-welded PVC flanges, drilled to ASME B 16.5 - Pipe Flanges and Flanged Fittings, Class 150, unless otherwise indicated. Gaskets shall be ANSI 150 lb. full face, 1/8-inch thick Neoprene for water or wastewater service. Gasket material for chemicals shall be suitable for the chemical service.

2.3 SLOTTED PVC SPRING COLLECTION PIPE

A. Materials: Pipe and PVC couplings shall be made from unplasticized PVC compounds having a minimum cell classification of 12454, as defined in ASTM D1784. The compound shall qualify for a Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4°F, in accordance with the requirements of ASTM D2837. Pipe color shall be white. Pipe shall be Schedule 40 with solvent weld joints.

B. Approvals: Products intended for contact with potable water shall be evaluated, tested, and certified for conformance with NSF-61 by an acceptable certifying organization, when required by the regulatory authority having jurisdiction.

C. Marking: Well Casing pipe shall be legibly and permanently marked in ink with the following information: • Manufacturer and Trade Name • Nominal Size and SDR or SCH Rating • Manufacturing Date Code • NSF-61-G • NSF-pw-G, as applicable.

D. Workmanship: Pipe and couplings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, blisters and dents, interior roughness, and other injurious defects that may affect wall integrity. The pipe and couplings shall be as uniform as commercially practicable in color, opacity, density, and other physical characteristics.

E. Slotting: Pipe can be supplied with multiple rows of machined circumferential slots, to allow water entry into the casing. Slot patterns should be specified to provide the required open area and flow rate (taking into account the surrounding embedment material), while maintaining structural integrity of the installed system. Slot width shall be 0.125-inches at a slot spacing of 0.25-inch.

F. The manufacturer shall be CertainTeed Slotted PVC Well Casing or approved equal.

2.4 FITTINGS

A. Solvent-welded and threaded fittings shall be Schedule 80 PVC fittings in accordance with ASTM D 2467 - Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

B. Flanged fittings shall be Schedule 80 fabricated PVC fittings with 150 lb. flanges to ASME B 16.5.

PART 3 EXECUTION

3.1 INSTALLATION

A. Excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.

B. PVC 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, piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points.

C. Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 05 45 00 – Mechanical Metal Supports (Pipe Supports). 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 changes.

D. 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. Valves and flanges attached to PVC pipe shall be provided with adequate supports.

3.2 PIPE PREPARATION

A. Prior to installation, each pipe length shall be carefully inspected, 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

3.3 PIPE JOINTS

A. Pipe threads shall conform to ASTM F 1498 and shall be full and cleanly cut with sharp dies or molded. Joints shall be made with Teflon tape or thread sealant.

B. Solvent-welded joints shall be made with fresh primer and solvent cement on clean, dry pipe ends. The primer and cement cans shall be kept closed at all times and the joints shall be made up at the recommended ambient temperatures, according to the pipe or cement manufacturer's written recommendations. Pipe ends shall be inserted to the full depth of the socket. Solvents used on potable water pipes shall be ANSI/NSF 61 certified.

C. Flanged joints shall be made with gaskets and Type 316 stainless steel bolts and nuts, unless noted otherwise. Care shall be taken not to over-torque the bolts, in accordance with the manufacturer's written recommendations.

3.4 PRELIMINARY CLEANING AND FLUSHING

A. CONTRACTOR shall flush the pipeline as the work progresses by a means in accordance with good practice to insure that sand, rocks, or other foreign material are not left in any of the pipeline. If possible the flushing shall be made with an open pipe end.

B. CONTRACTOR shall provide to ENGINEER a proposed schedule and method of flushing for review before the flushing starts.

3.5 INSPECTION AND TESTING OF PIPELINE

A. CONTRACTOR shall provide temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.

B. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection and/or pressure testing of the pipeline.

C. Testing Procedure

1. CONTRACTOR shall allow adequate time for the solvent cement joints to cure. Curing time shall be per the solvent cement manufacturer's recommendation. Prior to enclosure or burying, piping systems shall be pressure tested as required on the Contract Drawings, for a period of not less than one hour, without exceeding the tolerances listed on the Contract Drawings. Caution - Do not use air or gas for testing PVC pipe. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. CONTRACTOR shall furnish test equipment, labor, materials, and devices
2. In Leakage shall be determined by loss of pressure. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.
3. Leaks shall be repaired, and the piping shall be re-tested until no leaks are found.
4. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

3.6 DISINFECTING

A. Disinfection shall be in accordance with Section 33 13 00 – Pipeline Testing and Disinfection.

- END OF SECTION –

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SECTION 33 05 26
UTILITY IDENTIFICATION

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall provide and install identification markers for all exposed valves, piping, equipment, tanks, and warning signs, all in accordance with these specifications and the Contract Documents.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 09 90 00 Painting and Finishes

1.3 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI A13.1 Scheme for the Identification of Piping Systems
2. ANSI Z535 Safety Signs and Colors

C. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

1. ASTM D 1593 Standard Specification for Nonrigid Vinyl Chloride Plastic Film and Sheeting
2. ASTM D 3652 Standard Test Method for Thickness of Pressure-Sensitive Tapes

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer’s data sheets showing wording, symbols, letter size, and color coding.

C. Submit one sample of each type of identification device to be used.

D. Submit sample of each proposed color required by the color schedule.

E. Submit the manufacturer’s installation instructions.

1.5 QUALITY ASSURANCE

A. Product manufacturer shall be ISO 9001 Quality Certified.

PART 2 PRODUCTS

2.1 VALVE TAGS

A. General: Provide each valve of size 2-inch and larger with an identification tag. Tag shall show the pipeline station (if applicable), type, manufacturer, date of manufacture, and pressure rating.

B. Metal Tags:

1. Stainless Steel: 0.6 mm (0.025 inch) thick, Grade 304 stainless steel. Manufacturer shall be **Seton, Brady**, or approved equal.
2. Lettering: Stamped or Engraved letters; character size and words according to ANSI A13.1.

C. Beaded Chains: No. 6 stainless steel, 114 mm (4-1/2 inch) long, with locking link.

D. OR Nylon Ties: Colored, 6 inches long, nonconductive.

E. Chart: Typewritten letter size list in anodized aluminum frame.

2.2 PIPE MARKERS

A. General: Labels for piping shall bear the full piping system name. Provide flow arrows and working pressure next to each label.

B. Mechanically Fastened Pipe Markers:

1. Vinyl: Factory fabricated vinyl, 0.020 inch to 0.030 inch thick, performed to fit around pipe or pipe covering. Model **Setmark by Seton, B-915 Brady SnapOn Vinyl by Brady**, or approved equal.
2. Polyester: Factory fabricated polyester, 0.1 mm (4 mil) thick, laminated with UV-resistant poly vinyl fluoride (PVF), preformed to fit around pipe or pipe covering. Model **Ultramark by Seton, B-689 High Performance by Brady**, or approved equal.

C. Self-Adhesive Pipe Markers:

1. Vinyl: Factory fabricated vinyl, 0.102 mm (5 mil) thick, preformed to fit around pipe or pipe covering. Model **Opti-Code by Seton, B-946 by Brady**, or approved equal.
2. Polyester: Factory fabricated polyester, 0.05 mm (2 mil) thick, coated with acrylic adhesive. Model **Poly-Code by Seton**, or approved equal.
3. Plastic: Factory fabricated plastic film, roll formed, clear laminated to protect lettering.

D. Nylon Ties: Colored, 6 inches long, nonconductive, locking type.

E. Identify fluid being conveyed and include flow direction arrow.

1. Language: English.
2. Lettering: Size and Color according to ANSI A 13.1.

F. Color and Text per the Schedule at the end of this Section.

2.3 WARNING SIGNS

A. Provide a properly labeled, rigid warning sign as shown on the Contract Drawings. Signs shall contain the header, pictogram/alert symbol, and messaging conforming to OSHA/ANSI A 535 requirements. Minimum size shall be 7-inch high by 10-inch wide. Signs shall be plastic with overlaminate and be pre-drilled for mounting. Manufacturer shall be **Seton, Brady**, or approved equal.

PART 3 EXECUTION

3.1 GENERAL

A. 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 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.3 INSTALLATION

A. Valve Tags:

1. Install tags with corrosion resistant ties.
2. Identify valves in main and branch piping with tags.
3. Identify small devices, such as in-line pumps, with tags.
4. Tag automatic controls, instruments, and relays.

B. Pipe Markers:

1. Identify all above grade piping. Include service, flow direction, and working pressure.
2. Provide snap-on type markers for pipes 6-inch diameter and smaller. Provide strap-on type for pipes over 6-inch diameter.
3. Each pipe shall me marked at:
   a. Intervals of 20-feet in straight runs.
   b. At least once in every room.
   c. Within 2 –feet of bends and valves.
   d. On the upstream side of Tees, branches, and other distribution points.
   e. On both sides of walls and floors through which the piping passes.

C. Warning Signs

1. Attach to walls according to the manufacturer's recommendations.

3.4 SCHEDULES

Color Schedule				
Pipe Contents		Pipe Color	Marker Color	Letter Color
Abbreviation	Identification			
CL	Chlorine (gas or liquid state)	Yellow	Orange	Black
CLS	Chlorine Solution	Yellow	Orange	Black
CLV	Chlorine Gas Under Vacuum	Yellow	Orange	Black
CV	Chlorine Vent & Detection Line	Yellow	Orange	Black
OF	Overflow		Green	White
PW	Potable Water	Dark Blue	Green	White
V	Vent	Dark Brown	Yellow	Black

- END OF SECTION –

SECTION 33 12 00
MECHANICAL APPURTENANCES

PART 1 GENERAL

1.1 SUMMARY

A. CONTRACTOR shall furnish and install all valves, and equipment, complete and operable in accordance with the Specifications.

B. Where 2 or more valves or equipment of the same type and size are required, the valves shall be furnished by the same manufacturer.

C. CONTRACTOR shall verify that flanges on pipe match the bolt hole pattern of the flanges on the mechanical appurtenances.

D. All appurtenances shall be NSF 61 certified if used in potable water systems.

E. Unless noted otherwise below or on the Contract Drawings, all system components shall be rated for the maximum system pressure or higher.

1.2 RELATED WORK

A. Related work specified in other sections:

1.	Section 01 33 00	Submittals
2.	Section 01 45 00	Quality Control & Materials Testing
3.	Section 01 50 00	Temporary Construction Utilities and Environmental Controls
4.	Section 31 23 15	Excavation and Backfill for Buried Pipelines
5.	Section 31 23 23	Excavation and Backfill for Structures
6.	Section 33 05 05	Ductile Iron Pipe and Fittings
7.	Section 33 05 07	Polyvinyl Chloride (PVC) Pressure Pipe (C900)
8.	Section 33 05 07.1	Polyvinyl Chloride (PVC) Pressure Pipe (ASTM D 1785)
9.	Section 40 05 13.13	Steel Process Piping
10.	Section 40 05 13.19	Stainless Steel Process Piping

1.3 REFERENCES

A. The latest edition of the following publications form a part of these Specifications to the extent referenced. The publications are referred to in the text to by basic designation only.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1.	A 126	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
2.	A 216	Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
3.	B 584	Standard Specification for Copper Alloy Sand Castings for General Applications

C. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. C 504 Rubber-Seated Butterfly Valves, 3-inch through 72-inch
2. C509 Resilient-Seated Gate Valves for Water Supply Service
3. C512 Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
4. C 515 Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
5. C 518 Dual-Disc Swing-Check Valves for Waterworks Service
6. C 550 Protective Interior Coatings for Valves and Hydrants

D. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. B 16.1 Gray Iron Pipe Flanges and Flanged Fittings
2. B 16.34 Valves – Flanged, Threaded, and Welding End

E. NSF INTERNATIONAL (NSF)

1. NSF/ANSI 61 Drinking Water System Components - Health Effects

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit catalog cut sheets on all mechanical appurtenances including fittings, valves, or other items shown on the Contract Drawings referencing each item by mark number. Information shall indicate manufacturer specification compliance, Cv factor, pressure rating, and dimensional data.

