

CONSTRUCTION DOCUMENTS

FOR THE

LOWER WELL IMPROVEMENT PROJECT

FOR THE

City of River Heights, Utah

520 South 500 East
River Heights, UT 84321



JANUARY 4, 2023

PREPARED BY:



RIVER HEIGHTS CITY

CONTRACT DOCUMENTS, STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS

for the

LOWER WELL IMPROVEMENT PROJECT

JANUARY 4, 2023

CITY COUNCIL

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Councilman..... Blake Wright
Councilman..... Chris Milbank
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** Special provisions have been included hereunder*

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** Special provisions have been included hereunder*

Part 1

BIDDING REQUIREMENTS

INVITATION TO BID

RECEIPT OF BIDS: Sealed bids for **Construction** of River Heights City's **Lower Well Improvement Project** ("Project") will be received by the Engineer at 95 West 100 South, Logan, Utah, until **Tuesday, January 31, 2023, at 3:00 p.m. (local time)** and then at said office publicly opened and read aloud.

OBTAINING CONTRACT DOCUMENTS: Digital copies of the bid documents may be obtained and/or hardcopies examined **on or after January 11, 2023**. Hardcopies may be examined at the City offices located at 520 South 500 East, River Heights, Utah 84321 during regular office hours. Digital copies may be obtained from the City Engineer via email at edursteler@forsgren.com at no cost. Hardcopies will not be provided to bidders. Please address questions on the project to Eric Dursteler, P.E. by email at edursteler@forsgren.com.

DESCRIPTION OF WORK: Work to be performed generally includes demolition of the existing facilities; site excavation, grading, and preparation; raising well casing to grade, construction of the well control building; gas chlorination system, install new well pump, pipeline to 400 East; telemetry; pump-to-waste; electrical transformer; standby generator, safety handrail; and site grading and surface improvements.

PRE-BID CONFERENCE: A **mandatory** pre-bid conference will be held **on Tuesday, January 24, 2023, at 3:00 p.m. meeting at City Hall**. Representatives of the Owner and the Engineer will be present to discuss the project. A site visit will be conducted following thereafter.

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

PROJECT ADMINISTRATION: All questions relative to this project prior to the opening of bids shall be directed to the Engineer for the project, and all questions shall be in writing. For "or equal" items to be considered for evaluation, Contractor must submit information in compliance with Article 11 in Section 00 21 13 - "Instructions to Bidders." No clarifications or questions will be answered three (3) days prior to bid date.

OWNER'S RIGHTS RESERVED: The OWNER reserves the right to waive any informalities or to reject any or all bids, if in the best interest of the OWNER. Final quantities and project work portions will be dependent upon bids and the final project budgets.

PUBLISHED: Logan Herald Journal, January 10, 14, 21 and January 24, 2023.

INSTRUCTIONS TO BIDDER

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Article 19 - Addenda
Article 20 - Pre-Bid Conference
Article 21 - Execution of Agreement

PART 2 - ARTICLES

ARTICLE 1. DEFINED TERMS

Terms used in these Instructions to Bidder which are defined in the Standard General Conditions of the Construction Contract have the meanings assigned to them in the General Conditions.

Certain additional terms used in these Instructions to Bidder have the meanings indicated below, which meanings are applicable to both the singular and plural thereof.

- 1.01 *Issuing Office* – the office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.
- 1.02 *Plan Holder* – An entity having purchased a complete set of Bidding Documents.

ARTICLE 2. COPIES OF BIDDING DOCUMENTS

- 2.01 Bidding Documents may be obtained as indicated in the Invitation to Bid.
- 2.02 Complete sets of Bidding Documents must be used in preparing Bids. Neither Owner nor Engineer assume 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 confer a license or grant for any other use.

SECTION 00 21 13 INSTRUCTIONS TO BIDDERS

- 2.04 Drawings bound in the Contract Documents may be reductions of scaled plots. The amount of reduction is indicated by a note or scale bar on the Drawings.
- 2.05 Documents will be distributed via electronic file sharing, regular mail, or by express parcel carrier. Addenda may be delivered via electronic file sharing, regular mail, by an express parcel carrier, or by fax.
- 2.06 Parties ordering Contract Documents must include company name, email address, U.S. Mail address, express parcel carrier address, phone number and fax number for timely receipt of Bidding Documents and Addenda.

ARTICLE 3. QUALIFICATIONS OF BIDDERS

To demonstrate qualifications to perform the Work, each Bidder must be prepared to submit within five calendar days after Bid opening upon Owner's request detailed written evidence such as financial data, previous experience, present commitments and other such data as may be called for below.

ARTICLE 4. FORMAT DIFFERENCES

Specification sections may have different formats. Bidder shall make no special interpretation or inference of intent from different formats of different Specification sections.

ARTICLE 5. EXAMINATION OF BIDDING DOCUMENTS AND SITE

- 5.01 It is the responsibility of each Bidder before submitting a Bid:
 - 5.1.1 To examine thoroughly the Bidding Documents and other related data identified in the Bidding Documents, including "technical data" referred to below at paragraph 5.02;
 - 5.1.2 To visit the site to become familiar with and satisfy Bidder as to the general local and site conditions that may affect cost, progress, performance or furnishing of the Work;
 - 5.1.3 To consider federal, state and local Laws and Regulations that may affect material cost, labor cost, progress, performance or furnishing of the Work;
 - 5.1.4 To study and carefully correlate Bidder's knowledge and observations with the Bidding Documents and such other related data;
 - 5.1.5 Agree at the time of submitting its Bid that 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 and in accordance with the other terms and conditions of the bidding documents;
 - 5.1.6 Determine that the bidding documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work; and,
 - 5.1.7 To promptly notify Engineer of all conflicts, errors, ambiguities or discrepancies which Bidder has discovered in the Bidding Documents and such other related documents.
- 5.02 Reference is made to the Supplementary Conditions for identification of:
 - 5.2.1 Those reports of explorations and tests of subsurface conditions at or contiguous to the site which have been utilized by Engineer in preparation of the Bidding Documents. Bidder may rely upon the general accuracy of the "technical data" contained in such reports but not upon other data, interpretations, opinions or information contained in such reports or otherwise relating to the subsurface conditions at the site, nor upon the completeness thereof for the purposes of bidding or construction.

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

- 5.2.2 Those drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the site that have been utilized by Engineer in preparation of the Bidding Documents. Bidder may rely upon the general accuracy of the "technical data" contained in such drawings but not upon other data, interpretations, opinions or information shown or indicated in such drawings or otherwise relating to such structures, nor upon the completeness thereof for the purposes of bidding or construction.
- 5.2.3 Copies of such reports and drawings may be examined at Owner's office.
- 5.2.4 Bidder is solely responsible for any interpretations or conclusions drawn by the Bidder from such reports or drawings.
- 5.03 Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities or others, and Owner and Engineer do not assume responsibility for the accuracy of completeness thereof unless it is expressly provided otherwise in the Supplementary Conditions.
- 5.04 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 conditions appear in paragraph 4.03 of the General Conditions.
- 5.05 Before submitting a Bid, each Bidder will be responsible to obtain such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise, which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Bidder and safety precautions and programs incident thereto or which Bidder deems necessary to determine its Bid.
- 5.07 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article (Article 5); that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying the specific means, methods, techniques, sequences or procedures of construction (if any) that may be shown or indicated or expressly required by the Bidding Documents; that Bidder has given Engineer written notice of all conflicts, errors, ambiguities and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer is acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work and for preparing the Bid.
- 5.08 The provisions of 5.01 through 5.07 inclusive, do not apply to Asbestos, Polychlorinated Biphenyls (PCBs), Petroleum, Hazardous Waste or Radioactive Material covered by Paragraph 4.06 of the General Conditions.

ARTICLE 6. INTERPRETATIONS AND ADDENDA

- 6.01 All questions about the meaning or intent of the Bidding Documents are to be directed to Engineer. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer 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 formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 6.02 Addenda may be issued to clarify, correct or change the Bidding Documents as deemed advisable by Owner or Engineer.

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

ARTICLE 7. BID SECURITY

- 7.01 Each Bid must be accompanied by Bid Security made payable to Owner in an amount of five percent (5%) of Bidder's Bid Price and in the form of a certified cashier's check or a Bid Bond issued by a surety meeting the requirements of Paragraph 5.01 of the General Conditions.
- 7.02 The Bid Security of Successful Bidder will be retained until the Contract Documents have been fully executed and returned to the Successful Bidder with his copy of the fully executed Contract Documents.
- 7.03 The Bid Security of such other Bidders as the Owner believes to have a reasonable chance of receiving the award will not be returned until the execution of the Agreement by the Owner or until the rejection of all bids by the Owner.
- 7.04 The Bid Securities of any other Bidders will be returned within 30 days of Bid Opening.
- 7.05 If the Successful Bidder fails to sign and return the Agreement (and stipulated attachments) within the time period specified in Article 19, Execution of Agreement, the Owner may annul the award and the Bid Security of that Bidder shall be forfeited.

ARTICLE 8. CONTRACT TIMES

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

ARTICLE 9. LIQUIDATED DAMAGES

Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 10. SUBSTITUTE AND "OR-EQUAL" ITEMS

The Contract, if awarded, will be on the basis of materials and equipment shown on the Drawings or specified in the Specifications without consideration of possible substitute or "or-equal" items. A substitute or "or-equal" item of material or equipment may be furnished or used by Contractor, if approved by the Engineer. Application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement. The procedure for submission of any such application by Contractor and consideration by Engineer is set forth in Article 6.05 of the General Conditions.

ARTICLE 11. SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 11.01 **Bidder shall provide** evidence of qualification for each Subcontractor, Supplier, person or organization **if requested by Engineer**. If Owner or Engineer, after due investigation has reasonable objection to any proposed Subcontractor, Supplier, or other person or organization, Owner may request, before the Notice of Award is given, that apparent Successful Bidder submit an acceptable substitute and Owner will pay any increase in cost resulting from the change.

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 and other persons and organizations. The declining to make requested substitutions will not constitute grounds for sacrificing the Bid Security of any Bidder. Any Subcontractors, Supplier, other person or organization listed and to whom Owner or Engineer does not make written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in paragraph 6.06 of the General Conditions.

ARTICLE 12. BID FORM

- 12.01 The Bid Form is included with the Bidding Documents. Additional copies may be obtained from Engineer. No substitution of forms will be allowed.
- 12.02 All blanks on the Bid Form shall be completed by typing or printing with black ink, and the Bid signed. A Bid price shall be indicated for each section [Bid Item, alternative, adjustment unit price item, and unit price item] listed therein. No changes shall be made in the phraseology of the forms.
- 12.03 Bids by corporations shall be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.
- 12.04 Bids by partnerships shall be executed in the partnership name and signed by a partner, whose title shall appear under the signature and the official address of the partnership must be shown below the signature.
- 12.05 Bids by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown below the signature.
- 12.06 All names shall be typed or printed in black ink below the signature line.
- 12.07 The Bid shall contain an acknowledgement of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).
- 12.08 The address and telephone number for communications regarding the Bid shall be shown.
- 12.09 The Bid Price shall include such amounts as the Bidder deems proper for overhead and profit on account of cash allowances named in the Contract Documents as provided in paragraph 11.02 of the General Conditions.
- 12.09 The Bid Price shall include all applicable taxes.

ARTICLE 13. SUBMISSION OF BIDS

- 13.01 Faxed copies of Bid shall be considered non-responsive.
- 13.02 Submit Bids no later than the time prescribed, and at the place, and in the manner set forth herein. Enclose Bids in an opaque sealed envelope, marked with the Project title and name and address of Bidder and accompanied by the Bid Security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it. Bids must be made on the prescribed Bid form provided and submitted with the attachments listed below.
- 13.04 Only one Bid from any individual, firm, partnership, or corporation, under the same or different names, will be considered. Should it appear to the Owner that any Bidder is interested in more than one Bid for Work contemplated all Bids in which such Bidder is interested will be rejected.

ARTICLE 14. MODIFICATION AND WITHDRAWAL OF BIDS

- 14.01 Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids.

SECTION 00 21 13 INSTRUCTIONS TO BIDDERS

- 14.02 If, before the scheduled closing time for receipts of bids 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, that Bidder will be disqualified from further bidding on the Work to be provided under the Contract Documents.

ARTICLE 15. OPENING OF BIDS

Bids will be opened and (unless obviously non-responsive) read aloud publicly at the place where Bids are to be submitted. A summary of the Bids will be made available to Bidders within seven days after the opening of Bids.

ARTICLE 16. BIDS TO REMAIN SUBJECT TO ACCEPTANCE

All Bids shall remain subject to acceptance for the period of time noted in Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid Security prior to that date.

ARTICLE 17. EVALUATION OF BIDS / BASIS OF AWARD / AWARD OF CONTRACT

- 17.01 Prior to issuing a Notice of Award, Owner will evaluate the Bids, considering whether the Bids comply with the prescribed requirements and whether it is in the best interest of the Owner to award the contract.
- 17.02 Owner may conduct such investigations as Owner deems necessary to assist in bid evaluation.
- 17.03 Criteria for Rejection of Bids:

A bid will be rejected if:

- The authorized Bid Form furnished is not used or is altered.
 - The completed Bid Form contains any unauthorized additions, deletions, alternate bids, or conditions.
 - The Bidder adds provisions, especially any to the effect of reserving the right to reject or accept the award.
 - The Bid Form is not properly executed.
 - The proposed subcontractors and work responsibilities are not listed in the Bid.
 - The Bid Security is not provided.
 - Receipt of addenda is not acknowledged.
 - A member of a joint venture and the joint venture submit bids for the same project (in such an instance, both bids may be rejected).
 - If Bid Form entries are not clear, legible, and made in ink.
- 17.04 Owner reserves the right to waive all informalities not involving Price, time, or changes in the Work. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.
- 17.05 Owner also reserves its right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, non-responsive, unbalanced or conditional Bids, and to reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder, whether because the Bid is not responsive or the Bidder fails to meet any other pertinent standard or criteria established by Owner.
- 17.06 If, at the time this contract is to be awarded, the total of the lowest acceptable Bid exceeds the funds then estimated by the Owner as available, the Owner may reject all Bids or take such other action as best serves the Owner's interests.
- 17.07 If, and only if, the Owner determines the contract is to be awarded:

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

17.07.1 Owner will issue a Notice of Award within 30 days after the day of the Bid Opening.

17.07.2 The contract will be awarded to lowest responsive, responsible Bidder whose evaluation by Owner indicates to Owner that the award will be in the best interests of the Owner. This Bidder will be designated as the Successful Bidder.

17.08 In the event of failure of the Successful Bidder to sign the Agreement and provide acceptable Performance and Payment Bond(s), insurance certificate(s), and other required documents, within the specified time, the Owner may withdraw the designation of Successful Bidder and may award the contract to the next lowest responsive, responsible Bidder, who would then be designated as the Successful Bidder.

17.09 Owner will select the lowest responsible bidder based on the BASE BID amount.

17.10 Final quantities and project work portions will be dependent upon bids and the final project budgets.

ARTICLE 18. CONTRACT SECURITY

Paragraph 5.01 of the General Conditions sets forth Owner's requirements as to Performance and Payment Bonds. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by the required Performance and Payment Bonds

ARTICLE 19. ADDENDA

Engineer will transmit to all Plan Holders such Addenda as Engineer considers necessary. Oral statements in response to questions shall not be relied upon and shall not be binding or legally effective.

ARTICLE 20. PRE-BID CONFERENCE

Where a Prebid Conference is deemed appropriate, times and locations are noted in Invitation to Bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are required to attend and participate in the conference. Engineer will transmit to all Plan Holders such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements shall not be relied upon and shall not be binding or legally effective.

ARTICLE 21. EXECUTION OF AGREEMENT

When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within ten (10) days after receipt of Notice of Award, Contractor shall sign and return all required copies of the Agreement to the Owner. These shall be accompanied by copies of each attachment (e.g., Bonds) stipulated by the Agreement. Owner will assemble and execute the Contract Documents. One fully executed set of Contract Documents will be delivered to Contractor.

END OF SECTION

LOWER WELL IMPROVEMENT PROJECT

BID FORM

Bid Submitted To: **City of River Heights**
Address: **520 South 500 East**
River Heights, Utah 84321

1. BIDDER'S DECLARATION AND UNDERSTANDING.

- 1.1 Bidder accepts all of the terms and conditions of the Advertisement and Instructions to Bidders, including without limitations those dealing with the dispositions of Bid security. The bid will remain subject to acceptance for 30 days after the Bid opening, or for such longer period of time that the Bidder may agree to in writing upon request of the Owner.
- 1.2 BIDDER acknowledges that no special interpretation for inference of intent is to be given to different formats of different Specifications sections.
- 1.3 In submitting this Bid, Bidder acknowledges and accepts CONTRACTOR's representations as more fully set forth in the Agreement.
- 1.4 Bidder understands and agrees that if a contract is awarded, OWNER may elect to modify the scope of Work as best serves the interests of OWNER.
- 1.5 In addition to this Bid Form, the Bidder agrees that the following shall form part of this Bid:
 - Proposed Subcontractors
 - Bid Bond (or cashier's check in lieu of Bid Bond)

2. CONTRACT EXECUTION AND BONDS.

- 2.1 The undersigned BIDDER agrees, if this Bid is accepted, to enter into an Agreement with OWNER on the form included in the Bidding Documents to perform and furnish Work as specified or indicated in the Bidding documents for the Contract Price derived from the Bid and within the Contract Times indicated in the Agreement and in accordance with the other terms and conditions of the Bidding Documents.
- 2.2 BIDDER accepts the terms and conditions of the Bidding Documents.

3. ADDENDA.

- 3.1 BIDDER hereby acknowledges that it has received Addenda No's.:

_____, _____, _____, _____, _____, (BIDDER shall insert number of each Addendum received) and agrees that Addenda issued are hereby made part of the Contract Documents, and Bidder further agrees that this Bid includes impacts resulting from said Addenda.

**SECTION 00 30 00
BID FORM**

4. BID SCHEDULES

- 4.1 In the event of a discrepancy, amount in words shall prevail.
4.2 The BIDDER hereby acknowledges that the bid prices are based solely on the BIDDER's own estimates of costs and includes all applicable taxes, overheads, and profit.

5. BID SUBMITTALS

All Bidders shall submit the following with their Bids:

- Tabulation of the Bid (consisting of Document 00 31 00 Bid Schedule);
- Required Bid Security
- A tabulation of Subcontractors, Suppliers and/or other individuals and entities required to be identified in the Bid

6. SURETY.

If BIDDER is awarded a construction contract from this Bid, the surety who will provide the Performance and Payment Bond(s) is:

_____ whose address is

Street City State Zip

7. BIDDER.

By _____
(Business Name)

(Type of Bidder: Individual, Partnership, Corporation, Joint Venture)

(State of Incorporation)

By _____
(Name and Signature of Person Authorized to Sign)
(For a Joint Venture, Each Joint Venture Must Sign)

(Title)

(Corporate Seal)

SECTION 00 30 00
BID FORM

Name, Phone Number, and Address for receipt of official communications and for additional information on this Bid:

SUBMITTED ON _____, 20__.

END OF SECTION

BID SCHEDULE

CONTRACT FOR: LOWER WELL STATION IMPROVEMENT PROJECT

The undersigned Bidder, having examined and determined the scope of the Contract Documents, hereby proposes to perform the work described herein for the following unit prices or lump sum amounts.

Note: 1. Bids shall include sales tax and all other applicable taxes and fees 2. All bids shall be checked for errors. If errors are made, unit prices shall govern and corrections will be made according to the unit price					
Item No.	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization and Demobilization	1	LS		
2	Materials Testing	1	LS		
3	Minor Traffic Control	1	LS		
4	Remove and Dispose of Existing Facilities (Including fence and pipeline)	1	LS		
5	Sawcut Asphalt	1	LS		
6	Tree/Vegetation Removal & Cleanup	—	LS	<i>To be completed by others under separate contract</i>	
7	Raise Well Casing and Furnish and Install Well Pump and Motor <i>(To be furnished, installed, and executed by Glenn's Electric under Contractor's prime agreement with Owner)</i>	1	LS		
8	Construct Well Control Building and Appurtenant Facilities <i>(Wellhead piping and assembly in building to be furnished, installed, and executed by Glenn's Electric under Contractor's prime agreement with Owner)</i>	1	LS		
9	Furnish and Install Superior Gas Chlorination System (Including set up, spare parts/kits, operation/startup, and training)	1	LS		
10	Construct Pump-to-Waste Assembly (non-woven geotextile fabric, rip rap, and swale to existing ditch; <i>wellhead pump-to-waste piping and assembly to be furnished, installed, and executed by Glenn's Electric under Contractor's prime agreement with Owner</i>)	1	LS		
11	Construct Concrete Driveway, Generator Pad, and Landing (including footings, foundations, backfill, etc.)	1	LS		
12	Furnish and Install Site and Building Electrical Systems (Control panels, lighting, receptacles, switches, actuators, conduit, wiring, controls, connections, etc. <i>Well motor VFD to be furnished, installed, and executed by Glenn's Electric under Contractor's prime agreement with Owner</i>)	1	LS		
13	Furnish and Install Well SCADA with Controls, Integration, Testing and Training <i>(to be coordinated with Intermountain Environmental, Inc.)</i>	—	LS	<i>To be completed by Intermountain Environmental, Inc. under separate contract</i>	
14	4-inch Diameter Electrical Service Conduit from Power Pole to Transformer (see electrical drawings)	1	LS		
15	Safety Handrail (west and south sides of driveway/genset pad)	35	LF		
16	8-inch Diameter C900 PVC Waterline	20	LF		
17	8-inch Diameter Gate Valve	1	EA		
18	Roadway Asphalt Patch	20	SY		
19	Site Grading Backfill and Earthwork (Completed to finished grade elevations)	1	LS		
20	Disturbed Surfaces Restoration/Re-seeding (Final grading)	1	LS		
TOTAL OF BASE BID:					

ADDITIONAL BID ITEMS

Item No.	Description	Quantity	Unit	Unit Price	Amount
1A	Standby Generator	1	LS		
1B	Re-Route Primary Power Line (Conduit)	1	LS		
TOTAL OF ADDITIONAL BID ITEMS:					

The undersigned Bidder certifies that this proposal is made in good faith, without collusion or connection with any other person or persons bidding on the work.