PART 2 PRODUCTS

2.1 GATE VALVES

A. Gate valves shall conform to the requirements of AWWA C-509 or C-515. Valves shall be of the resilient-seat type with non-rising stem (NRS), opening to the left, and provided with a 2-inch square operating nut for buried valves or hand wheel for valves located in structures. Buried valves shall be of flange or mechanical joint design to match pipe joint system.

B. Valves, valve-operating units, stem extensions and other accessories shall be installed by CONTRACTOR where shown, or where required in the opinion of ENGINEER, to provide for convenience in operation. Where buried valves are indicated, CONTRACTOR shall furnish and install valve boxes to 3-inches above grade in unimproved areas or at grade with concrete collar in improved areas. All valves and gates shall be new and of current manufacture.

C. The valve shall have a two-part thermosetting or fusion bonded epoxy protective coating (10 mil minimum inside and out) system that is non-toxic and imparts no taste to water. The epoxy shall be applied in accordance with AWWA C550 and be ANSI/NSF 61 certified.

D. The flanges of valves may be raised or plain faced. Flanges of valves shall be faced and drilled to 125-lb American Standard template. Provide ASME Class 250 flanges for valves located on the high-pressure discharge side piping.

E. All valves shall be furnished with pressure classes equal to or better than the pressure class of the pipe with which the valves are to be used. Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

F. Valves shall be manufactured by **Mueller Co., Clow Valve Co., American Flow Control, Kennedy Valve Co., American AVK Company (high pressure)**, or approved equal.

2.2 BUTTERFLY VALVES

A. Butterfly valves shall conform to the following requirements:

1. Butterfly valves shall have a double offset disc design to reduce torque and seat wear, known as a double eccentric type. Valves shall be AWWA C504 Standard Class 150B.
2. The valves shall have a heavy-duty ductile iron body conforming to ASTM A 536 65-45-12 with flanges fully faced and drilled per ANSI B16.1 Class 150B. Maximum flow velocity shall be less than 16 fps for cold water service.
3. Disc body shall conform to ASTM A536 65-45-12 or 60-40-18 and shall be pinned used 2205 Duplex stainless steel pin. Disc seat shall be elastomeric and shall be secured to the disc with Type 316 stainless steel hardware. Disc seat shall be EPDM unless manufacturer recommends alternative which demonstrates better resistance to abrasion.
4. Body seat shall be 316L stainless steel and shall be applied through a high alloy weld double overlay process with a minimum thickness of 5mm.
5. The valve shall have a hand wheel operator and shall be geared to close slowly. Position indicator shall be provided with valve.
6. The valve shall a fusion bonded epoxy protective coating inside and outside with a minimum DFT of no less than 14 mils. Coating shall meet AWWA C550 and shall be non-toxic and impart no taste to water.

B. The valve shall be manufactured by **Av-Tek, VAG, AVK**, or approved equal.

2.3 BALL VALVES

A. Valves shall be rated for the working pressure of the system. Valves for use in potable water systems shall be NSF 61 certified.

B. **Stainless Steel Ball Valves** shall be full port opening stainless steel and have adjustable stem packing gland. Body and ball shall be stainless steel in accordance with ASTM A351. Seats shall be reinforced PTFE and packing stem shall be PTFE. The handle shall be Type 304 stainless steel with vinyl insulator. The valves shall conform to MSS-SP-110 and be **Apollo 76F-100, NIBCO T-585-S6-R-66-LL, Watts Series S-FBV-1**, or approved equal.

C. **Bronze Ball Valves** shall be full port opening bronze body, hard chrome plated brass ball and have adjustable stem packing gland. Seat and seals shall be PTFE. Handle shall be heavy, duty, zinc-plated steel with vinyl insulator. They shall be **Watts Series LFB6080G2, NIBCO T685-80-LF, Apollo 70LF-100 Series**, or approved equal.

D. **Brass Ball Valves** shall be full port opening brass, blow out proof stem design, adjustable stem packing, secondary O-ring stem seal, zinc plated steel handle with vinyl insulator. Provide **Apollo Series 64, Watts Series LFB6801, NIBCO FP600A-LF, FNW X410C,** or approved equal.

E. **PVC Ball Valves** shall be full port opening with all wetted materials composed of Schedule 80 PVC. Valve shall have true union ends or flanged ends to mate with ANSI B16.5 Class 150 flanges. PVC ball valves shall be **NIBCO Chemtrol Series, Spears Mfg. Co. TU-2-2025**, or approved equal. PVC Ball valves are not allowed to be connected to any pump discharge piping.

2.4 VALVE BOXES AND LIDS

A. All buried valves shall be installed complete with 6-inch diameter slide type, two-piece cast iron valve box. The manufacturer will be **Tyler 562 Series** or approved equal. The valve box lid shall be designated “WATER” unless noted otherwise on the Contract Drawings.

B. Concrete Collars shall be 10" thick x 2'- 6" in diameter centered on the valve box. They shall have two circumscribing #4 bars, one at three inches from the outside edge and a second bar nine inches from the outside edge each centered in the concrete. Concrete shall be 3000 psi.

2.5 PRESSURE GAUGES

A. Pressure gauges shall be provided where shown on the drawings. Gauges shall meet the requirements of ASME B40.1 Grade 2A and be industrial type with stainless steel movement, liquid filled, and stainless steel, Polypropylene, or Phenolic case. Gauges shall have a rear blowout disc or panel. Unless noted otherwise on the drawings, pressure gauges shall have a 4-1/2-inch dial with white face and black lettering, a ½-inch threaded connection, and shut-off valve. The measuring element shall be a stainless-steel Bourdon Tube. Gauges shall be calibrated to read in applicable units, with an accuracy of ± 0.5 percent to 150 percent of the working pressure. Gauges shall be manufactured be **Ashcroft Model 1279 Duragauge, 1900 Series SOLFRUNT by Ametek (U.S. Gauge), Process Gauge by Marsh Bellofram**, or approved equal.

B. Pressure gauges that connect to lines other than potable water shall have gauge guards to prevent corrosion and clogging. Gauge guards shall have a durable flexible diaphragm which serves as a protective barrier between the process fluid and instrument. The diaphragm shall be either elastomer or Teflon and rated for the pressure of the gauge.

C. Pressure gauges for chemical service lines shall be 2-1/2-inch diameter with integral diaphragm seal. These gauges shall be manufactured by **Plast-o-matic**, or approved equal.

2.6 CHECK VALVES

A. The 1-inch and 2-inch brass check valves shall be **Watts CVY Series**, or approved equal, with rating 125 WSP/200 WOG.

B. The 1-inch PVC check valves shall be **Spears Industrial Ball Check Valve Model 4521**, or approved equal, with a pressure rating of 235 psi.

2.7 RUBBER FLAPPER SWING CHECK VALVES

A. Rubber flapper swing check valves shall meet the requirements of AWWA C508. The valve shall be provided with flanges in accordance with ANSI B16.1, Class 125. The valve body shall be full flow equal to the nominal pipe diameter at all points through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. The valve shall be provided with a backflow device, disc closure accelerator, and position indicator.

B. The valve body and cover shall be constructed of ASTM A536 Grade 65-45-12 ductile iron. The disc shall be precision molded Buna-N (NBR) ASTM D2000-BG. The disc accelerator shall be stainless steel.

C. The check valve shall be **Series 100SR by APCO (DeZURIK)**, **Series 7200 Surgebuster by Val-Matic,** or approved equal.

2.8 VERTICAL TURBINE WELL PUMP AIR VALVE

A. Air valves for vertical turbine pump discharge pipes shall be provided where shown. Valve body shall be ductile iron and trim and float shall be stainless steel and shall conform to the requirements of AWWA C 512. Air release valves on the discharge piping shall be designed for a working pressure of 200 psi. Valves shall have a Dual Port Throttling Device, or equivalent device. Valve coating shall be fusion bonded epoxy on the interior and exterior. Valves shall be the size indicated on the Contract Drawings and shall be **Series 140DAT by APCO, Series 100ST by Val-Matic**, or approved equal.

2.9 HOSE BIBBS and SAMPLING TAPS

A. Hose bibbs shall be as manufactured by Watts, or approved equal, and shall include an integral vacuum breaker or built-in backflow protection devices and cast iron wheel handle. Sampling Taps shall be smooth nose type. Valves shall be stainless steel.

2.10 COMBINATION AIR VALVES

A. Combination Air/Vacuum valves shall be single body, double orifice valves conforming to the requirements of AWWA C 512. Valve float shall be stainless steel. Valves shall be the size indicated on the Contract Drawings and shall be **Valmatic 201C.2, Series 140C by APCO (DeZURIK)**, or approved equal.

2.11 FLOW METER

A. See Section 40 91 23 – Miscellaneous Properties Measurement Devices.

2.12 PRESSURE TRANSMITTERS

A. See Section 40 91 23 – Miscellaneous Properties Measurement Devices.

PART 3 EXECUTION

3.1 INSTALLATION

A. Valves, valve-operating units, stem extensions and other accessories shall be installed by CONTRACTOR where shown, or where required in the opinion of ENGINEER, to provide for convenience in operation. Where buried valves are indicated, CONTRACTOR shall furnish and install valve boxes at grade with concrete collars. All valves and boxes shall be new and recently manufactured.

B. Install mechanical appurtenances as indicated on the Contract Drawings and in accordance with the manufacturer's written instructions.

- END OF SECTION -

SECTION 33 12 30
PUMP AND PUMP MOTOR

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish, deliver and install a short set vertical turbine pump and motor, integral suction barrel with below grade suction nozzle, fabricated discharge head with above grade discharge nozzle, and appurtenant work, complete and operable, as shown on the drawings.

B. The pump manufacturer shall be made responsible for furnishing the Work and for the coordination of design, assembly, testing, and installation of the Work. CONTRACTOR shall be responsible to OWNER for compliance with the requirements of each pump.

C. Where 2 or more pumps of the same type or size are required, provide pumps produced by the same manufacturer.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 22 00 Measurement and Payment
2. Section 01 33 00 Submittal Procedures
3. Section 33 12 00 Mechanical Appurtenances
4. Section 33 13 00 Pipeline Testing and Disinfection

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI B16.1 Gray Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 36 Standard Specification for Carbon Structural Steel
2. ASTM A 48 Standard Specification for Gray Iron Castings
3. ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot- Dipped, Zinc-Coated, Welded and Seamless
4. ASTM A 108 Standard Specification for Steel Bars, Carbon and Alloy, Cold ` Finished
5. ASTM A 536 Standard Specification for Ductile Iron Castings
6. ASTM A 582 Standard Specification for Free-Machining Stainless Steel Bars
7. ASTM B 505 Standard Specification for Copper-Alloy Continuous Castings
8. ASTM B 584 Standard Specification for Copper Alloy Sand Castings General Applications

D. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 651 Standard for Disinfecting Water Mains
2. AWWA E 103 Standard for Horizontal and Vertical Line-Shaft Pumps

E. NSF INTERNATIONAL (NSF)

1. NSF 60 Drinking Water Treatment Chemicals
2. NSF 61 Drinking Water System Components – Health Components
3. NSF 372 Drinking Water System Components – Lead Content

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. CONTRACTOR shall submit for review to ENGINEER, sufficient literature, detailed specifications, and drawings to show dimensions, make, style, speed, size, type, horsepower, head-capacity, efficiency, materials used, design features, internal construction, weights, and any other information required by ENGINEER for review of all pumping equipment. No pumping equipment will be accepted, and installation will not be allowed, until such review has been completed. All submittals shall clearly state any deviations from the specified requirements. The following shall also be furnished with the submittal:

1. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. The equipment manufacturer shall indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the specified design point.
2. Equipment manufacturer shall provide complete and detailed information regarding the installation of the pumps. Any installation requirements or operating conditions which the supplier or manufacturer considers to be critical to the safe and reliable operation of the pumps should be identified and described in detail.
3. Shop drawings submitted for review also shall include electrical diagrams, schematic control diagrams, and a detailed description of how the control system is to function.
4. Submit performance curves at intervals of 100 rpm from minimum speed to maximum speed for each pump equipped with a variable speed drive.