Seal (if bid is by Corporation)

Respectfully Submitted:

Bidder: _____

Signature _____

Title: _____

License No. _____ Address: _____

Date: _____

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):*

**City of River Heights
520 South 500 East
River Heights, Utah 84321**

BID

Bid Due Date: _____

Description *(Project Name and Include Location):*

Lower Well Improvement Project, River Heights, Utah

BOND

Bond Number: _____

Date *(Not earlier than Bid due date):* _____

Penal sum	Five Percent of Amount Bid	\$5%
	(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

_____ Bidder's Name and Corporate Seal	(Seal)	_____ Surety's Name and Corporate Seal	(Seal)
---	--------	---	--------

By: _____
Signature

By: _____
Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

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 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 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.

CONTRACTORS QUALIFICATIONS AND INFORMATION

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

1. Contractor's name and address (mail and business):

2. Contractor's telephone number:

3. Contractor's State License No:
Supplemental Classification held, if any:
Public Works License No:
Bid Limit:

4. Number of years as a contractor in construction work of this type:

5. Names and titles of Principal Officers of Contractor's firm:

1.
2.
3.
4.
5.

5. Name of Individual(s) who inspected the Project site of the proposed Work for your firm:

1.
2.

6. Name, address, and telephone number of surety company and agent who will provide required bonds on this contract:

Surety Company:
Mailing Address:
City, State, Zip:
Contact:
Phone:

7. Is the contractor or anyone employed under litigation or arbitration? YES ____ NO ____
If yes, please attach a brief description of the lawsuit and the parties involved.

SUBCONTRACTORS LIST

TO BE EXECUTED BY ALL BIDDERS AND SUBMITTED WITH BID

The Bidder shall list below the names and business address of each subcontractor who will perform Work on this contract in excess of 5% (0.05) of the total bid price and shall also list the portion of the Work which will be done by such subcontractor. After the opening of proposals, no changes or substitutions will be allowed without the written approval of Owner.

Full Name of Subcontractor and Address	Description of Work: Reference To Bid Items	Subcontractor's License No.

(Bidder to attach additional sheets if necessary)

END OF DOCUMENT

Part 2
CONTRACT FORMS

Notice of Award

Date: _____

Project: **Lower Well Improvement Project**

OWNER: **City of River Heights**

Contract No.:

Bidder:

Bidder's Address:

You are notified that your Bid dated _____, **2023** for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for the **Lower Well Improvement Project**:

The Contract Price of your Contract is _____
Dollars (\$_____).

You must comply with the following conditions precedent within **10 days** of the date you receive this Notice of Award.

1. Deliver to the OWNER three **(3)** fully executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Contract security Bonds as specified in the Instructions to Bidders (Article 20), General Conditions (Paragraph 5.01), and Supplementary Conditions (Paragraph SC-5.01).

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 Contract Documents.

Owner

By: _____
Authorized Signature

Title

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

THIS AGREEMENT is by and between City of River Heights (“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:

Work to be performed generally includes demolition of the existing facilities; site excavation grading and preparation; construction of the Well Control Building; raise wellhead; appurtenant pipes, valves, equipment, pipeline connection to 400 East; electrical systems and components, telemetry; pump-to-waste assembly; electrical transformer concrete pad; safety handrail; site grading and surface improvements.

ARTICLE 2 – THE PROJECT

- 2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

See Article 1 - Work

ARTICLE 3 – ENGINEER

- 3.01 The Project has been designed by Forsgren Associates, Inc. (ENGINEER), which is 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 *Days to Achieve Substantial Completion and Final Payment*

- A. The Work will be substantially completed within **120** days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within **150** days after the date when the Contract Times commence to run.

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 loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. 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), CONTRACTOR shall pay OWNER **\$250 (Two Hundred Fifty Dollars)** for each day that expires after the time specified in Paragraph 4.02 above for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER **\$500.00 (Five Hundred Dollars)** for each day that expires after the time specified in Paragraph 4.02 above for completion and readiness for final payment until the Work is completed and ready for final payment.

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 Paragraphs 5.01.A, 5.01.B, and 5.01.C below:

A. For all Work, a lump sum of:

_____ (\$ _____)
(words) (figure)

All specific cash allowances are included in the above price in accordance with Paragraph 11.02 of the General Conditions.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. CONTRACTOR shall submit Applications for Payment in accordance with Article 14 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 during performance of the Work as provided in Paragraph 6.02.A.1 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions or, in the event there is no schedule of values, as provided in the General Requirements.

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 ENGINEER may determine or OWNER may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions.

a. **95 percent** of Work completed (with the balance being 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 as ENGINEER shall determine in accordance with Paragraph 14.02.B.5 of the General Conditions.

6.03 *Final Payment*

- A. Upon **final completion and acceptance** of the Work in accordance with Paragraph 14.07 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said Paragraph 14.07.

ARTICLE 7 – INTEREST

- 7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the rate 8 percent per annum.

ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS

- 8.01 In order to induce OWNER to enter into this Agreement, CONTRACTOR makes the following representations:
 - A. CONTRACTOR has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
 - B. CONTRACTOR has visited the Site 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 federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
 - D. CONTRACTOR has carefully studied reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities), if any, that have been identified in Paragraph SC-4.02 of the Supplementary Conditions.
 - E. CONTRACTOR has considered the information known to CONTRACTOR; 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, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents; and (3) CONTRACTOR’s safety precautions and programs.
 - F. Based on the information and observations referred to in Paragraph 8.01.E above, CONTRACTOR does not consider that 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 Documents.
 - 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.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

- A. The Contract Documents consist of the following:
1. This Agreement (pages 1 to 6, inclusive).
 2. Performance bond (pages ____ to ____, inclusive).
 3. Payment bond (pages ____ to ____, inclusive).
 4. Other bonds (pages ____ to ____, inclusive).
 - a. ____ (pages ____ to ____, inclusive).
 - b. ____ (pages ____ to ____, inclusive).
 - c. ____ (pages ____ to ____, inclusive).
 5. General Conditions (pages ____ to ____, inclusive).
 6. Supplementary Conditions (pages ____ to ____, inclusive).
 7. Specifications as listed in the table of contents of the Project Manual.
 8. Drawings consisting of _____ sheets with each sheet bearing the following general title:
LOWER WELL IMPROVEMENT PROJECT
 9. Addenda (numbers __ to __, inclusive).
 10. Exhibits to this Agreement (enumerated as follows):
 - a. CONTRACTOR's Bid (pages ____ to ____, inclusive).
 - b. Documentation submitted by CONTRACTOR prior to Notice of Award (pages ____ to ____, inclusive).
 - c. *Other:*
 11. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
 - a. Notice to Proceed (pages 1 to 1, inclusive).
 - b. Work Change Directives.
 - c. Change Orders.
- 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 Paragraph 3.04 of 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. 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, moneys that may become due and moneys that are 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 partners, successors, assigns, and legal representatives to the other party hereto, its partners, 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 anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of OWNER, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive OWNER of the benefits of free and open competition;
 3. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of OWNER, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
 4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.06 Other Provisions

In employing workmen in the construction of public works by the state or any county or municipality, or by persons contracting with the state or any county or municipality, preference shall be given citizens of the United States, or those having declared their intention of becoming citizens. In each contract for the construction of public works a provision shall be inserted to the effect that, if the provisions of this section are not complied with, the contract shall be void.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have signed this Agreement. Counterparts have been delivered to OWNER and CONTRACTOR. All portions of the Contract Documents have been signed or have been identified by OWNER and CONTRACTOR or on their behalf.

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

OWNER:

CONTRACTOR

CITY OF RIVER HEIGHTS

By: **Jason Thompson**

By: _____

Title: **Mayor**

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:

City of River Heights

520 South 500 East

River Heights, Utah 84321

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.)

Agent for service of process:

NOTICE TO PROCEED

Date: _____

Project: **Lower Well Improvement Project**

OWNER: **City of River Heights, Utah**

Bidder:

Bidder's Address:

You are notified that the Contract Times under the above Contract will commence to run on _____, 2023. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with the Agreement, the date of Substantial Completion is _____, 2023 and the date of readiness for final payment is _____, 2023.

City of River Heights

Owner

Given by:

Authorized Signature

Title

Date

Copy to Engineer

PERFORMANCE BOND

CONTRACTOR *(name and address):*

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

OWNER *(name and address):*

**City of River Heights
520 South 500 East
River Heights, Utah 84321**

CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description *(name and location):*

LOWER WELL IMPROVEMENT PROJECT, RIVER HEIGHTS, UTAH

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

CONTRACTOR's Name and Corporate Seal *(seal)*

Surety's Name and Corporate Seal *(seal)*

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
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.

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;

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:

PAYMENT BOND

CONTRACTOR (name and address):

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

OWNER (name and address):

**City of River Heights
520 South 500 East
River Heights, Utah 84321**

CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description (name and location):

LOWER WELL IMPROVEMENT PROJECT, RIVER HEIGHTS, UTAH

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

CONTRACTOR's Name and Corporate Seal

Surety's Name and Corporate Seal

By: _____
Signature

By: _____
Signature (attach power of attorney)

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
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.

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 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 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.

18. Modifications to this Bond are as follows:

Change Order

No. _____

Date of Issuance: _____ Effective Date: _____

Project: LOWER WELL IMPROVEMENT PROJECT	Owner: RIVER HEIGHTS CITY	Owner's Contract No.:
Contract:		Date of Contract:
Contractor:		Engineer's Project No.:

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

Description:

Attachments (list documents supporting change):

CHANGE IN CONTRACT PRICE:

Original Contract Price:

\$ _____

[Increase] [Decrease] from previously approved
Change Orders No. _____ to No. _____:

\$ _____

Contract Price prior to this Change Order:

\$ _____

[Increase] [Decrease] of this Change Order:

\$ _____

Contract Price incorporating this Change Order:

\$ _____

CHANGE IN CONTRACT TIMES:

Original Contract Times: ☐ Working Days ☐ Calendar days

Substantial completion (days or date): _____

Ready for final payment (days or date): _____

[Increase] [Decrease] from previously approved Change Orders
No. _____ to No. _____:

Substantial completion (days): _____

Ready for final payment (days): _____

Contract Times prior to this Change Order:

Substantial completion (days or date): _____

Ready for final payment (days or date): _____

[Increase] [Decrease] of this Change Order:

Substantial completion (days or date): _____

Ready for final payment (days or date): _____

Contract Times with all approved Change Orders:

Substantial completion (days or date): _____

Ready for final payment (days or date): _____

RECOMMENDED:

By: _____

Engineer (Authorized Signature)

Date: _____

Approved by Funding Agency (if applicable):

ACCEPTED:

By: _____

Owner (Authorized Signature)

Date: _____

ACCEPTED:

By: _____

Contractor (Authorized

Date: _____

Date: _____

Change Order

Instructions

A. GENERAL INFORMATION

This document was developed to provide a uniform format for handling contract changes that affect Contract Price or Contract Times. Changes that have been initiated by a Work Change Directive must be incorporated into a subsequent Change Order if they affect Price or Times.

Changes that affect Contract Price or Contract Times should be promptly covered by a Change Order. The practice of accumulating Change Orders to reduce the administrative burden may lead to unnecessary disputes.