C. Submit signed, dated, and certified factory test data for each pump which requires factory testing. Submit this data before shipment of equipment.

1.5 MECHANICAL DEFECTS AND REJECTIONS

A. CONTRACTOR furnished pumps that have mechanical defects or do not meet the requirements for head-capacity, horsepower, efficiency, and vibration requirements will be rejected, and shall be replaced by Contractor without additional cost to OWNER for furnishing, removal, reinstallation, and retesting. Mechanical defects shall include excessive vibration, improper balancing of any rotating parts, improper tolerances, binding, excessive bearing or motor heating, defective materials, including materials that do not conform to the Specifications, improper fitting of parts, and any other defect which will in time damage the pump or unreasonably impair its efficiency or operation.

1.6 WARRANTY

A. CONTRACTOR furnished equipment covered by these specifications shall be warranted against defective parts due to faulty material or workmanship for one (1) year after date of start-up and acceptance by OWNER. CONTRACTOR shall guarantee to replace any defective parts within the period of time specified at no additional cost to OWNER. If CONTRACTOR has to pull pump to replace defective parts, CONTRACTOR shall guarantee to pull and replace pump at no additional cost to OWNER.

PART 2 PRODUCTS

2.1 GENERAL

A. Compliance with the requirements below may necessitate modifications to the manufacturer's standard equipment.

B. Unless otherwise noted, the required shaft horsepower for the entire pump assembly at any point on the performance curve shall not exceed the rated horsepower of the motor or encroach on the service factor.

C. Provide each pump with a stainless-steel nameplate indicating serial number(s), rated head and flow, impeller size, pump speed, and manufacturer's name and model number.

2.2 FACTORY TESTING

A. Equipment shall be factory tested and inspected as specified hereinafter. All costs for the tests shall be borne by CONTRACTOR. Conduct the following tests on each indicated pump system:

1. Factory Non-Witnessed Test
   a. Perform tests using the complete pump system to be furnished. Half speed tests or affinity rule test results will not be accepted.
   b. For pumps with motors smaller than 300 hp, the manufacturer's certified test motor will be accepted.
   c. Testing of prototype models will not be accepted.
   d. Conduct the following minimum tests and submit the test results:
      1) Hydrostatic Test;
      2) Performance Test:
         a) Conduct performance test at maximum speed, obtain a minimum of 5 hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, and record on data sheets as defined by the Hydraulic Institute standards;
         b) For variable speed pumps, test each pump between maximum and minimum speed at 100 rpm increments;
         c) Submit pump curves showing head vs. flow, bhp, KVA, KW, and efficiency results;

3) Mechanical Test:
   a) Submit certification signed by a senior official of the pump manufacturer that the pump shaft horsepower demand did not exceed the rated motor horsepower of 1.0 service rating at any point on the curve.
   b) Submit test results to Engineer for review prior to delivery of the pumps to the Site.

2. In the event of failure of any pump to meet any of the requirements, make necessary modifications, repairs, or replacements in order to conform to the requirements of this Section and re-test the pump until found satisfactory.

2.3 VERTICAL TURBINE PUMP

A. The pumps shall be of the vertical turbine type suitable for pumping culinary water. All material, manufacturing, and performance standards shall be in compliance with AWWA E 103, NSF 60, NSF 61 and NSF 372, as applicable.

B. Performance Requirements

1. Operating Conditions:

DESCRIPTION	Pump ID Number(s) (P-1)	Pump ID Number(s) (P-2)
Duty	Continuous	Continuous
Drive	Variable Speed	Variable Speed
Ambient Environment	Indoors	Indoors
Ambient Temperature (°F)	40 to 100	40 to 100
Ambient relative humidity (%)	20 to 80	20 to 80
Fluid Temperature (°F)	35 to 60	35 to 60
Fluid pH range	6 to 9	6 to 9
Project site elevation (ft above msl)	4,800	4,800
NPSH Available (ft)	34.4	34.4
NPSH Required	34.1	15.6
Pump Lubrication	Product	Product
Maximum shutoff head (ft)	250	225
Design flow capacity (gpm)	3,600	800
Minimum Continuous Stable Flow (gpm) (Maximum allowable value)	700	200

DESCRIPTION	Pump ID Number(s) (P-1)	Pump ID Number(s) (P-2)
Design flow total dynamic head (ft)	145	140
Pump Setting Depth (ft) (Bottom of Discharge Head to Suction Bell)	~~20' 9"~~ *16'-10"*	~~13' 8"~~ *17'-2"*
Nominal Operating Speed (rpm)	1,800	1,800

DESCRIPTION	Pump ID Number(s) (P-1)	Pump ID Number(s) (P-2)
Design flow minimum efficiency (%)	83	83
Maximum Bowl Diameter (inches)	15.75	11.25
Column Size (diameter in inches)	12	8
Minimum Shaft Size (inches)	1-1/2	1-1/4
Minimum Barrel Diameter (inches)	30	18
Pump Model Number	National H16MC	National J11LC
Maximum Number of Pump Bowls for Designated Barrel Length	2	3
Minimum Motor Horsepower (hp)	200	40
Utility Power (Phase, Volts, Hertz)	3, 480, 60	3, 480, 60
Motor Duty	Inverter Duty Rated	Inverter Duty Rated

2. Pump Characteristics - The pump shall be characterized by head capacity curves of steadily decreasing head with increasing capacity. Maximum head shall be at zero flow. The pump shall have a minimum efficiency as provided in the table above during operation against the system head. Pump head-capacity curves shall indicate that these losses have been included. Pumps shall have head-capacity curves similar to that of the specified pump. Pumps having curves that show a flatter or near horizontal slope over a section in the head–capacity curve will not be accepted. Curves with head-capacity curves with slopes of the curve flatter than that shown for the specified pump will not be accepted.
3. The pump and motor shall be capable of producing the flow rates and total dynamic heads indicated in the table above.
4. Motor Characteristics - Under no operating conditions shall the required pump brake horsepower exceed the nameplate rating of the motor being furnished.

5. The pump shall be designed to operate throughout its entire range without excessive vibration or noise.

C. Vertical Turbine Pump Components

1. Pumps
   a. The vertical turbine pump shall be as manufactured by **National Pump Company, Flowserve, American-Marsh,** or approved equal, and shall be a multistage bowl assembly.
   b. Unless otherwise stated herein, the pump shall in all respects conform to the requirements of AWWA E 101 and shall comply with all local and state sanitary and safety regulations.
2. Discharge Head
   a. The discharge head shall be fabricated steel (ASTM A53 Grade B Pipe and ASTM A 36 Steel Plate), accurately machined and with suction and discharge pipes in line with each other and located 180 degrees apart. Suction and discharge shall be provided with flanges with a working pressure of 150 psi and shall be sized to match the specified system. The top of the discharge head shall have a rabbet fit to accurately locate the vertical hollow shaft driver, and have a diameter equal to the driver base diameter (BD). Lifting lugs of sufficient strength to support the weight of the complete unit shall be provided. The base shall be round or square and be machined to match the pump barrel and be capable of withstanding the system inlet pressure without leaking. CONTRACTOR shall modify the pump base dimensions on the Contract Drawings to match supplied head.
   b. A lifting soleplate shall be supplied and installed, if required by the pump manufacturer.
   c. The pump manufacturer shall include the method of adjusting the pump impellers at the top of the head shaft. This method shall provide a positive locking device.
   d. CONTRACTOR shall be responsible for ensuring that the discharge head is structurally and mechanically adequate for the provided and installed pump configuration.
3. Suction Barrel
   a. The pumps shall be provided with a suction barrel of the same materials as the discharge head. The barrel shall be capable of containing the maximum suction pressure applied to the suction connection. The bottom of the suction barrel shall be supplied with a welded cap or flange for water service. **Note that if Contractor proposes a pump (as an equal) with more pump bowls than used on the design pump, suction barrel length shall be modified to accommodate additional pump bowls at no additional cost to OWNER**.
   b. The barrel shall be equipped with a square base plate which shall be machined and tapped to match the discharge head base flange. The base shall be drilled to allow the barrel to be secured in place with anchor bolts. The barrel shall be supplied with proper gasket or “O” ring and bolting for application to seal between the barrel flange and the head base flange.
   c. The barrel shall be provided with flow vanes on the sides of the barrel for Pump P-1. Both barrels (Pumps P-1 and P-2) shall be provided with bottom cross vanes as shown on the Contract Drawings.
4. Packing Boxes
   a. The pump shall have a split type mechanical seal with housing which bolts to the head with an “O” ring seal. The mechanical seal shall be able to be replaced

without removing the motor. Mechanical seals shall be **442 High Performance Split Seal by Chesterton**, or approved equal. The housing shall have a lower bronze throttle bushing. The housing seal chamber shall accommodate a single sleeved balanced mechanical seal suitable for the maximum pressure developed by the pump and temperature of 100 degree F maximum. Seal materials shall be suitable for potable water and ANSI/NSF 61 certified. A balanced seal shall be mounted on a shaft sleeve. The shaft supplied shall be a one-piece bowl, line, and head shaft where practical of 416 stainless steel material.

5. Column Assembly
   a. The column assembly shall be supplied with ASTM A 53 Grade B steel pipe *threaded or* flanged with fabricated steel, bronze, or removable ductile iron A 536 Grade 60-40-18 bearing retainer equipped with suitable lineshaft bearings for the application. Column bearing spacing shall be such that shaft first critical frequency shall be safely above or below the operating resonant frequency.
6. Pump Bowl Assembly
   a. Pump bowl castings shall be of close-grained cast iron ASTM A48 Class 30 or ASTM A536 ductile iron Class 60-40-18 where required to meet the hydrostatic pressure criteria listed above. The water passages shall be free of blowholes, sand holes, and other detrimental defects, shall be lined with porcelain enamel, and shall be accurately machined and fitted. The finished bowls shall be capable of withstanding a hydrostatic pressure equal to twice the head at rated capacity or 1-1/2 times the shut-off head, whichever is greater.
   b. The impellers shall be bronze ASTM B584 alloy C83800, enclosed type, and shall be statically balanced, and shall be fastened securely to the impeller shaft with taper split bushings of steel. Impellers shall be adjustable vertically by an external means. Impeller skirt and series case throat area shall be thick enough to allow for machining and wearing at the time of repair. Provide bowl wear rings of hardened 17-4 stainless steel with a Rockwell C-Scale Hardness number of 40 and impeller wear rings of hardened 17-4 stainless steel with a Rockwell C-Scale Hardness number of 32.
7. Pump Shaft
   a. The pump shaft shall be of ASTM A564 17-4 Stainless Steel turned, ground and polished. It shall be supported by bronze bearings of ASTM B505 alloy C84400 above and below each impeller. The suction case bearing shall be grease lubricated and protected by a bronze sand collar of ASTM B584 alloy C83800. The size of the shaft shall be no less than that determined by AWWA E101, Section A4.3 Paragraph 4.3.3.

2.4 MOTOR

A. Pump motors shall be a vertical hollow shaft, premium efficiency, inverter duty electric motor, and shall be sized as noted in the table above. They shall have a non-reverse ratchet, P-base, squirrel cage induction design. Motor shall have Class B or Class F insulation with temperature rise as specified by NEMA standards for class of insulation used and shall have a 1.15 service factor.

B. Pump motors shall be provided with a vibration switch. Switch rating 120 VAC, 2 amps minimum.

C. Thrust bearing shall be chosen to handle the continuous down-thrust as specified by the pump manufacturer with an ABMA an L-10 bearing life of 75,000 hours, and an L-50

bearing life of 375,000 hours. Provisions shall be made for momentary up-thrust equal to 30% of rated down-thrust. The thrust value shall be calculated at curve points 75% to 125% of specified, full speed, flow rate.

D. The motor shall be suitable for across-the-line starting, soft start, and shall be capable of reduced-voltage starting.

E. The motor primary thrust bearing shall incorporate a grounding ring to prevent damage from VFD harmonics and/or stray electrical currents. Grounding rings shall be stainless split-type. Ground rings shall be connected to the electrical ground system for the facility. Ground ring manufacturer shall be **Aegis SGR (for up to 500 HP motors) and Aegis PRO (for motors over 500 HP)** or approved equal. For motors over 100 HP insulated upper bearings shall be provided. The insulating bearing material shall be alumina oxide or ceramic. Insulated bearing manufacturer shall be **SKF, NTN Corporation, GMN Bearing USA,** or approved equal.

F. The motor rating shall be such that at design it will not be loaded beyond nameplate rating and at no place on the pump curve shall the loading exceed the service factor.

G. The motor temperature shall be rated no higher than the allowable operating temperature of the motor thrust and radial bearings and in no case shall it exceed the temperature rating of the insulation class used to wind the motor.

H. The junction box shall be oversized to accommodate the wiring connection.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install pump and motor at the location shown on the Contract Drawings and according with manufacturer's recommendations.

B. All pumps, complete with drive system, in place at the jobsite, shall not exceed acceptable field vibration limits given in the latest revisions of the Hydraulic Institute Standards. All pumps shall be free of static unbalance; shall be free of dynamic unbalance up to the maximum speed of the pump and drive system; shall be free of torsional vibration from 10 percent below the minimum speed to 10 percent above the maximum speed of the pump and drive system; and shall be free of apparent unbalance caused by defective bearings, by close fittings parts which may rub on the rotating parts intermittently, or by loose discs or rotor parts, or unbalanced loads.

C. The motor/discharge head assembly shall be shimmed with respect to the suction barrel flange to bring the motor/discharge assembly into optimum alignment with any variations that the pump column and line shaft may exhibit from being truly plumb. Such shims must be structurally sound and securely attached. The watertight seal between the discharge head and the suction barrel flange must be maintained.

3.2 FIELD TESTS

A. After installation, the pump shall be given an operating test to demonstrate freedom from mechanical defects, excessive noise, and vibration. The test shall include operating the pump continuously while throttling the discharge as needed. The operating test shall be

performed for a minimum of one hour, or as directed by ENGINEER. Pumps with variable speed drives shall be tested at maximum speed, and at the average and minimum speeds listed under the specification for the pumps. A copy of actual test data shall be furnished to ENGINEER.

B. Tests for acceptable vibration shall be made, at no additional cost to OWNER, in the field on each pump system, which in the opinion of ENGINEER, seem to have excessive vibration. All field tests shall be running tests with the pump pumping the product for which it is intended, and each pump system shall be tested separately with no other pumps running. All testing shall be done in the presence of ENGINEER. Amplitude as used in this Specification shall mean total peak-to-peak displacement. The required test for acceptable vibration will be the measurement of this peak-to-peak displacement and will be performed with an **IRD Vibration Meter, Model 306; Bently-Nevada TK-8**; or approved equal.

3.3 PROTECTIVE COATING

A. Coat materials and equipment in accordance with the requirements of Section 09 90 00 Painting and Finishes. Coating in contact with potable water shall be NSF 61 certified.

1. Coat the pump bowls (outside) in accordance with System No. 1.
2. The Discharge Head shall be lined per System # System No. 1 and the exterior coated per system No. 3.

3.4 DISINFECTING

A. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection of the pumping system.

3.5 TESTING PROCEDURE

1. Leakage and pressure testing must be completed prior to disinfection procedures.
2. All pump and water piping installed under this Contract shall be disinfected using an approved disinfection method in accordance with the AWWA C651.
3. Heavily chlorinated water shall not be discharged onto the ground. Upon completion of disinfection, Sodium Bisulfite (NaHSO3) shall be applied to the heavily chlorinated water to neutralize thoroughly the chlorine residual remaining. Water shall be neutralized to less than 1 ppm.
4. After approval of disinfection, CONTRACTOR shall flush the new system until the chlorine residual is a maximum of 0.3 ppm.
5. At the end of the disinfecting period, a bacteriological test will be performed by OWNER to ensure adequate disinfection and a second test will be taken at the end of an additional 24-hour period after the first test. If either of the tests fails to provide satisfactory bacteriological results, or shows the presence of coliform, then the line shall be re-chlorinated, flushed, and retested until satisfactory results are obtained at the expense to CONTRACTOR.

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SECTION 33 13 00
PIPELINE TESTING AND DISINFECTION

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers testing and disinfection in order to remove bacteriological contamination of the pipeline. Disinfection is only required if the pipeline is used for potable water.

B. CONTRACTOR shall be responsible for obtaining permits for discharging excess testing water and dechlorination of such water, if required.

C. Hydrostatic testing shall meet the requirements of this Section, or the requirements provided in each individual pipeline Section, whichever is more stringent.

1.2 RELATED SECTIONS

A. Related Work specified in other Sections includes but is not limited to the following:

1. Section 01 33 00 Submittal procedures
2. Section 33 05 05 Ductile Iron Pipe
3. Section 33 05 07 Polyvinyl Chloride (PVC) Pipe (AWWA C900)

1.3 REFERENCES

A. The latest edition of the following publications form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. AWWA C-651 - Disinfecting Water Mains
2. Utah Public Drinking Water Regulations

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Furnish a written testing plan and schedule, including water source and methods for conveyance to the project, sequence, control, and disposal. Include the name of the certified bacteriological testing laboratory.

C. Disinfection Report:

1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24 hour disinfectant residuals in treated water in parts per million (ppm) for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.

PART 2 MATERIALS

2.1 DESCRIPTION

A. All test equipment, temporary valves, bulkheads, and other water control equipment, shall be as determined by CONTRACTOR. No materials shall be used which damage the project pipelines for future conveyance of potable water.

B. Disinfecting materials shall consist of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules or tablets.

C. Dechlorination agents may be sodium bisulfate, sodium sulfite, or sodium thiosulfate.

PART 3 EXECUTION

3.1 GENERAL

A. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water for testing and disinfection of the water line system. All testing water used in the pipeline shall be potable water from a State approved drinking water system.
2. All pressure pipelines shall be tested.
3. Disposal of flushing water and water containing chlorine shall be by methods acceptable to the State of Utah, Division of Water Quality.

3.2 HYDROSTATIC TESTING OF PIPELINES PROCEDURE

A. Prior to hydrostatic testing, pipelines 24-inches diameter and larger shall be swept free of debris and visually inspected that all debris has been removed prior to filling.

B. Prior to hydrostatic testing, pipelines shall be flushed or blown out as appropriate. CONTRACTOR may test pipelines in sections. Sections to be tested shall be defined by isolation valves in the pipeline. Where such valves are not present, CONTRACTOR shall install temporary bulkheads or plugs for the purpose of testing. Sections that do not have isolation valves shall be tested in approximate one-mile segments. Sections that have a zero leakage allowance may be tested as a unit. No section of the pipeline shall be tested until field-placed concrete or mortar has attained an age of 14 Days. The test shall be made by closing valves when available or by placing bulkheads and filling the line slowly with water (maximum filling velocity shall not exceed 0.25 foot per second, calculation based on the full area of the pipe). CONTRACTOR shall be responsible for ascertaining that 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. CONTRACTOR shall provide sufficient temporary tappings in the pipelines to allow for trapped air to exit or for water to be drained. After completion of the tests, such taps shall be permanently plugged. Care shall be taken that air relief valves are open 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. The air within the pipeline shall be allowed to escape completely. The differential pressure across the orifices in the air release valves shall not be allowed to exceed 5 psi at any time during filling. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb water and to allow the escape of air from air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to ENGINEER shall be taken. Additional water shall be added to the pipeline to replace any water absorbed by the cement mortar lining.

D. The hydrostatic test shall consist of holding 150 psi pressure on the pipeline segment for a period of 2 hours. Visible leaks that appear during testing shall be repaired. Add water to restore the test pressure if the pressure decreases 5 psi below test pressure during the test period.

E. Pipe with welded joints shall have no leakage. In the case of pipelines that fail to pass the leakage test, CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipeline, repeating as necessary until the pipeline passes.

F. Exposed piping and valves shall show no visible leaks and no pressure loss during the test.

G. Blowoff isolation gate valves and plug valves (throttling valves) shall be operated and tested during a simulated blow down operation to demonstrate functionality of the valves to the satisfaction of ENGINEER. Isolation valves (gate valves) shall not be used for throttling.

3.3 DISINFECTING OF PIPELINES PROCEDURE

A. Leakage and pressure testing must be completed prior to disinfection procedures.

B. All water and solution piping installed under this Contract shall be disinfected using an approved disinfection method in accordance with the "American Water Works Association Standard for Disinfecting Water Mains" (AWWA C651).

C. CONTRACTOR may use one of the three chlorination methods – tablet, continuous feed, and slug, as outlined in AWWA C651 that is acceptable to OWNER. Care must be taken to prevent the strong chlorine solution in the line being disinfected from flowing back into the line supplying the water.

D. CONTRACTOR shall provide sampling ports along the pipeline as defined in AWWA C651. Taps may be at manways and air valves to help facilitate the spacing requirement.

E. Heavily chlorinated water shall not be discharged onto the ground. Upon completion of disinfection, Sodium Bisulfate (NaHSO4), or other approved dechlorination agent, shall be applied to the heavily chlorinated water to neutralize thoroughly the chlorine residual remaining. Water shall be neutralized to less than 1 ppm total chlorine residual.

F. After approval of disinfection, CONTRACTOR shall flush the new system until the chlorine residual is a maximum of 0.3 ppm.

G. After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the pipeline being tested. Sampling and testing will be completed by CONTRACTOR. CONTRACTOR shall collect at least one set of samples from every 1,200 feet of pipeline, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological (chemical and physical) quality in accordance with "Standard Methods for Examination of Water and Wastewater" and shall show the absence of coliform organisms. If the initial disinfection fails to provide satisfactory bacteriological results, or shows the presence of coliform, then the line shall be re-chlorinated, flushed, and retested until satisfactory results are obtained at the expense of CONTRACTOR.

3.4 CONNECTIONS TO EXISTING SYSTEM

A. Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used in making the connections shall be swabbed or sprayed with a one percent hypochlorite solution before installation. Thorough flushing shall be started as soon as the connection is completed and shall be continued until discolored water is eliminated.