If Milestones have been listed in the Agreement, any effect of a Change Order thereon should be addressed.

For supplemental instructions and minor changes not involving a change in the Contract Price or Contract Times, a Field Order should be used.

B. COMPLETING THE CHANGE ORDER FORM

Engineer normally initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by Contractor, or requests from Owner, or both.

Once Engineer has completed and signed the form, all copies should be sent to Owner or Contractor for approval, depending on whether the Change Order is a true order to the Contractor or the formalization of a negotiated agreement for a previously performed change. After approval by one contracting party, all copies should be sent to the other party for approval. Engineer should make distribution of executed copies after approval by both parties.

If a change only applies to price or to times, cross out the part of the tabulation that does not apply.

Part 3

CONDITIONS OF THE CONTRACT

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by



Issued and Published Jointly by



These General Conditions have been prepared for use with the Agreement Between Owner and Contractor for Construction Contract (EJCDC® C-520, Stipulated Sum, or C-525, Cost-Plus, 2013 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other.

To prepare supplementary conditions that are coordinated with the General Conditions, use EJCDC's Guide to the Preparation of Supplementary Conditions (EJCDC® C-800, 2013 Edition). The full EJCDC Construction series of documents is discussed in the Commentary on the 2013 EJCDC Construction Documents (EJCDC® C-001, 2013 Edition).

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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 form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting 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, or both; 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, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (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. 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), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree 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 the 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. *Engineer*—The individual or entity named as such in the Agreement.
21. *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.
22. *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. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *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.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
27. *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.
28. *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.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
30. *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.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.
33. *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.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.
35. *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.
36. *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.
37. *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 furnished by Owner which are designated for the use of Contractor.

38. *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.
39. *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.
40. *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 thereof.
41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, 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.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *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.
48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:*
1. 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:*
1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:*
1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. 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 15.04).
- E. *Furnish, Install, Perform, Provide:*
1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean 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, shall mean 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, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words

“furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

- F. 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 Bonds and Evidence of Insurance*

- A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), 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 executed 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 specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial 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 for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall 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.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items 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 items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one 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 or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall 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.

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, shall mean 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, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, 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, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

- A. *Reporting Discrepancies:*
 - 1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents 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 Documents 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 shall 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 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 thereunder.
- 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 give written notice to Owner and Contractor 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 editions, 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 shall preclude 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 thirtieth 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 sixtieth day after the day of Bid opening or the thirtieth 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 shall be done at the Site prior to such date.

4.03 *Reference Points*

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

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall 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 shall 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 the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the 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. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall 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 utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 4. acts of war or terrorism.
- D. 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.
- E. Paragraph 8.03 governs 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.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times 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.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

- A. *Limitation on Use of Site and Other Areas:*
 - 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; 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 7.12, 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 at law; 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 shall conform to applicable Laws and Regulations.

- C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings*: The Supplementary Conditions identify:
 - 1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
 - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); 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 upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. 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; or
 - 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.

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 either:
 - 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; or
 - 2. is of such a nature as to require a change in the Drawings or Specifications; or
 - 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 the necessity of Owner's obtaining 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 above; 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. *Possible Price and Times Adjustments:*
 1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
 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; or
 - 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 as 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, or both, then any such adjustment shall 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, or both, 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.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
 - 1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
 - 2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. 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 in the Contract Documents, or was not shown or indicated 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), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.
- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; 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 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. *Possible Price and Times Adjustments:*
 - 1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, 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. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
 - 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;
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
 - d. 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, or both, then any such adjustment shall 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, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
 - 2. 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 Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. 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; or
 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, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, 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.
- H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

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

- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or 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.H shall obligate 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 shall obligate 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 all of Contractor's obligations under the Contract. These bonds shall 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 Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.
- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, 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 shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. 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.
- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

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. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements 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 and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements 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 and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- E. 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, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

- F. If either party does not purchase or maintain all of 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.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect 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 shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

- A. *Workers' Compensation:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
 - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
 - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).
 - 4. Foreign voluntary worker compensation (if applicable).
- B. *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:
 - 1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
 - 2. claims for damages insured by reasonably available personal injury liability coverage.
 - 3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- C. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
 - 1. Products and completed operations coverage:
 - a. Such insurance shall 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, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Broad form property damage coverage.
 4. Severability of interest.
 5. Underground, explosion, and collapse coverage.
 6. Personal injury coverage.
 7. 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); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
 8. 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.
- D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims 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 shall be written on an occurrence basis.
- E. *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. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.
- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial

Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

- I. *General provisions:* The policies of insurance required by this Paragraph 6.03 shall:
 - 1. include at least the specific coverages provided in this Article.
 - 2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
 - 3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
 - 4. remain in effect at least until final payment (and longer if expressly required in this Article) 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 Documents.
 - 5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed 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.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- B. 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.

6.05 *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 full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
 - 1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
 3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
 4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
 5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.
 11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this

Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed 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.

- C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- 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 notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance*: 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 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. 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 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 Subcontractors, all individuals or entities identified in the Supplementary Conditions as 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. None of the above waivers shall extend 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. 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:
 - 1. loss 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 perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner 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.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work 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 any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 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 6.05 shall 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, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

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

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

7.02 *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 at all times maintain good discipline and order at the Site.
- B. 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 shall 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.

7.03 *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 shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall 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 shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 *"Or Equals"*

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, 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 material or equipment, or items from other proposed suppliers under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

- a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it 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) it has a proven record of performance and availability of responsive service; and
 - 4) it is not objectionable to Owner.
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it 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 shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 Substitutes

- A. Unless the specification or description of an item of material or equipment 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 material or equipment under the circumstances described below. To the extent possible such requests shall 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 material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - a. shall 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 that specified, and
 - 3) be suited to the same use as that 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 that specified, and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the

Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

- E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities 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, Supplier, or other individual or entity 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 five days.
- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. 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, Suppliers, or other individuals or entities 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, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, 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, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.
- O. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
 - 2. shall create 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.

7.07 *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 a particular 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 shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the

performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

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

7.08 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. 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

7.09 *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.

7.10 *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. Except where otherwise expressly required by applicable Laws and Regulations, 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 shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give 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 notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

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

7.12 *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. 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.
- B. 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. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when 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.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
- D. 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.
- E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.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).

- F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- G. Contractor's duties and responsibilities for safety and protection shall 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.

7.13 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of 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 threatened 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 thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

- A. *Shop Drawing and Sample Submittal Requirements:*
 - 1. Before submitting a Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - c. determined and verified 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
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
 - 2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.
1. *Shop Drawings:*
 - a. Contractor shall submit the number of copies required in the Specifications.
 - b. Data shown on the Shop Drawings will 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.D.
 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.D.
 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. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- D. *Engineer's Review:*
1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 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 shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and

Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.

5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 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, shall 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, Sample, or other submittal shall 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.D.4.

E. *Resubmittal Procedures:*

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 submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

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 and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper 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.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

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. any inspection, test, or approval by others; or
 8. any correction of defective Work by Owner.
- D. 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 shall 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 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 performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury 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 shall 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.
- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

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

- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, 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.

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 at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner 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, or both. 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 shall 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. When applicable, any such equitable adjustment in Contract Price shall 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 is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- 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. 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 to 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.

- C. 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 to Contractor.
- D. 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 shall be that of the former Engineer.

9.03 *Furnish Data*

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

9.04 *Pay When Due*

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

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

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

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

9.07 *Change Orders*

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

9.08 *Inspections, Tests, and Approvals*

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

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

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

9.11 *Evidence of Financial Arrangements*

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

9.12 *Safety Programs*

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

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

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

10.02 *Visits to Site*

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

the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. 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 *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 Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

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

10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *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.

10.07 *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.

10.08 *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, shall 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 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 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *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 (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 - 1. *Change Orders:*
 - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
 - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not 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, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
 - 2. *Work Change Directives:* 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 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

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

11.02 *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. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes 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 shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate 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.

11.03 *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.

11.04 *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 shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 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 11.04.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 11.04.C).
- C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall 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 shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five 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 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.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 five 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 shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall 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 will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *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 shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. 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. The supporting data shall 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. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
 2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *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 that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the 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 11.02, (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 in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *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 shall be submitted 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; and
 - 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.
- 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 shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

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

13.01 Cost of the Work

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. 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 shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall 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. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, 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, shall 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 shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall 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, who 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 shall 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 for services specifically related to the Work.
5. Supplemental costs including 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, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - 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 property insurance established in accordance with Paragraph 6.05), 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 shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

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

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, 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. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 4. 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.
- 5. 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:* When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

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 on account of any of the foregoing will be valid.
- C. *Contingency Allowance*: Contractor agrees that a 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 on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:
 - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

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 will 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 therewith 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 shall be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 - 3. by manufacturers of equipment furnished under the Contract Documents;
 - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall 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 shall 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 notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall 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 special 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, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall 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 rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven 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 on account of 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. 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 shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and 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.
 2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.
- C. *Review of Applications:*
1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
 2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon

Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

- c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
- a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
- a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, 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 on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. the Contract Price has been reduced by Change Orders;
 - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
 - j. liquidated 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;
 - l. there are other items entitling 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 shall 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 shall be treated as an amount due as determined by Paragraph 15.01.C.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 seven days after the time of payment by Owner.

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall 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 seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 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 6.05 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 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; 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 Application and Acceptance:*
1. 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 ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall 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. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. 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. *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.
- D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- 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 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 terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then 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 other adjacent areas;
 - 2. correct such defective Work;
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, 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 therefrom.
- B. If 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 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 correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- C. 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.
- D. 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.
- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not 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, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall 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) ten 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) 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 seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When

exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

- A. Upon seven 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 on account of loss of anticipated overhead, profits, or revenue, 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 seven 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, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this Article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
 - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising 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; or
 - 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 Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall 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 or completion of the Contract or termination 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 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend and supplement Standard General Conditions (SC) and other provisions of the Contract Documents. All provisions which are not so amended or supplemented remain in full force and effect.

SC-1.01.A.20 **Replace** paragraph 1.01.A.20 *Engineer* for the Standard General Conditions in its entirety with the following:

20. Engineer– Forsgren Associates prepared the design and is the ENGINEER for this project.

SC-1.01.A.48 **Delete** the following definitions from paragraph SC-1.01.A.48

48. *“Work Change Directive”*

SC-1.01.A.49-53 **Add** the following paragraphs 1.01.A.49 thru 53:

49. *Specialist:* The term Specialist refers to a person, partnership, firm, or corporation of established reputation (or if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the Contract Documents, or otherwise performing Work required by the Contract Documents. Where Specifications require installation by a Specialist, that term shall also be deemed to mean either the manufacturer of the item, a person, a partnership, firm, or corporation licensed by the manufacturer, or a person, partnership, firm, or corporation who will perform the Work under the manufacturer's direct supervision.
50. *Drawing Clarification:* An answer from the Owner, in response to an inquiry from the Contractor, intended to make some requirement(s) of the drawings clearly understood. Drawing clarifications may be sketches, drawings, or in narrative form and will not change any requirements of the drawings. Responses to Contractor inquiries shall be as outlined in the paragraph "Request for Information" of these General Conditions.
51. *Non-Conformance Notice:* A notice issued by the Owner documenting that the work or some portion thereof has not been performed in accordance with the requirements of the Contract Documents. Payment shall not be made on any portion of the work for which a Non-Conformance Notice has been issued and the work not corrected to the satisfaction of the Owner. Upon receipt of a Non-Conformance Notice the Contractor shall provide a written Response to Non-Conformance Notice within five working days after receipt of the Notice. The Contractor's response shall detail either (a) why they believe that the work was performed in accordance with the Contract Documents or (b) what corrective action they intend to take, at their sole expense, to correct the non-conforming work. If the Contractor dispute issuance of the Notice the Owner has five working days in which to respond by either (a) withdrawing the Notice of Non-Conformance or (b) directing the Contractor to correct the work. Such determination by the Owner shall be final and conclusive of the matter. If directed to correct the work, the Contractor shall do so within five working days after receipt of such direction from the Owner, or such other time as may be agreed to with the Owner.
52. *Project Communications* – Routine written communications between the owner and the

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contractor shall be in letter, field memo, or fax format. Such communications shall not be identified as Request for Information nor shall they substitute for any other written requirement pursuant to the provisions of these contract documents.