B. Final Fill: After a successful pressure and disinfection tests, the pipeline(s) shall be filled with fresh potable water and shall remain filled.

- END OF SECTION –

SECTION 40 05 13.13
STEEL PROCESS PIPING

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install all steel process piping and appurtenances as shown and specified, and as required for a complete and workable piping system.

B. This Section includes schedule 40 and 80 steel process pipe in accordance with ASTM A53 and ASTM A106 with welded, flanged, grooved, or threaded joints.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 31 23 15 Excavation and Backfill for Pipelines
3. Section 33 12 00 Mechanical Appurtenances
4. Section 33 13 00 Pipeline Testing and Disinfection

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

1. ASME B 16.1 Gray Iron Flanges and Fittings, Classes 25, 125, and 250
2. ASME B 16.3 Malleable Iron Threaded Fittings, Classes 150 and 300
3. ASME B 16.4 Gray Iron Threaded Fittings, Classes 125 and 250
4. ASME B 16.5 Pipe Flanges and Flanged Fittings
5. ASME B 16.9 Factory-Made Wrought Butt Welded Fittings
6. ASME B 16.11 Forged Fittings, Socket-Welding and Threaded
7. ASME B 16.12 Cast Iron Threaded Drainage Fittings
8. ASME B 31.1 Power Piping

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
2. ASTM A 106 Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

D. AMERICA WELDING SOCIETY (AWS)

1. AWS D1.1 Structural Welding Code

E. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 207 Steel Pipe Flanges for Waterworks Services

2. AWWA C 606 Grooved and Shouldered Joints
3. AWWA C 651 Standard for Disinfecting Water Mains

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

C. Submit shop drawings of pipe, fittings, supports and appurtenances showing compliance with this Section including necessary dimensions, details, pipe joints and material lists.

D. Submit gasket material data including manufacturer's catalog indicating that the proposed product is suitable for each fluid of service application.

E. Submit welders' qualifications in accordance with AWS D1.1.

PART 2 PRODUCTS

2.1 STEEL PIPE

A. Galvanized and black steel process pipe shall be fabricated in accordance with ASTM A 53 or ASTM A 106, Grade B, and shall be Schedule 40 or 80 as indicated on the Contract Drawings. Unless noted otherwise, galvanized steel pipe shall not be cement mortar lined.

2.2 PIPE JOINTS

A. Black steel pipe joints shall be screwed ends with NPT threads, welded, or flanged. Screwed joints shall be up with Teflon tape. Welded joints may have butt-weld or socket weld fittings or flanges. Where indicated on the Contract Drawings, provide grooved ends for rigid or flexible mechanical couplings or plain ends for sleeve-type couplings.

B. Galvanized steel pipe shall have screwed ends with NPT threads. Screwed joints shall be up with Teflon tape. Where indicated on the Contract Drawings, provide grooved ends for rigid or flexible mechanical couplings or plain ends for sleeve-type couplings.

C. Flanged joints shall be in accordance with ASME B16.5 or AWWA C207 flanges for the pressure class required for the project conditions or as indicated on the Contract Drawings. CONTRACTOR is responsible for providing the appropriate flanges required to connect steel pipe to equipment and other appurtenances. CONTRACTOR shall replace flanges that do not match the mating equipment or appurtenance at no additional cost to OWNER. Gaskets shall be ANSI 150 lb. full face, 1/8-inch thick Neoprene for water or wastewater service. Gasket material for chemicals shall be suitable for the chemical service.

2.3 FITTINGS

A. Threaded fittings shall be in accordance with ASME B 16.3 or ASME B 16.4 for pressure pipe. Threaded fittings for gravity pipe systems shall be in accordance with ASME B 16.12.

B. Welded fittings shall be in accordance with ASME B 16.11 or ASME B 16.9.

C. Flanged fittings shall be in accordance with ASME B 16.1 or ASME B 16.5.

D. Grooved fittings shall conform to AWWA C 606.

PART 3 EXECUTION

3.1 INSTALLATION

A. For buried pipelines, excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.

B. Above ground steel process piping 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, piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points.

C. Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 05 45 00 – Mechanical Metal Supports. 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 changes.

D. 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. Low points shall be provided with a drain valve.

3.2 PIPE PREPARATION

A. Prior to installation, each pipe length shall be carefully inspected, 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

3.3 PIPE JOINTS

A. Pipe threads shall be full and cleanly cut with sharp dies or molded. Joints shall be made with Teflon tape.

B. Welded joints shall conform to the requirements of this Section and the recommendations of ASME B 31.1. Welding shall be done by skilled and qualified welders. Welders shall be qualified under the provisions of AWS D1.1. Machines and electrodes similar to those used in the work shall be used in qualification tests.

C. Grooved couplings shall be installed per the manufacturer’s recommendations and shall conform to AWWA C 606.

3.4 INSPECTION AND TESTING OF PIPELINE

A. Completed steel process piping systems shall be inspected for proper supports, anchorage, and damage to pipe, fittings, and coatings. Any damage shall be repaired by CONTRACTOR at no additional cost to OWNER.

B. CONTRACTOR shall provide temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.

C. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection and/or pressure testing of the pipeline.

D. Testing Procedure

1. Prior to enclosure or burying, piping systems shall be pressure tested as required on the Drawings, for a period of not less than one hour, without exceeding the tolerances listed on the Drawings. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. CONTRACTOR shall furnish test equipment, labor, materials, and devices.
2. Leakage shall be determined by loss of pressure, soap solution, or other positive and accurate method. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.
3. Leaks shall be repaired, and the piping shall be re-tested until no leaks are found.
4. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

3.5 DISINFECTING

A. Disinfection shall be in accordance with AWWA C 651 and the requirements of Section 33 13 00 – Pipeline Testing and Disinfection.

- END OF SECTION –

SECTION 40 05 13.19
STAINLESS STEEL PROCESS PIPING

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install all stainless-steel process piping and appurtenances as shown and specified, and as required for a complete and workable piping system.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 05 45 00 Mechanical Metal Supports
3. Section 33 12 00 Mechanical Appurtenances

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

1. ASME B 16.5 Pipe Flanges and Flanged Fittings
2. ASME B 16.9 Factory-Made Wrought Butt Welded Fittings
3. ASME B 16.11 Forged Fittings, Socket-Welding and Threaded
4. ASME B 31.1 Power Piping

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM A 312 Standard Specification for Seamless, Welded, and Heavy Cold Worked Austenitic Stainless Steel Pipes
2. ASTM A 403 Standard Specification for Wrought Austenitic Stainless Steel Piping and Fittings
3. ASTM A 409 Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service
4. ASTM A 778 Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products

D. AMERICA WELDING SOCIETY (AWS)

1. AWS D1.1 Structural Welding Code

E. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 606 Grooved and Shouldered Joints
2. AWWA C 651 Standard for Disinfecting Water Mains

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer's affidavit certifying product was manufactured, tested, and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

C. Submit shop drawings of pipe, fittings, supports and appurtenances showing compliance with this Section including necessary dimensions, details, pipe joints and material lists.

D. Submit gasket material data including manufacturer's catalog indicating that the proposed product is suitable for each fluid of service application.

E. Submit welders' qualifications in accordance with AWS D1.1.

PART 2 PRODUCTS

2.1 STAINLESS STEEL PIPE

A. Stainless steel process pipe shall be in accordance with ASTM A 312, Type 304 or 316, seamless, Schedule 40S or 80S, with screwed fittings for sizes up to and including 3-inches and welded fittings for sizes 3-inches and larger. Type shall be as indicated on the Contract Drawings. Flange fittings may be used for pipe diameters 2-inches and larger. Stainless steel process piping 12-inches and larger shall be in accordance with ASTM A 409 or ASTM A 778, Type 304 or 316, Schedule 10S, 40S or 80S, with welded or flanged joints.

2.2 PIPE JOINTS

A. Stainless steel pipe 3-inches and smaller shall have screwed ends with NPT threads. Screwed joints shall be up with Teflon tape. Stainless steel pipe 3-inches and larger shall have welded joints or flanges. Flanges shall have stainless steel nuts and bolts the same material type as the pipe. Where indicated on the Drawings, provide grooved ends for rigid or flexible mechanical couplings. Pipe grooving is only allowed for Schedule 40S or 80S pipe. For plain end stainless steel pipe use sleeve-type couplings where noted on the Drawings.

B. Flanged joints shall be in accordance with ASME B16.5 for the pressure class required for the project conditions or as indicated on the Contract Drawings. CONTRACTOR is responsible for providing the appropriate flanges required to connect stainless steel process pipe to equipment and other appurtenances. CONTRACTOR shall replace flanges that do not match the mating equipment or appurtenance at no additional cost to OWNER. Gaskets shall be ANSI 150 lb. full face, 1/8-inch thick Neoprene for water or wastewater service. Gasket material for chemicals shall be suitable for the chemical service.

2.3 FITTINGS

A. Threaded fittings shall be forged stainless steel fittings in accordance with ASME B 16.11.

B. Socket welded fittings shall be forged stainless steel fittings in accordance with ASME B 16.11.

C. Butt-welded fittings shall be wrought stainless steel fittings in accordance with ASTM A 403 and ASME B 16.9.

D. Flanged fittings shall be in accordance with ASME B 16.5.

E. Grooved fittings shall be wrought stainless steel conforming to ASTM A 403 and ASME B 16.9 and to AWWA C 606. Gasket material shall be suitable for the intended service.

F. Fittings shall be in accordance with the pressure class shown on the Drawings or have the same pressure rating as the pipe.

PART 3 EXECUTION

3.1 INSTALLATION

A. Stainless steel process piping 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, piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points.

B. Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 05 45 00 – Mechanical Metal Supports. 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 changes.

C. 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. Low points shall be provided with a drain valve.

3.2 PIPE PREPARATION

A. Prior to installation, each pipe length shall be carefully inspected, flushed clean of any debris or dust, and be straightened, if not true. The ends of threaded pipes shall be reamed and filed smooth. Pipe fittings shall be equally cleaned before assembly.

3.3 PIPE JOINTS

A. Pipe threads shall be full and cleanly cut with sharp dies or molded. Joints shall be made with Teflon tape.

B. Welded joints shall conform to the requirements of this Section and the recommendations of ASME B 31.1. Welding shall be done by skilled and qualified welders. Welders shall be qualified under the provisions of AWS D1.1. Machines and electrodes similar to those used in the work shall be used in qualification tests. Field welds shall be kept to a minimum by using couplings or shop fabrication as much as possible. Weld residue, oxide, and heat stain shall be removed by stainless steel wire

brushes followed by cleaning with an agent, followed by complete removal of the agent. Cleaning agent shall be **BlueOne Pickling Paste 130 by Avesta Finishing Chemicals, STAR Gel by Krystal Surface Solution**, or approved equal. Passivation must following the cleaning process using **FinishOne Passivator 630 by Avesta Finishing Chemicals, STAR Pass 1 by Krystal Surface Solution**, or approved equal. Following the manufacturer's instruction for the cleaning/pickling and passivation process.

C. Grooved couplings shall be installed per the manufacturer's recommendations and shall conform to AWWA C 606.

3.4 INSPECTION AND TESTING OF PIPELINE

A. Completed stainless steel process piping systems shall be inspected for proper supports, anchorage, and damage to pipe, fittings, and coatings. Any damage shall be repaired by CONTRACTOR at no additional cost to OWNER.

B. CONTRACTOR shall provide temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.

C. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection and/or pressure testing of the pipeline.