53. *Requests for Information:* A request from the Contractor or one of its subcontractors, to the Owner, seeking an interpretation or a clarification of some requirement of the Contract Documents. The Contractor shall clearly and concisely set forth the issue for which it seeks clarification or interpretation and why a response is needed from the Owner. The Contractor shall, in written request, set forth its interpretation or understanding of the Contractor's requirements along with reasons why it has reached such an understanding. Responses from the Owner will not change any requirements of the Contract Documents. Responses to Contractor inquiries shall be as outlined in the paragraph "Requests for Information" of these General Conditions".

SC-1.01.A.40 Add the following to paragraph 1.01.A.40 *Substantial Completion* of the Standard General Conditions:

Substantial Completion is further defined as that degree of completion of the Project's operating facilities and systems sufficient to satisfy all of the following:

- a. provides the OWNER the full time, uninterrupted, continuous beneficial operation of the Work;
- b. all required functional, performance and acceptance or startup testing has been successfully demonstrated for all components, devices, equipment, and instrumentation and controls to the satisfaction of the ENGINEER in accordance with the requirements of the Specifications;
- c. all inspections required have been completed and identified conditions corrected.

Specific items of Work which shall be completed prior to declaration of Substantial Completion date included, but are not limited to, the following:

- a. conformance with all training services requirements.
- b. correction of all state, local, and other regulatory agency's *defective* Work lists.
- c. submittals have been received and approved by the ENGINEER including, but not necessarily limited to, the following:
 - (1) Record documents.
 - (2) Operation and maintenance manuals, including service and maintenance agreements.
 - (3) Equipment data forms.
 - (4) Manufacturers' certificates of proper installation.
 - (5) Factory test reports.
- d. all special accessories have been provided that are required to place each item of equipment in full operation. These special accessory items include, but are not limited to, specified spare parts, test equipment, adequate oil and grease or other lubrication, air filters, light bulbs, fuses, special tools, valve operators, and other expendable items required for startup and operation of the operating facilities or systems as a whole.
- e. all additional warranty or insurance coverage requirements have been provided.

SC-1.01.A.49 Add the following definition to section 1.01.A – *Defined Terms*:

49. *Incidental* – Work, Materials or Services required by the Contract which are not specifically identified as payment item(s). No specific measurement and/or payment will be made for incidental items. The cost thereof should be included in other items of work listed in the Bid Schedule.

SC-2.02.C Add the following to paragraph 2.02 *Copies of Documents* of the Standard General Conditions:

- C. The CONTRACTOR shall utilize one set of drawings for record document purposes. See Section 01 70 00 – EXECUTION AND CLOSEOUT PROCEDURES for project record document requirements.
- SC-3.03.C** **Add** the following paragraph to paragraph 3.03 – *Reporting and Resolving Discrepancies* of the Standard General Conditions:
- C. Precedence of Documents:
1. In resolving inconsistencies among two or more sections of the Contract Documents, precedence shall be given in the following order:
 - a. AGREEMENT
 - b. ADDENDA TO CONTRACT DOCUMENTS
 - c. SUPPLEMENTARY CONDITIONS
 - d. INSTRUCTIONS TO BIDDERS
 - e. STANDARD GENERAL CONDITIONS
 - f. SPECIFICATIONS
 - g. DRAWINGS
 - h. INVITATION TO BID
 2. Figure dimensions on DRAWINGS shall take precedence over scaled dimensions.
 3. Detailed DRAWINGS shall take precedence over more general DRAWINGS.
- SC-5.02.A.3** **Add** the following at the end of paragraph 5.02.A of the Standard General Conditions:
4. CONTRACTOR shall not enter upon nor use property not under OWNER control until appropriate easements have been executed and a copy is on file with the ENGINEER.
- SC-5.04.A** **Insert** the following to paragraph 5.04.A *Notice by Contractor* of the Standard General Conditions immediately after the word “promptly”:
- “and within 24 hours”
- SC-6.03.A.5** **Add** the following to paragraph 5.04.A *Workers’ Compensation* of the Standard General Conditions:
5. Claims for damages insured by customary personal injury liability coverage which are sustained:
 - a. by any person as a result of a claim directly or indirectly related to the employment of such person by CONTRACTOR, or
 - b. by any other person for any other reason;
- SC-6.03.G** **Replace** the phrase “OWNER and ENGINEER,” in paragraph 5.04.G of the Standard General Conditions with the following: “OWNER, ENGINEER, and Engineer’s Consultants,”

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SC-6.03.D Add the following to subsection 6.03 *Contractors Insurance* of the Standard General Conditions:

The limits of liability for the insurance required by paragraph 6.03 *Contractor's Insurance* of the Standard General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations.

Worker's compensation, disability benefits and other similar employee benefit acts, and damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees as provided in paragraphs 5.04.A and 5.04.B of the Standard General Conditions:

- State: Statutory.
- Federal (if any applicable): Statutory
- Employer's Liability or "Stop-Gap": \$1,000,000

Contractor's Liability Insurance under paragraphs 5.04.A and 5.04.B of the Standard General Conditions shall provide the following minimum limits and conditions:

- | | |
|--|--------------|
| • General Aggregate | \$2,000,000. |
| • Products-Completed Operations Aggregate | \$1,000,000. |
| • Personal Accident Injury (per person/organization with employment exclusion deleted) | \$1,000,000. |
| • Each Occurrence (bodily injury and property damage) | \$1,000,000. |
| • Fire Damage (any one fire) | \$1,000,000. |
| • Medical Expenses (any one person) | \$5,000. |

Property Damage liability insurance shall not include the explosion, collapse, and underground exclusions and shall provide broad form property damage coverage.

Automobile Liability under paragraph 5.04.A.6 of the Standard General Conditions shall provide for the following for owned,

Non-owned, rented, or hired vehicles:

- Combined Single Limit (bodily injury and property damage) \$1,000,000

SC-6.05.A. & B. Replace paragraphs 6.05.A and 6.05.B of the Standard General Conditions in their entirety with the following:

- A. CONTRACTOR shall purchase and maintain property insurance upon the Work at the site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in these Supplementary Conditions or required by Laws and Regulations). This insurance shall:
1. Include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, and Engineer's Consultants and any other persons or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;
 2. Be written on a Builder's Risk, special peril, or risk of loss policy form that shall at least include insurance for physical loss and damage to the Work, temporary buildings, falsework and Work in transit and shall insure against at least the following perils: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and other such perils as may be specifically required by the Supplementary Conditions.

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3. Include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of ENGINEER's, Engineer's Consultants, Consultants, and specialists);
 4. Cover materials and equipment in transit for incorporation in the Work or stored at the site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application Payment recommended by ENGINEER; and
 5. Be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR and ENGINEER with thirty days written notice to each other additional insured to whom a certificate of insurance has been issued.
- B. The policies of insurance required to be purchased and maintained by CONTRACTOR in accordance with this paragraph 6.05 shall comply with the requirements of 6.07 *Receipt and Application of Insurance Proceeds* and 6.05.D *Partial Occupancy or Use by Owner*.

SC-6.05.D **Add** the following to paragraph 6.05.D *Partial Occupancy or Use by Owner* of the Standard General Conditions:

The property insurance shall contain no partial occupancy restriction for utilization of the Project by the OWNER for the purpose intended.

SC-6.07 **Replace** paragraph 6.07 *Receipt and Application of Insurance Proceeds* of the Standard General Conditions in its entirety with the following:

6.07 Receipt and Application of Insurance Proceeds

- A. Any insured loss under the policies of insurance required by Paragraphs 6.03 and 6.05 will be adjusted with CONTRACTOR and made payable to CONTRACTOR as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and or paragraph 6.07.B. CONTRACTOR shall deposit in a separate account any money so received, and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.
- B. CONTRACTOR as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to CONTRACTOR's exercise of this power. If such objection be made, CONTRACTOR as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, CONTRACTOR as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, CONTRACTOR as fiduciary shall give bond for the proper performance of such duties.

SC-7.01.B **Add** the following sentence to the end of paragraph 7.01.B of the Standard General Conditions:

If during the performance of the Work, the Owner determines that the CONTRACTOR has provided an incompetent resident superintendent, the OWNER shall notify the CONTRACTOR in writing, and the CONTRACTOR shall replace said resident superintendent within ten days with a competent resident superintendent.

SC-7.02.B **Replace** paragraph 7.02.B of the Standard General Conditions in its entirety with the following:

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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 shall be performed during regular working hours, Monday through Friday. Regular working hours consist of up to 10 working hours within an 11-hour period between 7:00 a.m. and 6:00 p.m. 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, given after prior written notice to Engineer.

SC-7.16.E.2 **Replace** paragraph 7.16.E.2 of the Standard General Conditions in its entirety with the following:

2. ENGINEER will record time required by ENGINEER or Engineer's Consultants for submittal review occasioned by CONTRACTOR's resubmissions, in excess of one resubmission, of a required submittal, caused by unverified, unchecked or unreviewed, incomplete, inaccurate or erroneous, or nonconforming submittals. Upon receipt of Engineer's accounting of time and costs, CONTRACTOR will reimburse OWNER for charges of ENGINEER or Engineer's Consultants review for excessive resubmissions through setoffs from the recommended OWNER payments to CONTRACTOR as established in paragraph 15.01.E *Reductions in Payment by Owner* of the Standard General Conditions.