D. Testing Procedure

1. Prior to enclosure or burying, piping systems shall be pressure tested as required on the Drawings, for a period of not less than one hour, without exceeding the tolerances listed on the Contract Drawings. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. CONTRACTOR shall furnish test equipment, labor, materials, and devices
2. Leakage shall be determined by loss of pressure, soap solution, or other positive and accurate method. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.
3. Leaks shall be repaired, and the piping shall be re-tested until no leaks are found.
4. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

3.5 DISINFECTING

A. Disinfection shall be in accordance AWWA C 651 and the requirements of Section 33 13 00 - Pipeline Disinfection.

- END OF SECTION –

SECTION 40 05 13.33
BRASS PROCESS PIPING

PART 1 GENERAL

1.1 DESCRIPTION

A. CONTRACTOR shall furnish and install all brass process piping and appurtenances as shown and specified, and as required for a complete and workable piping system.

B. This Section includes schedule 40 and 80 brass process pipe in accordance with ASTM B43.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 05 45 00 Mechanical Metal Supports (Pipe Supports)
3. Section 31 23 15 Excavation and Backfill for Pipelines
4. Section 33 12 00 Mechanical Appurtenances
5. Section 33 13 00 Pipeline Testing and Disinfection

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

1. ASME B1.20.1 Pipe Threads, General Purpose
2. ASME B 16.15 Cast Bronze Threaded Fitting Class 125 & 250

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM B 43 Standard Specification for Seamless Red Brass Pipe, Standard Sizes

D. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 651 Standard for Disinfecting Water Mains

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit manufacturer's affidavit certifying product was manufactured, tested, and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

C. Submit shop drawings of pipe, fittings, supports, and appurtenances showing compliance with this Section including necessary dimensions, details, pipe joints and material lists.

PART 2 PRODUCTS

2.1 BRASS PIPE

A. Brass pipe and fittings shall conform to ASTM B 43, regular wall thickness (Schedule 40), except that nipples and pipe of sizes 1-inch and smaller shall be extra strong (Schedule 80).

B. Brass pipe joints shall be screwed ends with NPT threads. Screwed joints shall be up with Teflon tape. Threads shall conform to ASME B1.20.1.

C. All brass pipe and fittings shall be NSF 61 or NSF 372 certified.

2.2 FITTINGS

A. Threaded fittings shall be in accordance with ASME B 16.15.

PART 3 EXECUTION

3.1 INSTALLATION

A. For buried pipelines, excavation and backfill of trenches and for appurtenances shall be in accordance with Section 31 23 15 - Excavation and Backfill for Buried Pipelines.

B. Above ground brass process piping 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, piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points.

C. Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 05 45 00. 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 changes.

D. 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. Low points shall be provided with a drain valve.

3.2 PIPE PREPARATION

A. Prior to installation, each pipe length shall be carefully inspected, flushed clean of any debris or dust, and be straightened, if not true. The ends of threaded pipes shall be reamed and filed smooth. Pipe fittings shall be equally cleaned before assembly.

3.3 PIPE JOINTS

A. Pipe threads shall be full and cleanly cut with sharp dies or molded. Joints shall be made with Teflon tape.

3.4 INSPECTION AND TESTING OF PIPELINE

A. Completed brass process piping systems shall be inspected for proper supports, anchorage, and damage to pipe, fittings, and coatings. Any damage shall be repaired by CONTRACTOR at no additional cost to OWNER.

B. CONTRACTOR shall provide temporary blow-off valves and fittings as required to flush and disinfect new pipelines. Temporary blow-off valves and fittings shall be removed prior to placing pipeline into service.

C. Source of Water

1. CONTRACTOR shall assume all responsibility to obtain the necessary water supplies for disinfection and/or pressure testing of the pipeline.

D. Testing Procedure

1. Prior to enclosure or burying, piping systems shall be pressure tested as required on the Drawings, for a period of not less than one hour, without exceeding the tolerances listed on the Drawings. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. CONTRACTOR shall furnish test equipment, labor, materials, and devices.
2. Leakage shall be determined by loss of pressure, soap solution, or other positive and accurate method. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.
3. Leaks shall be repaired, and the piping shall be re-tested until no leaks are found.
4. ENGINEER shall be notified at least 48 hours before the pipeline is to be tested so that ENGINEER may be present during the test.

3.5 DISINFECTING

A. Disinfection shall be in accordance with AWWA C 651 and the requirements of Section 33 13 00 – Pipeline Testing and Disinfection.

- END OF SECTION –

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SECTION 40 91 23
MISCELLANEOUS PROPERTIES MEASUREMENT DEVICES

PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers the Work necessary to install a ready to use and tested process and analysis system. CONTRACTOR shall provide all components required for a complete and functional system.

1.2 RELATED WORK

A. Related Work in other sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures

1.3 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract. The publication is referred to in the text by basic designation only.

B. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. AWWA C 207 Steel Pipe Flanges for Waterworks Service—Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
2. AWWA C 751 Magnetic Inductive Flowmeters

C. NSF INTERNATIONAL (NSF)

1. NSF/ANSI 61 Drinking Water System Components - Health Effects

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit catalog cuts on all process equipment including switches, meters, sensors, or other items shown on Contract Drawings referencing each item by mark number. Information shall indicate manufacturer specification compliance and dimensional data.

C. CONTRACTOR shall supply operation and maintenance manuals for all process equipment.

1.5 WARRANTY

A. Manufacturer shall provide to OWNER written guarantee against defects in material or workmanship for a period of one (1) year.

1.6 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants. Each system shall be factory calibrated and certified prior to delivery.

1.7 MEASUREMENT AND PAYMENT

A. There shall be no separate measurement and payment for any systems. Full compensation for the system shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which it relates.

1.8 QUALITY ASSURANCE

A. Equipment to be furnished under this section shall be the product of manufacturers regularly engaged in the design and manufacturing of this type of equipment. The manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving CONTRACTOR from responsibility for the proper installation and functionality of the work.

PART 2 PRODUCTS

2.1 GENERAL

A. Each process measurement system shall typically consist of a sensor and analyzer/transmitter. Where shown on the Contract Drawings, the analyzer/transmitter may be utilized for multiple sensors. When an analyzer/transmitter is used for multiple sensors, it shall be capable of displaying simultaneously each process measurement.

B. Each analyzer/transmitter shall be equipped with a means to transmit process measurement data to the plant SCADA system.

1. For hardwired signals, unless indicated otherwise on Contract Drawings, provide the following:
   a. 4-20 mA output signals for each process measurement (for up to 500 Ohm loads).
   b. Two programmable SPDT relay outputs, rated at 5A up to 230 VAC, for each process measurement.

2. Where shown on the Contract Drawings, provide the following digital communications to the plant SCADA system:
   a. HART Protocol
   b. PROFIBUS
   c. MODBUS

C. Each analyzer/transmitter shall be powered by 115VAC (+/- 10%) at 60 Hz unless shown on Contract Drawings as being powered by 24 VDC (+/- 15%). Each analyzer/transmitter shall retain its programmable settings in non-volatile memory. Battery powered instruments, analyzer, or transmitters will not be accepted.

D. Each sensor and corresponding analyzer/transmitter shall be supplied as a complete and operable system. This includes all cabling, mounting hardware and fasteners.

When installed outdoors, the analyzer/transmitter shall be protected from the sun such that direct sunlight will not shine on the display.

E. All analyzers/transmitters shall be waterproof and made from corrosion resistant materials.

F. All sensors to be immersed in liquids shall be rated for permanent submersion and shall be corrosion resistant.

2.2 MAGNETIC FLOW METERS

A. Magnetic flow meters shall be the low the low frequency induction type which produces a DC pulsed signal directly proportional to and linear with the flow rate. Liners shall be polyurethane. Flow meters shall be rated at 250 psi. Standard output shall be an analog 4-20 mA signal with a local indication from a liquid crystal display (LCD) reading in gallons per minute flow. The meter shall also have a totalizer (with pulsed output), and non-full pipe detection. Meters shall have a minimum of 2 self-cleaning electrodes. CONTRACTOR shall field verify length of cable for connection.

B. Flanged connections shall be constructed of Type 304 or Type 316 stainless steel with pressure ratings to match the connecting pipe.

C. Liner shall be polyurethane or PTFE and electrodes stainless steel suitable for potable water service. Liners and electrodes for service other than potable water shall be constructed of materials conforming to the manufacturer's recommendation for the intended service.

D. Meter housing shall be rated for NEMA 6 for submersible operation.

E. Meters shall include grounding rings.

F. The transmitter shall have six-digit LCD displays for flow rate, percent of span, and totalization; be capable of measuring flow in both directions; automatic range change; capability to convert DC pulse signal from the tube to a standardized 4 to 20 mA DC signal into a minimum of 700 ohms; self-diagnostics and automatic data checking, and a scaleable frequency output, 0 to 100 Hz.

G. The flow measuring system shall conform to the following:

1. Time constant: 0.5 to 1000 seconds; galvanic or optic isolation
2. Accuracy: 0.50 percent of flow rate from 10 to 100 percent full scale velocities over 3 feet per second.
3. Repeatability: 0.25 percent of full scale
4. Power consumption: 30 watts or less
5. Power requirements: 120 VAC, plus or minus 10 percent, unless indicated otherwise on the Contract Drawings. Battery powered flow meters will not be accepted.

H. Magnetic flow meters shall be **Proline Promag W400 by Endress+Hauser, 8700 Series by Rosemount, Siemans Sitrans FM 5100W,** or approved equal.

2.3 PRESSURE SWITCH

A. A high pressure cutoff switch shall be installed as shown on Contract Drawings, and shall be as specified in the Electrical Drawings. The switch setting shall be adjustable as specified on the drawings. The switch shall be rated for the pressure of the system where it is installed with a safety factor of 1.5.

2.4 PRESSURE TRANSMITTER

A. The pressure transmitter shall be an electronic pressure transducer tailored to the installation as shown on the drawings and suitable for the planned application. The system shall include a pressure transducer with integral diaphragm seal. The pressure transmitter shall operate on 24 VDC, and shall provide a 4-20 mA DC signal to the RTU panel. The loop signal shall measure the water pressure and have a 4-20 mA signal output. The pressure transmitter shall have a LCD display showing the pressure in “psi”. The pressure transmitter shall be coded “DW” for NSF drinking water certification. Pressure transmitters shall be **Rosemount Series 3051**, or approved equal.

2.5 SUBMERSIBLE LEVEL TRANSMITTER

A. Submersible level transmitter shall be a ceramic open face type with Type 316 stainless steel housing. Range shall be 0 to 10 psi with ±0.1% accuracy. Enclosure shall include electrical termination strip.

B. Nominal size shall be 12” high by 9” wide by 5” deep.

C. Cable shall be polyurethane molded, vented with Kevlar, with four (4) conductors. CONTRACTOR to determine required cable length to install from level transmitter from Spring Box to inside Pump House as shown on the Contract Drawings.

D. Manufacturer or approved equal:

1. PMC Engineering VL-2-1-1-3

2.6 SUBMERSIBLE LEVEL TRANSMITTER TERMINATION ENCLOSURE

A. Termination Enclosure shall be a NEMA 4X polycarbonate enclosure.

B. Provide total isolation of the vent tube from atmosphere by utilization of a custom bladder which changes volume with barometric pressure.

C. Manufacturer or approved equal:

1. PMC Engineering TE-11 Enclosure with MP-11 Moisture Protection

PART 3 EXECUTION

3.1 INSTALLATION

A. All equipment shall be mounted and installed as per manufacturer recommendations. Coordinate final location with ENGINEER.

3.2 FLOW METER FIELD QUALITY CONTROL

A. Each instrument shall be tested before commissioning and ENGINEER shall witness the interface capability in the PLC control system and associated registers.

1. Each instrument shall provide direct programming capability through the PLC.
2. Each instrument shall provide direct control of totalizer reset functions through the PLC.
3. Each instrument shall be supported with a device profile permitting direct integration in the PLC.

B. ENGINEER shall witness all instrument verifications in the field.

C. Manufacturers Field Services shall be provided for start-up and commissioning by a Factory field service representative or a manufacturer's authorized service provider (ASP).

1. The manufacturer representative shall verify installation of all installed flow tubes and transmitters.
2. Manufacturer representative shall notify ENGINEER in writing of any problems or discrepancies and proposed solutions.
3. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability, and electronics health. A comparative report shall be generated for each meter tested.
4. The manufacturer's representative shall generate a configuration report for each meter.

3.3 TESTING

A. After installation of the equipment is complete, operating tests shall be carried out to assure that the equipment operates properly. All piping shall be tested hydrostatically and for leaks. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

- END OF SECTION –

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SECTION 43 42 22
BLADDER STYLE SURGE TANK

PART 1 GENERAL

1.1 SUMMARY

A. The work described by this section of specifications consists of furnishing all equipment, materials, and labor to provide, install, and test one (1) vertical bladder-type surge tank for potable water surge control as shown on the Contract Drawings and specified in the Contract Documents.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Contractor Submittals
2. Section 09 90 00 Painting and Finishes
3. Section 40 05 13.13 Steel Process Piping

1.3 REFERENCES

A. The latest edition of the following publications forms a part of these specifications to the extent referenced. The publications are referred to in the text to by basic designation only.

B. CODES

1. The building code referenced herein shall be the International Building Code (IBC) as defined in Section 01 42 19 entitled “Reference Standards”.
2. ASME Boiler and Pressure Vessel Code.
3. American Welding Society (AWS) Fabrication Code.
4. ASME Fabrication Code
5. National Board Inspection Code (NBIC)
6. NEMA Industrial Control Systems Code

C. COMMERCIAL STANDARDS

1. ANSI B 16.3-85 Malleable iron threaded fittings Class 150 and 300
2. ANSI B 16.9-86 Factory-made wrought steel butt welding fittings
3. ASTM A 36 Rolled structural steel bars, plates, shapes, and sheet piling.
4. ASTM A 53-87 Pipe, steel, black and hot-dipped, zinc-coated welded and seamless
5. ASTM A 47-84 Malleable iron castings
6. ASTM A 197-87 Cupola malleable iron
7. ASTM A 234-87 Pipe fittings of wrought carbon steel and allow steel for moderate and elevated temperatures
8. ASTM A 285 Pressure vessel plates, carbon steel, low- and intermediate- tensile strength intended for fusion-welded pressure vessels
9. NEMA ICS 6 Enclosure
10. SSPC-SP5 Shop blast surface preparation - White Metal Blasting Cleaning
11. SSPC-SP6 Shop blast surface preparation - Commercial Blast Cleaning

12. SSPC-SP10 Shop blast surface preparation - Near White Metal Blast Cleaning

1.4 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 - Submittal Procedures:

1. Complete dimensional fabrication drawings of the surge tank and include the dimensions of all equipment, accessories, supports, connections, outlets, and all related piping.
2. Catalog cut sheets for all accessories and piping.
3. Tank NSF 61 certification.
4. Equipment weights and anchor bolt designs.
5. Stamped calculations prepared by a professional engineer (registered in the State of Utah) for approval before tank fabrication.
6. Immediately following fabrication, and before tank shipment, provide a Certification of ASME Code stamp. This document shall be signed by the fabricator and shall bear a notary stamp for the state in which fabrication takes place and shall indicate that the code stamp has been obtained for the tank actually to be supplied.

1.5 QUALITY ASSURANCE

A. This specification has been constructed around a vertical bladder-type vessel as manufactured by Charlatte of America. Any related construction and/or design modifications necessitated due to the use of an alternate tank design shall be the responsibility of CONTRACTOR.

B. The manufacturer shall be iso-9001 certified which includes engineering, design, manufacturing and testing complete components. Vessel manufacturer shall manufacture their own vessels and bladders within the same plant as per quality control through ISO.

C. Manufacturer shall provide inhouse x-rays of welds if required by ASME code, hydrostatic test, and ASME inspection. ENGINEER reserves the right to inspect the vessel manufacturing facility to confirm requirement above.

PART 2 PRODUCTS

2.1 GENERAL

A. The vertical bladder-type surge tank shall be provided with the manufacturer's services at the jobsite at no additional cost to OWNER. One full 8-hour day of service from manufacturer's representative shall be provided per tank to approve the tank installation and advise CONTRACTOR during startup, testing, and final adjustment of each tank. In addition to this day, one additional full 8-hour day shall be provided in a separate trip to instruct OWNER's personnel in the operation and maintenance of the tank system.

2.2 SURGE TANK

A. The tank shall be a vertical, bladder-type vessel suitable for use with potable water. Tank shall be **HCA-1000-10/15-V (264 gallons)**, bladder type vertical surge tank as manufactured by **Charlatte, Young Engineering and Manufacturing, Inc**., or approved

equal.

B. Refer to the Contract Drawings for a detailed list of sizing parameters for the surge bladder tank. Some basic parameters are:

1. Maximum Surge Tank Diameter: 40 inches
2. Maximum Surge Tank Height: 80 inches

C. Structural Design and Supports shall include the tank, supports, and anchor bolts shall be designed based upon local building codes in addition to the following criteria:

1. Design for a hydrostatic operating pressure of 145 psi and a test pressure of 217 psi with no reactive load permitted through the inlet/outlet piping.
2. Support tank by support legs (four minimum) for attaching to a concrete floor slab. Material of construction shall comply with ASTM A 36 or ASTM A 285, Grade C. Weld the support legs to the tank.
3. Seismic Design Parameters to conform to the current IBC (if necessary and required by design engineer).

D. Surge Tank Design and Materials

1. Materials for the tank, design, and shop fabrication and inspection shall comply with Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code with only the plate steels in Table UCS-23 of said code being used. Provide ASME code stamp, National Board Registration number and pressure rating on tank.
2. Minimum design pressure shall be as stated in this section of the Specifications. Perform hydrostatic testing in shop. Test pressure shall be 150% of the design pressure of the tank.
3. The surge tank, the bladder, coating and lining shall be NSF 61 approved, and listed on the NSF database, for use with potable water applications. Proof of NSF listing of the entire tank model shall be submitted to ENGINEER.
4. Complete anchor bolt assembly (studs, nuts, washers, etc.) to be provided by CONTRACTOR.
5. Bladders and replacement bladders shall be manufactured in the tank manufacturers' plant. Tanks/Vessels shall be fabricated by listed manufacturer, not contracted out.
6. Provide a 1/2-inch threaded connection at the top of the tank to contain a gas charging valve and pressure gauge. Tank shell will be constructed of deep drawn carbon steel double sub-arc welded domes and side shells with double welded seams. Tank shall be equipped with a food grade, heavy duty butyl rubber bladder. The precharge pressure will be located between the shell of the tank and the bladder. The top manhole shall be removable to allow inspection and maintenance of the bladder. The bladder shall be sized to conform to the inner shape of the vessel. Bladder tank shall be of the vertical configuration.
7. Bladder tank shall conform with NBIC.

E. Service Conditions

1. Tank hydraulic performance conditions and design data shall be as shown on Contract Drawings. In the event that the manufacturer's hydraulic analysis of the system yields varying design requirements, ENGINEER should be contacted.

F. Valves

1. The tank shall be designed to function properly with the specific valves, including but not limited to plug valves and check valves, submitted by CONTRACTOR. Acceptance of these valves shall be clearly stated in the surge tank submittal.
2. Safety (Pressure Relief) Valve: The valve shall have a stainless-steel body and bonnet and shall have stainless steel trim. Pressure relief valves shall be certified to ASME Section VIII, GENERAL REQUIREMENTS, UG-125, AND 126. Set at 450 psig. Valves shall be **Apollo Series 500**, or approved equal.

G. Level monitoring

1. Pressure differential transmitter shall be **Rosemount Model 3051 digital pressure transmitter** or approved equal.
   a. Transmitter shall be two-wire, capacitance (DP/GP) or piezoresistive (AP/GP), high performance differential/gage/absolute/level/flow pressure transmitter with HART® based fieldbus based digital communication capabilities.
   b. Pressure transmitter shall be NEC 501-5, NEMA code ICS6 and FM certified and have 4-20 mA output signal.
   c. Pressure differential transmitter shall be hard mounted on the tank via a 2-inch 150 lbs flange.
2. Magnetic Level Gauge (optional)
   d. Tank shall be equipped with a magnetic level gauge.

H. Painting and Coating

1. All coating and lining shall be completed at the factory per Section 09 90 00 – Painting and Finishes.

PART 3 EXECUTION

3.1 TESTING

A. FABRICATION TEST

1. The Surge Tank shall be shop tested hydrostatically to a pressure of 1.5 times the design pressure for a period of not less than 24 hours. All leaks shall be detected and immediately repaired prior to painting.

B. FIELD STATIC TEST

1. The Surge Tank and system piping shall be hydrostatically tested to the design pressure immediately following installation and before any dynamic testing. Test period shall be four hours minimum, and all leaks detected shall be immediately repaired. Finish touchup painting shall be provided as necessary.

C. FUNCTIONAL TEST

1. The surge tank manufacturer shall verify the performance of the surge protection equipment provided by recording surge pressures following a pump trip and summarize the results in a written document. During the required field visit, at least one pump trip will be required to provide field data needed for the surge model

calibration. Field data will be provided to ENGINEER to develop and evaluate the surge computer model. The surge tank vendor shall provide all equipment needed to record the field data during a pump trip. The pressure shall be recorded with a pressure transducer capable of recording the surge pressures at a sample rate of 100 recordings per second. The manufacturer shall provide temporary transducers and software for use during testing.

2. CONTRACTOR shall provide to ENGINEER a complete report of each test performed within ten days after test completion. Reports shall include:
   a. Date and time of all testing.
   b. Description of method of testing including pumping combinations, pressure records, etc.
   c. Description of all observed leaks and method and date of repair. Description of any catastrophic failures.
   d. Certification that necessary repairs have been made.
   e. Signature of CONTRACTOR and Manufacturer's representative.

3.2 TANK INSTALLATION

A. The tank shall be installed in accordance with the manufacturer's suggested procedures. All supports, piping, valves, and related appurtenances shall be provided and installed by CONTRACTOR at no additional cost to OWNER.

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SECTION 46 31 11
CHLORINATION EQUIPMENT

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers the work necessary to install a ready to use and tested variable flow rate chlorination system. CONTRACTOR shall supply and install all equipment defined herein, and shall provide all other components required for a complete and functional system.

1. All equipment for the chlorination system shall be **Wallace and Tiernan**, or approved equal.

1.2 RELATED WORK

A. Related Work in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittal Procedures
2. Section 33 12 00 Mechanical Appurtenances

1.3 REFERENCES AND STANDARDS

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

B. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

1. B16.3 Malleable Iron Threaded Fittings, Classes 150 and 300

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
2. B 88 Seamless Copper Water Tube
3. D 1784 Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
4. D 1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
5. D 1998 Standard Specifications for Upright Storage Tanks
6. D 2466 Polyvinyl Chloride (PVC) Plastic Pipe and Fittings, Schedule 40
7. D 2564 Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
8. F 411 Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe, Schedules 40 and 80

D. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. C 800 Standard for Underground Service Line Valves and Fittings
2. C 900 Standard for Polyvinyl Chloride (PVC) pressure Pipe and Fabricated Fittings, 4 In. (100mm) Through 12 In. (300 mm), for Waster Distribution.
3. C 901 Standard for Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm)Through 3 In. (76 mm), for Water Service.