SC-7.18.A **Replace** paragraph 7.18.A of the Standard General Conditions, in its entirety, with the following:

- A. To the fullest extent permitted by Law or Regulation, the CONTRACTOR shall indemnify, hold harmless, and defend the OWNER and its agents, architects, ENGINEER, Consultants, officers, agents, servants, employees, and each of them (hereinafter individually and collectively, the "Indemnitees") from and against any and all liability, claims, damages, injury of any kind or nature whatsoever (including death) and cost of defense to any person or property (including, without limitation, claims for injury to or death to any employee of CONTRACTOR, Subcontractor or Supplier) which result from, arise out of, or occur in connection with the execution of the Work, whether or not such claims are based upon actual or alleged active or passive negligence or wrongdoing of any Indemnities, except that the CONTRACTOR shall not be required to indemnify an Indemnities against a claim or loss that is the result of the Indemnities's sole negligence or willful misconduct. CONTRACTOR shall indemnify all Indemnities from and against all loss, cost, expense, liability, damage or injury, including legal fees, that Indemnities may directly or indirectly sustain suffer or incur as a result thereof, and the CONTRACTOR agrees to and does hereby assume on behalf of Indemnities the defense of any action at law or in equity which may be brought against Indemnities by reason of such claim, and will pay on behalf of Indemnities, upon their demand, the amount of any judgment that may be entered against Indemnities or any of them in any such action. In the event that any such claims, loss, costs, expense, liability, damage or injury arise or are made, asserted or threatened against an Indemnities for which the insurer of CONTRACTOR does not admit coverage, or if the OWNER deems such coverage to be inadequate, the OWNER shall have the right to withhold from any payments due or to become due to the CONTRACTOR an amount sufficient to protect Indemnities from such claims, loss costs, expense, liability, damage or injury, including legal fees. The CONTRACTOR will require any and all subcontractors and supplier to conform with the provisions of this clause prior to commencing any work and agrees to insure this clause in conformity with Article 5. Bonds and Insurance, herein.

SC-7.18.D., E. & F. **Add** the following after paragraph 7.18.C of the Standard General Conditions:

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- D. For suits, actions, legal or administrative proceedings, claims, demands, damages, losses, penalties, fines, costs, and expenses caused by or resulting from the concurrent negligence of the OWNER and the ENGINEER, or the OWNER's or ENGINEER's agents or employees, and the CONTRACTOR or the CONTRACTOR's agents or employees, in situations where liability for damages arises from claims of bodily injury to persons or damage to property, the preceding indemnity provision shall be valid and enforceable only to extent of the CONTRACTOR's negligence.
- E. CONTRACTOR acknowledges that by entering into a contract with OWNER, CONTRACTOR has mutually negotiated the above indemnity provision with the OWNER.
- F. CONTRACTOR's indemnity and defense obligations shall survive the termination or completion of the Work and remain in full force and effect until satisfied in full.

SC-8.01.D Replace paragraph 8.01.D of the Standard General Conditions in its entirety with the following:

- D. Other work anticipated to be performed at the site by others, prior to, during, and in sequence with the scheduled performance of the Work under these Contract Documents is described in Section 01 31 00 – COORDINATION AND SEQUENCING.

SC-9.02.B Add the following to paragraph 9.02 *Replacement of Engineer* of the Standard General Conditions:

- B. In such an event, work on the project shall temporarily cease until a new ENGINEER is appointed and on-site.

SC-10.03.B., C., D. & E. Add the following to paragraph 10.03 *Project Representative* of the Standard General Conditions:

- B. The Resident Project Representative (RPR) for the Project will be furnished by ENGINEER.
- C. The responsibilities and authority of the Resident Project Representative, assistants and other field staff are limited to those of ENGINEER in paragraph 10.08 *Limitations on Engineer's Authority and Responsibilities* of the Standard General Conditions and to those delegated to the RPR by the ENGINEER's project manager.
- D. The RPR will be prohibited from:
 - 1. Undertaking any of the responsibilities of CONTRACTOR, Subcontractors or CONTRACTOR's superintendent; or
 - 2. Accept Submittals from anyone other than CONTRACTOR.
 - 3. Exceeding the authority delegated by the ENGINEER's project manager.
- E. The following are examples of responsibilities and authority typically delegated to the RPR:
 - 1. Schedules: Review and monitor the Progress Schedule, Schedule of Submittals and Schedule of Values prepared by CONTRACTOR and consult with ENGINEER concerning acceptability.
 - 2. Conferences and Meetings: Conduct or attend meetings with CONTRACTOR, such as preconstruction conferences, progress meetings, Work conferences and other Project related meetings.
 - 3. Liaison:
 - a. serve as ENGINEER's liaison with CONTRACTOR, working principally through CONTRACTOR's superintendent and assist in understanding the intent of the Contract Documents;
 - b. assist ENGINEER in serving as OWNER's liaison with CONTRACTOR when

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- CONTRACTOR's operations affect Owner's onsite operations;
- c. obtain from OWNER and CONTRACTOR additional details or information when required for proper execution of the Work.
- 4. Submittals:
 - a. receive Submittals at the site, from CONTRACTOR.
 - b. advise ENGINEER and CONTRACTOR of the commencement of any Submittal has not been approved by ENGINEER.
- 5. Review of Work, Rejection of *defective* Work, Inspection and Tests:
 - a. conduct onsite observations of the Work in progress to assist ENGINEER in determining if the Work is in general proceeding in accordance with the Contract Documents;
 - b. inform ENGINEER and CONTRACTOR when whenever RPR believes that any Work is unsatisfactory, faulty or *defective*, or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test, or approval required to be made
 - c. advise ENGINEER and CONTRACTOR whenever RPR believes that any Work will not produce a completed Project that conforms generally to the Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or whenever RPR believes Work should be uncovered for observation, or requires special testing, inspection, or approval
 - d. monitor that tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that CONTRACTOR maintains adequate records thereof
 - e. observe, record and report to ENGINEER appropriate details relative to the test procedures and startups
 - f. accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections and report to ENGINEER.
- 6. Records:
 - a. maintain at the site files for correspondence, conference records, Submittals including Shop Drawings and Samples, reproductions of original Contract Documents including all Addenda, the signed Agreement, Work Change Directives, Change Orders, Field Orders, additional Drawings issued after the Effective Date of the Agreement, Engineer's written clarifications and interpretations, progress reports, and other Project related documents;
 - b. keep a diary or log book recording pertinent site conditions, activities, decision and events.
- 7. Payment Requests: Review applications for payment with CONTRACTOR.
- 8. Certificates, Maintenance, and Operation Manuals, Record Documents, and Site Records: During the course of the Work, monitor that these documents and other data required to be assembled, maintained, and furnished by CONTRACTOR are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to ENGINEER for review and forwarding to OWNER prior to final payment for the Work.
- 9. Substantial Completion:
 - a. conduct an inspection in the company of ENGINEER, OWNER, and CONTRACTOR and prepare a list of items to be completed or corrected;
 - b. submit to ENGINEER a list of observed items requiring completion or correction.
- 10. Completion:
 - a. conduct final inspection in the company of ENGINEER, OWNER, and CONTRACTOR;
 - b. notify CONTRACTOR and ENGINEER in writing of all particulars in which this inspection reveals that Work is incomplete or *defective*;
 - c. observe that all items on final list have been completed, corrected, or accepted by OWNER and make recommendations to ENGINEER concerning acceptance.

SC-10.10 **Add** the following paragraph at the end of Article 10 – ENGINEER’S STATUS DURING CONSTRUCTION of the Standard General Conditions:

10.10

Requests for Information

- A. In the event that the Contractor or subcontractor, at any tier, determines that some portion of the drawings, specifications, or other Contract Documents requires clarification or interpretation by the Owner, the Contractor shall submit a Request for Information in writing to the Owner. Requests for Information may only be submitted by the Contractor and shall only be submitted on the Contractor’s standard Request for Information Forms. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the Owner. In the Request for Information, the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.
- B. The Owner acknowledges that this is a complex project. Based upon the Owner’s past experience with projects of similar complexity, the Owner anticipates that there will probably be some Requests for Information on this project.
- C. The Owner will review all Requests for Information to determine whether they are Requests for Information within the meaning of this term. If the Owner determines that the document is not a Request for Information, it may be returned to the Contractor, unreviewed as to content, for resubmittal on the proper form and in the proper manner.
- D. Responses to Requests for Information shall be issued within five working days of receipt of the request from the Contractor unless the Owner determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Owner, the Owner will, within five working days of receipt of the request, notify the Contractor of the anticipated response time. If the Contractor submits a Request for Information on an activity with five working days or less of float on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Owner to respond to the request provided that the Owner responds within the five working days set forth above.
- E. Responses from the Owner will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a Request for Information will cause a change to the requirements of the Contract Document, the Contractor shall immediately give written notice to the Owner stating that the Contractor considers the response to be a Change Order. Failure to give such written notice immediately shall waive the Contractor’s right to seek additional time or cost under the Changes article of these General Conditions.

SC-13.01.E **Add** a sentence to the end of paragraph 13.01.E *Documentation*: of the Standard General Conditions as follows:

Supporting data shall include but not be limited to daily submissions of timesheets indicating hours and trades worked, equipment and time equipment was employed, and materials expended.

SC-13.03.E **Replace** paragraph 13.03.E of the Standard General Conditions in its entirety the following:

- E. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:
 - 1. If the total cost of a particular item of Unit Price Work amounts to 15% or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by CONTRACTOR differs by more than 25% from the estimated quantity of such item indicated in the Agreement; and

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2. If there is no corresponding adjustment with respect to any other item of Work
3. If CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof; or if Owner believes that the quantity variation entitles OWNER to an adjustment in the unit price, either OWNER or CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 11 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

SC-14.02.D Add the following at the end of paragraph 14.02.D of the Standard General Conditions:

See paragraphs 14.02.G and 14.02.H.

SC-14.02.G., & H. Add the following new paragraphs immediately after paragraph 14.02.F of the Standard General Conditions:

- G. Tests required by Contract Documents to be performed by an independent laboratory for CONTRACTOR shall be made by a laboratory licensed or certified in accordance with Laws and Regulations and applicable state and local statutes. In the event state license or certification is not required, meet following applicable requirements.
 1. "Recommended Requirements for Independent Laboratory Qualification," published by the American Council of Independent Laboratories.
 2. Basic requirements of ASTM E329, "Standard General of Recommended Practice for Inspection and Testing agencies for Concrete and Steel as Used in Construction" as applicable.
 3. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.
- H. The CONTRACTOR shall establish an inspection program and a testing plan acceptable to the ENGINEER and shall maintain complete inspection and testing records available to ENGINEER.

SC-15.01.B.1 In the first sentence of paragraph 15.01.B.1 of the Standard General Conditions, after the phrase "At least 20 days before" **delete** the phrase "the date established in the Agreement for".

SC-15.01.C.1 In paragraph 15.01.C.1 of the Standard General Conditions, **delete** the word "Ten" and **insert** the word "Twenty-five" in its place.

SC-15.01.E.1.e **Replace** paragraph 15.01.E.1.e of the Standard General Conditions, in its entirety, with the following:

- e. OWNER compensation to ENGINEER at an estimated average rate of \$100 per each extra personnel hour for labor plus expenses because of the following CONTRACTOR-caused events:
 - Retesting *defective* Work;
 - Return visits to manufacturing facilities for shop testing or retesting;
 - Shop Drawing review in excess of two reviews by ENGINEER for substantially the same submittal;
 - Evaluation and implementation of CONTRACTOR-proposed substitutes or "or equal" items of equipment and in making changes to Contract Documents occasioned thereby;

SC-15.06.A.2.f Add the following new paragraphs immediately after paragraph 15.06.A.2.e:

SC-15.07.A In paragraph 15.07.A of the Standard General Conditions, **delete** the word "appearing" and **insert** the word "discovered" in its place.

**SECTION 00 73 14
SUPPLEMENTARY CONDITIONS**

SC-15.08.A. **Revise** the first sentence of paragraph "A" to read as follows:

"A. If within two years after the date of Substantial Completion....."

SC-16.04.A In the first sentence of paragraph 16.04.A of the Standard General Conditions, and after the words "OWNER fails for", **delete** the phrase "30" and **insert** the phrase "60".

SC-16.04.B In the first sentence of paragraph 16.04.B of the Standard General Conditions, and after the words "OWNER fails for", **delete** the phrase "30" and **insert** the phrase "60".

SC-18.09 **Add** the following paragraph at the end of ARTICLE 18 – MISCELLANEOUS of the Standard General Conditions:

18.09 If any provision of portion of the Contract Documents is held unconstitutional, invalid or otherwise unenforceable the rest of the Contract Documents shall remain in full force and effect and shall in no way be affected, impaired or invalidated.

In such an event, the Owner reserves the right at it sole option to declare the Contract void and to enter into negotiations with Contractor for a new Contract.

END OF SUPPLEMENTARY CONDITIONS

Part 4

TECHNICAL SPECIFICATIONS

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SCOPE OF SERVICES FURNISHED

- A. The CONTRACTOR shall furnish all materials, equipment, labor, tools, supplies, transportation, and appurtenances for construction of the Project to be completed as shown and specified in these CONTRACT DOCUMENTS. These CONTRACT DOCUMENTS include provisions that will be required for construction of the Project.
- B. The CONTRACTOR shall be responsible for the performance of all labor, work, or other operations required for the fulfillment of the Contract in strict accordance with these specifications, drawings, Utah Chapter APWA standards and specifications, River Heights City Standards and Specifications, and other CONTRACT DOCUMENTS as herein before defined, all of which are made a part hereof, and including such detail sketches as may be furnished by the ENGINEER from time to time during construction in explanation of said CONTRACT DOCUMENTS. The work shall be complete, and all work, materials, and services not expressly shown or called for in the CONTRACT DOCUMENTS which may be necessary for the complete and proper construction of the work in good faith shall be performed, furnished, and installed by the CONTRACTOR as though originally so specified or shown, at no increase in cost to the OWNER.
- C. The OWNER will provide land and rights-of-way for the work specified in this contract. All required permits for construction will be supplied by the OWNER and ENGINEER. The CONTRACTOR shall not enter on or occupy with laborers, tools, equipment, or material any ground outside the property and rights-of-way provided by the OWNER unless provided otherwise in writing by the OWNER. Other contractors, employees, or agents of the OWNER/ENGINEER may enter the Project site and premises used by the CONTRACTOR for business purposes.

1.2 DESCRIPTION OF WORK

- A. The work to be performed under this Contract is summarized below and is discussed in further detail in subsequent sections of the CONTRACT DOCUMENTS.
- B. Work to be performed generally includes demolition of the existing facilities; site excavation grading and preparation; construction of the Well Control Building; raise wellhead; appurtenant pipes, valves, equipment, pipeline connection to 400 East; electrical systems and components, telemetry; pump-to-waste assembly; electrical transformer concrete pad; safety handrail; site grading and surface improvements.

1.3 WATER AND POWER

- A. Water required for the Project must be obtained by the CONTRACTOR. The CONTRACTOR must ensure that the water used for construction, filling, and flushing meets potable water standards, and shall provide the ENGINEER with adequate documentation of the source water quality from his subcontractor.
- B. The CONTRACTOR shall provide all necessary, transportation, equipment, and conveyance facilities to provide for quantity and quality of water required to complete the project. Costs for water conveyance facilities, temporary storage reservoirs, or transportation to the WORK site shall be borne by the CONTRACTOR. This includes all necessary piping and components, but only at such locations and in a manner approved by the ENGINEER. Before final acceptance of the wells, all temporary connections and piping installed by the CONTRACTOR shall be removed in a manner satisfactory to the OWNER.

SECTION 01 01 00
SUMMARY OF WORK

- C. The CONTRACTOR shall provide at his own expense all power required for his operations under the contract.

1.4 PROJECT SCHEDULE

- A. The CONTRACTOR shall provide a work schedule, including working hours, within seven (7) days of his Notice of Award. Project schedule will be provided in accordance with the requirements described in the General Conditions Articles 2 and 6 and the schedule will be provided in **GANTT Chart format** with the critical path and associated tasks clearly identified.

1.5 WORKING HOURS

- A. The CONTRACTOR shall work on this project in a steady and diligent manner. The CONTRACTOR shall, during all work periods, provide an adequate crew of suitably qualified personnel to prevent unnecessary delays in project completion.

1.6 SITE ACCESS

- A. The Project site can be accessed via existing asphalt roads. Contractor shall not utilize adjacent property for storage or access of equipment, tools, machinery, or any other item related to construction of the project.

~ END OF SECTION ~

CONTRACTOR'S USE OF PREMISES

1.1 PROJECT LOCATION

- A. The work covered by this Contract will be performed at the locations shown on the drawings.

1.2 ACCESS TO THE SITE

- A. Access to the site shall be from public roads and rights-of-way.
- B. The CONTRACTOR shall take all necessary steps and actions to protect the rights and property of private landowners, and all properties, features, and/or improvements on adjacent properties.

1.3 WORKING HOURS AND NOISE ATTENUATION

- A. Work performed under this Contract shall be conducted in accordance with River Heights City ordinances.

END OF SECTION

MEASUREMENT & PAYMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Bid item description
- B. Basis for progress payment
- C. Schedule of values
- D. Applications for payments
- E. Payment for mobilization
- F. Rejected or unused products
- G. Partial payment for stored materials and equipment
- H. Payment for CONTRACTOR installation of owner furnished items

1.2 BID ITEM DESCRIPTION

- A. Quantities and measurements indicated in contract documents that are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Engineer shall determine payment.
- B. Payment for all Bid Items, whether lump sum or unit price, shall include all compensation to be received by CONTRACTOR for furnishing all tools, equipment, dewatering, supplies, and manufactured articles, and for all labor operations, and incidentals appurtenant to the items of Work being described, as necessary to complete the various items of the Work all in accordance with the requirements of the Contract Documents, including all cost of compliance with the regulations or permits required of public agencies having jurisdiction, including safety and health requirements of the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor.
- C. No separate payment will be made for any item that is not specifically set forth in the Bid Form/Schedule, and all costs therefore shall be included in the Total Contract Price named in the Bid Form/Schedule.
- D. Payment for all Work shown or specified in the Contract Documents is included in the Total Contract Price.
- E. Payment for general construction will be made at the lump sum price where named in the Bid Form/Schedule under Base Bid plus any additive/deductive alternates, which price shall constitute full compensation for completion of all mobilization, demobilization, insurance, supervision, planning, design, engineering fees, furnishing and construction of all facilities, complete as defined within these Contract Documents, and all taxes.
- F. When the accepted quantities of work vary from the quantities in the bid schedule, the CONTRACTOR shall accept as payment in full, so far as contract items are concerned, payment at a calculated unit price for the work completed. The OWNER reserves the right to add or to subtract from quantities listed in the Bid Schedule in order to match the total Bid with the budgeted money available, or to meet demands or requirements dictated by field conditions.
- G. It is the responsibility of the CONTRACTOR to fully inform himself regarding all Federal, State and local tax laws, rules or regulations furnished under this Contract, including all exemption provisions and procedures.

**SECTION 01 01 90
MEASUREMENT & PAYMENT**

- H. The Total Contract Price for the Work under this Contract is inclusive of any taxes which are imposed by any governing agency to which the Work hereunder is subject. CONTRACTOR is solely responsible for assuring that all the applicable taxes are included in his bid.

1.3 BASIS FOR PROGRESS PAYMENT

- A. Progress payments shall be based on the activities defined in the approved Progress Schedule and the approved Schedule of Values, and on the percentage of completion of each activity.
- B. In general, measurement will not normally be required for lump sum Bid Items. In general, measurement will be required for items on which the CONTRACTOR is to be compensated on a time and materials basis (e.g., unit price Bid Items, allowance Bid Items, and force account work).
- C. No Progress Payments shall be made until an acceptable Progress Schedule, and an acceptable Schedule of Values, has been achieved. See Section 01 32 00 – “Progress Schedule.”

1.4 SCHEDULE OF VALUES

- A. See General Conditions Article 14 – “Payment to CONTRACTOR and Completion” for details for Schedule of Values. ‘
- B. Submit preliminary Schedule of Values in duplicate within 10 days after the effective date established in Notice to Proceed.
- C. The schedule of values shall:
1. Address the entire Work and Total Contract Price.
 2. Be generated from the Progress Schedule and be provided in a spreadsheet form compatible with the most recent version of Microsoft Excel.
 3. Be submitted for review in an electronic media version (e.g. email or compact disc).
 4. Include sub-schedules for each Bid Item.
 5. Include within each line item, direct proportional amount of CONTRACTOR’s overhead and profit.
 6. Revise schedule to list approved Change Orders, with each Application for Payment.
- D. Schedule of Values shall not be “unbalanced”. Examples include, but are not limited to, the following:
1. Value for mobilization shall not exceed 5% of total contract value.
 2. Value for start-up, commissioning, and demobilization shall not be less than 5% of total contract value.

1.5 APPLICATIONS FOR PAYMENTS

- A. See Section 01 32 00 – “Progress Schedule” and General Conditions Article 14.02 – “Progress Payments.”
- B. CONTRACTOR shall:
1. Submit applications for progress payments on a monthly basis.
 2. Update monthly the Progress Schedule, Schedule of Values, and Schedule of Estimated Progress Payments. These shall be submitted simultaneously with the Applications for Progress Payments.
 3. Note the review will not proceed until all of these items have been submitted.

- C. Application for Payment shall be generated by downloading cost and percentage complete data for the activities from the Progress Schedule to the Schedule of Values and such other spreadsheets (e.g., Cost Summaries) as are needed.
 - 1. Identify each activity in the Progress Schedule to which cost value has been allocated and for each indicate:
 - a. Its value at completion (i.e., at 100% percent complete)
 - b. The current estimate of percent complete
 - c. The value completed during the last period and cumulatively, for the Project to date.
 - 2. Provide Cost Summaries for each sub-schedule identified in the Schedule of Values.
- D. Provide Substantiating Data with cover letter identifying:
 - 1. Project
 - 2. Application for number and date
 - 3. Detailed list of enclosures
 - 4. For stored products with item number and identification on application, description of specific material, and proof of insurance coverage for offsite stored products.
 - 5. "Certified" payroll where required
- E. Application for Progress Payment shall be **MONTHLY**. Submit **two (2) paper copies and one electronic (spreadsheet) copy via email** of the Application for Progress Payment, each paper copy including the Substantiating Data and cover letter, signed by responsible officer of CONTRACTOR.
- F. ENGINEER will check Application for Payment for reasonableness and accuracy. If Application is not acceptable to ENGINEER, Application will be returned to CONTRACTOR for revising and resubmission. Once application is acceptable to ENGINEER, ENGINEER will transmit application to OWNER with recommendation for payment.

1.6 PAYMENT FOR MOBILIZATION

- A. Limit amounts included under Mobilizations to the following items:
 - 1. Moving on site any equipment required for first month's operations.
 - 2. Installing temporary construction power and wiring.
 - 3. Establishing fire protection system.
 - 4. Developing construction water supply.
 - 5. Providing field office trailers for CONTRACTOR.
 - 6. Providing field office trailer for ENGINEER
 - 7. Providing on-site sanitary facilities and potable water facilities as specified.
 - 8. Arranging for and erection of CONTRACTOR's work and storage yard.
 - 9. Subcontractor insurance and bonds.
 - 10. Obtaining all required permits, licenses and fees.
 - 11. Developing construction schedule.
 - 12. Provide and erect the project sign, if required.
 - 13. CONTRACTOR bonds and insurance.