E. CHLORINE INSTITUTE (CI)

1. CI-01 The Chlorine Manual
2. CI Pamphlet 6 - Piping Systems for Dry Chlorine

F. INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

G. INTERNATIONAL MECHANICAL CODE (IMC)

H. INTERNATIONAL PLUMBING CODE (IPC)

1.4 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit cut sheets for all equipment, piping, fittings, etc.

C. Shop drawing showing proposed layout with dimensions of the proposed chlorination system piping and equipment.

D. Submit sizing calculations for ejector and injection quill.

E. Submit shop drawing for cylinder storage rack construction.

F. Submit operation and maintenance manuals for all chlorination equipment.

1.5 WARRANTY

A. Manufacturer shall provide to OWNER written guarantee against defects in material or workmanship for a period of one (1) year for all equipment utilized.

1.6 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 GAS CHLORINATOR SYSTEM

A. CONTRACTOR shall install a vacuum operated solution feed and automatic flow proportioning, chlorination system. All required equipment shall be furnished and installed by CONTRACTOR. The system will utilize 150 lb. cylinders. Equipment shall be **Evoqua / Wallace & Tiernan S10K Sonic Chlorinator** or approved equal.

B. Automatic switchover chlorinators shall be vacuum operated solution feed and shall automatically switch the chlorine supply from an empty cylinder to a full cylinder. The system shall have automatic reset and shall not permit return to the initial source until the second source is empty.

C. The chlorinator shall have a maximum capacity of 125 pounds of chlorine feed per day and shall have a gas flow meter capable of 50 pounds of chlorine feed per day.

D. The system shall consist of the following: Two (2) vacuum regulators with automatic switchover module and 5-inch rotameter, one (1) gas flow rotameter with a rate valve, one (1) gas flow proportioning valve with controller, one (1) ejector/diffuser assemblies, one (1) dual chlorine scale, and one (1) loss of vacuum switch. Other equipment required include:

1. One (1) chlorine booster pump with all appurtenant valves, piping, tubing and vents.
2. Standard equipment furnished with the chlorinator including spare parts, lead gaskets, clamps, multi-purpose wrench and adapters.

E. The equipment and piping layout indicated on the Contract Drawings shall be taken in a sense as diagrammatic. The alignment of piping and the arrangement of equipment may be varied with approval from ENGINEER from that indicated on the Contract Drawings to suit the equipment furnished, without additional cost to OWNER. CONTRACTOR shall submit to the OWNER complete detailed drawings of the proposed installation, following the manufacturer's recommendations, in adequate time for proper sleeving and conduit work involved with the building structure.

F. CONTRACTOR shall furnish chlorine needed for testing and adjustment of the equipment.

2.2 VACUUM SWITCH

A. Remote mounted loss of vacuum switch shall be **W&T model W3T99114**.

2.3 EJECTOR ASSEMBLY

A. Two ejector assemblies are required to reach the design feed range. The back-pressure from the discharge line is 65 psi. The ejectors shall be as follows:

1. Ejector shall be 50 ppd type rated for 200 psi working pressure. The ejector shall be manufactured from high impact plastic. The ejector shall be **Wallace & Tiernan 3/4-inch fixed throat anti-siphon injector Model 99D (nozzle and tailway)**, or approved equal.
2. Ejector shall be 10 ppd type rated for 200 psi working pressure. The ejector shall be manufactured from high impact plastic. The ejector shall be **Wallace & Tiernan 3/4-inch fixed throat anti-siphon injector Model 99C (nozzle and tailway)**, or approved equal.

2.4 CYLINDER SCALES

A. Scales shall be capable of holding 150 lbs cylinders. Platforms shall be corrosion resistant and have a low profile. Each platform shall include an electronic stainless steel load cell with an output of a 4-20 mA signal. Provide with wall mounted chaining bracket. Scales shall be **Force Flow Model DR150-2, Scaletron Industries, Ltd,** or approved equal.

B. Electronic Scale Indicator shall be capable of monitoring two scales. The Indicator shall be **Solo G2** or approved equal. The indicator shall include 2 relays.

2.5 INJECTION QUILL

A. Injection quill shall be a 1/2-inch retractable, spring loaded ball check valve type. Valve material shall be stainless steel and solution tube shall be PVC. Insertion length shall be 4-inches with standard tip. Check valve seals shall be Viton.

B. Injection quill shall **EB-145 by Saf-T-Flo**, or approved equal.

2.6 CHLORINE BOOSTER PUMP

A. CONTRACTOR shall furnish and install the chlorine booster pump as shown on the Contract Drawings. Pump shall be equipped with a minimum 1.5 HP, 115/208-230 V, three phase, 60 hertz, 3600 rpm, TEFC motor with a 1.15 service factor. The pump shall be rated to 363 psi and have a design flow of 9.7 gpm at a TDH of 90 psi. Pump base, head, flanges, and all parts shall be stainless steel fitted construction, furnished with case wearing ring and mechanical seal, and shall be NSF 61 certified. The pump shall be **Grundfos Model CRI 1-10 A-FGJ-A-E-HQQE**, or approved equal.

2.7 WATER SUPPLY LINE

A. CONTRACTOR shall furnish and install the water supply line as shown on the Contract Drawings including all valves, PVC pipe, stainless steel pipe, HDPE pipe, tubing, corp stops, couplings, and any other accessories necessary to have a complete and ready to use system. PVC pipe shall be Schedule 80 or 120 as noted.

2.8 PVC BALL VALVES

A. PVC ball valves for the chlorination solution piping shall be Spears Industrial Grade Sealed Unit with PTFE ball seats, EPDM O-rings, and high impact handle. Valves shall be full port rated for water to 235 psi.

2.9 PIPING, PRESSURE HOSE, AND TUBING

A. Piping, pressure hose, and tubing shall be suitable to handle the pressure and chlorine solution carried as recommended by the manufacturer.

B. Piping and fittings shall be PVC and stainless steel as noted on the Contract Drawings. PVC pipe shall be Schedule 80. Stainless steel pipe shall be 316 standard wall with stainless steel fittings as noted on the Contract Drawings. The pressure hose shall be NSF 61 certified, reinforced with 316 stainless steel ends, and be rated for a minimum of 500 psi.

2.10 CHLORINE CYLINDER RACKS AND SAFETY CABINETS

A. Chlorine Cylinder Racks shall be powder coated. Units shall meet or exceed the requirements for UFC, NFPA, CGA, and OSHA, as well as Seismic Zone 4 requirements. Chlorine cylinder racks shall be **Justrite Model 35288 (2 cylinder storage)** or approved equal.

2.11 SAFETY EQUIPMENT

A. No Safety Equipment required.

2.12 HAZARDOUS MATERIAL IDENTIFICATION SIGNS

A. CONTRACTOR shall furnish hazardous material identification signs on the exterior of all doors leading into the Chlorine Room:

1. NFPA 704 Diamond Placard:
   a. Health Hazard (Blue): 4
   b. Fire Hazard (Red): 0
   c. Reactive Hazard (Yellow): 0
   d. Specific Hazard (White): OX
2. For outdoor applications, signs shall be
   a. Sign Dimension: 10” x 14”
   b. Manufacturer: Northern Safety and Industrial, or approved equal.
   c. Material: 0.118” thick outer aluminum with a solid thermoplastic Dura-AlumaLite as manufactured by Northern Safety and Industrial, or approved equal.
   d. Model:
      1) “Danger Chlorine” model #231- 29843

B. CONTRACTOR shall furnish hazardous material identification signs inside the Chlorine Room:

1. For indoor applications, signs shall be:
   a. Sign Dimension: 10” x 14”
   b. Manufacturer: Northern Safety and Industrial, or approved equal.
   c. Material: 0.060” thick polycarbonate material with overlaminate Dura-Plastic as manufactured by Northern Safety and Industrial, or approved equal.
   d. Model:
      1) “Keep All Cylinders Chained” model #231-30333
      2) “Notice – Empty Cylinders” model #231-29870
      3) “Notice – Full Cylinders” model #231-29871

2.13 VENTS

A. Tubing vents shall extend to the outside of structures and be turned down and be equipped with a #14 mesh non-corrodible screen.

B. Intake vents shall be motor operated and have #14 mesh screens.

2.14 MULTI-POINT TOXIC GAS DETECTION SYSTEM

A. A multi-point gas detector shall be supplied for monitoring the concentration of Chlorine in the Pump Room and Chlorine Room. The system shall consist of a NEMA 4X alarm module and a remote mounted gas sensor/transmitter for chlorine gas. A sensor/transmitter shall provide the gas measurement function for the system. The sensor/transmitters shall consist of a stable electrochemical gas sensor that shall generate a signal linearly proportional to gas concentration. The entire assembly shall be coated to minimize RFI interference. Each sensor/transmitter shall be supplied with an electrochemical gas generator closely coupled to the sensor which shall automatically generate a small concentration of gas every 24 hours to verify sensor operation. During the verification test, alarm relays shall be inhibited. A battery backup module shall be supplied to provide standby power to the gas detector. The battery backup module shall

be housed in a NEMA 4X enclosure and shall be suitable for operating the detector for at least 4 hours.

B. Two programmable alarm set points shall be provided for warning personnel of differing levels of leakage. Gas leak alarms shall be indicated by flashing LED indicators on the alarm receiver and activation of the SCADA system. The concentration of the gas shall be displayed directly in PPM units. Three alarm relays shall be provided for external alarming functions. Each alarm relay shall be independently assignable to either the low or the high alarm set point, and shall be provided on each receiver to indicate the loss of signal from the sensor/transmitter, or to alarm the loss of sensitivity of the gas sensor. Each receiver shall provide an isolated 4-20 mA output signal proportional to gas concentration, and shall also contain remote reset input terminals to allow alarm acknowledge from a remote location.

C. The gas detection system shall be **Wallace & Tiernan Acutec 35 Gas Detection System, ATI Series A14**, or approved equal.

1. System shall include a flashing beacon light with outside wall mounted bracket, to warn operator from entering room. Light shall be **Edwards Signaling & Security System Series 50** or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed as per manufacturers' directions. Weight of valves, hoses and equipment must not be carried by the fittings themselves. Proper support for all equipment shall be provided.

B. Chlorination injection points shall have anti-siphon valves and diffuser piping as required mounted horizontally.

C. Vents shall extend to the outside of structure and be turned down and be equipped with a non-corrodible screen.

D. The chlorine detector sensor shall be mounted not higher than 2 feet 6 inches above the lowest floor elevation and at least 4 feet away from the exhaust fans.

E. The chlorine equipment appurtenances shall be installed in accordance with CI-01 and CI Pamphlet 6 so as to provide a complete and integrated system in accordance with the instruction of the manufacturer.

F. The Chlorine ejector shall be placed on the piping so as to protect it from damage and installed per manufacturer's instruction.

3.2 START-UP AND TESTING

A. CONTRACTOR and Equipment Supplier (ES) shall verify that structures, equipment, pumps and motors are compatible for an efficient system.

B. CONTRACTOR and ES shall make equipment adjustments required to place system in proper operating condition.

C. CONTRACTOR and ES shall test the chlorination feed systems for proper operation in the presence of OWNER and ENGINEER. The ES shall furnish all testing equipment and devices required.

D. If chlorination feed systems fail to meet any of the specified performance requirements, CONTRACTOR and/or ES shall modify and/or replace defective equipment until it meets specified requirements.

E. All piping shall be tested hydrostatically for leaks. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

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