1.7 REJECTED OR UNUSED PRODUCTS

- A. Payment will not be made for the following:
 - 1. Loading, hauling, and disposing of rejected products or materials.
 - 2. Quantities of material wasted or disposed of in a manner not called for under Contract Documents.
 - 3. Rejected loads of material, including material rejected after it has been placed by reason of failure of CONTRACTOR to conform to provisions of Contract Documents.
 - 4. Equipment not unloaded from transporting vehicle.
 - 5. Defective Work not accepted by OWNER and cost to remedy.
 - 6. Material remaining on hand after completion of Work.

**SECTION 01 01 90
MEASUREMENT & PAYMENT**

7. Equipment stored or installed without approved Shop Drawings.
8. Equipment or materials stored or installed not in conformance with approved Shop Drawings.

1.8 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

- A. Partial payment will be made for materials and equipment delivered to the Project site for incorporation into the Work and not installed if and only if: (a) Shop Drawings are approved by ENGINEER, (b) the materials and equipment are stored as recommended by the manufacturer, and (c) CONTRACTOR provides certificate of insurance for said materials. The amount of partial payment shall be based not on actual invoice amounts but on an approved % value the equipment represents of the scheduled item and not to exceed the actual invoice amount.
- B. Final payment will be made only for products incorporated in Work. Remaining products, for which partial payments have been made, shall revert to CONTRACTOR unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

1.9 PAYMENT FOR CONTRACTOR INSTALLATION OF OWNER FURNISHED ITEMS

- A. No separate payment will be made for such activities as these activities are part of the Work and included in the Total Contract Price for the Work.

<u>PART 2 - PRODUCTS</u>	NOT USED
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<u>PART 3 - EXECUTION</u>	NOT USED
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END OF SECTION

ABBREVIATIONS AND REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

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 acronyms or abbreviations only. As a guide to the user of these Specifications, the following acronyms or abbreviations, which may appear herein, shall have the meanings indicated below.

1.2 DEFINITIONS OF ABBREVIATIONS AND ACRONYMS

AAR	Association of American Railroads
AASHTO	American Association of the State Highway and Transportation Officials
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGA	American Gas Association
AGC	Associated General Contractors
AGMA	American Gear Manufacturers Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute, Inc.
APWA	American Public Works Association
ARI	Air Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASQC	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
BLM	Bureau of Land Management (U.S. Department of Interior)
CDA	Copper Development Association
CEMA	Conveyor Equipment Manufacturer's Association
CGA	Compressed Gas Association
CFR	Code of Federal Regulations
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CS	Commercial Standard of NBS (U.S. Dept. of Commerce)
CTI	Cooling Tower Institute
DIP	Ductile Iron Pipe
EIA	Electronic Industries Association
EPA	U. S. Environmental Protection Agency
ETL	Electrical Test Laboratories
FEMA	Federal Emergency Management Administration
FERC	Federal Energy Regulatory Commission
FS	Forest Service (U.S. Department of Agriculture)

SECTION 01 09 00
ABBREVIATIONS & REFERENCES

FWS	Fish and Wildlife Service
GI	Galvanized Iron
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
ID	Inside Diameter
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IMC	International Mechanical Code
IME	Institute of Makers of Explosives
IPC	International Plumbing Code
ISA	Instrument Society of America
ISO	International Organization for Standardization
MBMA	Metal Building Manufacturer's Association
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFGC	National Fuel Gas Code
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NRCS	Natural Resources Conservation Service (U.S. Department of Agriculture) (formerly SCS)
NSF	National Sanitation Foundation
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PDI	Plumbing and Drainage Institute
PE	Polyethylene
PVC	Polyvinyl Chloride
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SSPWC	Standard Specification for Public Works Construction
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
UPRR	Union Pacific Railroad
USDARD	Rural Development (U.S. Department of Agriculture) (formerly Farmers Home Administration)
WCRSI	Western Concrete Reinforcing Steel Institute
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association.

PART 2 - REFERENCED WORKS, CODES AND STANDARDS

Whenever references to specifications, codes, standards and other publications are made to these Specifications, the following rules shall apply:

2.1 TITLES OF SECTIONS AND PARAGRAPHS

Titles of sections and/or paragraphs shown in these Specifications are for convenience of reference only, and do not form a part of the Specification.

2.2 APPLICABLE PUBLICATIONS

Whenever references in these specifications are made to published specifications, codes, standards, or other requirements, it shall be understood that unless a date is specified, only the latest edition of these specifications, codes, and/or standards 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.

2.3 SPECIALISTS AND SPECIAL ASSIGNMENTS

In certain instances, specification text 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 direction shall be recognized as special requirements and is 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" and qualified for the assignment of the work. Nevertheless, the final responsibility for fulfilling this assignment remains with the Contractor.

2.4 BUILDING CODES

Reference herein to "Building Code" shall mean the Uniform Building Code issued by the International Conference of Building Officials (ICBO). 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.

2.5 OSHA

OSHA REGULATIONS - 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.

OSHA STANDARDS - References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards of the U.S. Code of Federal Regulations, including all changes and amendments thereto.

2.6 DOT STANDARDS/SPECIFICATIONS

References to "State DOT Specifications" or "State DOT Requirements" shall mean the Specifications for Excavation on State Highway Right-of-Way and/or Standard Specifications for Road and Bridge Construction, including all amendments thereto, issued by the State agency responsible for highways wherein the Contract is located and any other written requirements or provisions issued by that agency which are contained in these Contract Documents.

2.7 FEDERAL PIPELINE SAFETY STANDARDS

Reference to "Federal Pipeline Safety Standards" shall mean Title 29, Parts 191 and 192, Federal Pipeline Safety Minimum Standards, U.S. Code of Federal Regulations including all changes and amendments thereto.

2.8 STATE GAS PIPELINE SAFETY STANDARDS

SECTION 01 09 00
ABBREVIATIONS & REFERENCES

References to "State Gas Pipeline Safety Standards" shall mean the appropriate section/s of the legal code or regulations adopted in the State wherein the work is located, including all changes and amendments thereto.

PART 3 - STANDARDS IMPOSED BY OTHER AGENCIES OR ORGANIZATIONS

3.1 PROPERTY BELONGING TO OTHER AGENCIES OR ORGANIZATIONS

Construction may occur on property owned or administered by agencies or organizations other than the Owner, such as federal and/or state departments of transportation, the U. S. Forest Service, the U. S. Bureau of Land Management, the U.S. Fish and Wildlife, counties, canal companies, irrigation companies, utility companies, other federal and state agencies, municipal governments, etc. Work which is to take place on such property may be required to be in accordance with special construction requirements of that agency or organization as well as these specifications.

3.2 ADDITIONAL INFORMATION AND SPECIFICATIONS

Information will be provided on the plans to indicate areas of the Work which fall on property owned or administered by agencies and organizations other than the Owner. Specifications from agencies which are affected by the work will be provided in the Appendix to the Contract Documents. Those specifications provided in the Appendix shall be considered part of the Contract Documents and the Contractor shall include sufficient compensation in its bid to cover the work required for compliance thereto.

PART 4 - CONFLICTS

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 the Engineer for clarification and directions prior to ordering or providing any materials or labor required therefrom. The Contractor shall assume the most stringent requirements apply when preparing bids for this Contract.

END OF SECTION

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 contract 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. 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.

SECTION 01 10 90
REFERENCE STANDARDS

- 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 the 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 ENGINEER'S REQUIREMENTS. CONTRACTOR's work shall conform to C.O.E. 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, 2017 Edition and Manual of Standard Plans, 2017 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 8205 Old Main Hill, Logan UT 84322-8205. 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, 2017 Edition and Manual of Standard Plans, 2017 Edition published by the Utah Chapter of the American Public Works Association, shall be resolved with the Owner and Engineer in favor of the technical specifications, drawing, and provisions contained in the Contract form or Contract Documents.

END OF SECTION

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 his work in conjunction with these other organizations to minimize mutual interference.
- E. All existing 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 4 hours**. CONTRACTOR shall provide a **minimum notice of 24 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. River Heights City's booster station provide a critical water supply to the upper distribution system pressure zone. The booster station must remain operational during the project, except for a **maximum time period of 3 hours** when connections are made. The CONTRACTOR shall coordinate with the City to ensure that the Cobblestone Tank is full prior to the time of connection.
- H. 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.
- I. Coordination with Adjacent Property Owner

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

1. Once each month hand deliver, mail, or email 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 OWNER'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 changes
 - h. to public transportation bus routes
 - i. any other construction or work items which will impact or restrict the normal use of streets and amenities

Failure to comply with this contract provision is considered grounds for project suspension per Article 15.1 of the General Conditions (APWA Document 00 70 00).

1.2 FIELD ENGINEERING

- A. ENGINEER shall provide the following construction staking at no cost to the CONTRACTOR.
 1. Benchmark network throughout the construction zone.
 2. Pipeline alignment stakes at approximately 100 foot intervals and all bends and designated changes in grade.
 3. Stake locations for air vents and other fittings.
- B. Surveyor shall be a registered Land Surveyor for 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. Locate and protect survey control and reference points. Promptly notify ENGINEER of discrepancies discovered.
- F. Control datum for survey is that shown on 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. The CONTRACTOR shall be responsible to coordinate with all property owners to determine location of and during installation of service laterals and to determine the location of existing sewer and water service laterals.
- J. All service laterals shall be verified and indicated on the "Record Drawings" supplied by the CONTRACTOR to the 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, its superintendent, and its subcontractors as appropriate. Other attendees will be:
 - 1. ENGINEER
 - 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.

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

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.

1.4 PROGRESS MEETINGS

- A. CONTRACTOR shall schedule and **hold regular on-site progress meetings at least 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 the CONTRACTOR containing an updated Progress Schedule. Where the delayed completion date of a project phase is noted, the CONTRACTOR shall describe the anticipated delays or problems and outline the action plan being taken to counter their effect.

PART 2 – PRODUCTS – Not Used

PART 3 – EXECUTION – Not Used

-END OF SECTION-

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures
- B. Shop drawings and samples
- C. Administrative submittals
- D. Certificates
- E. Test reports
- F. Quality control submittals
- G. Contract closeout submittals

1.2 SUBMITTAL PROCEDURES

- A. Timeline: Schedule and make submissions in accordance with requirements of individual Specification section and in such sequence as to cause no delay in Work or in work of other CONTRACTOR's.
- B. Identification of Submittals:
 - 1. Complete, sign, and transmit with each Submittal package, one transmittal of CONTRACTOR's Submittal Form as provided at preconstruction conference.
 - 2. Identify each Submittal with the following numbering and tracking system:
 - a. Sequentially number each Submittal.
 - b. Resubmissions of a Submittal will have original number with sequential alphabetic suffix.
 - 3. Format: Orderly, indexed with labeled tab dividers.
 - 4. Show date of submission.
 - 5. Show Project title and OWNER's contract identification and contract number.
 - 6. Show names of CONTRACTOR, Subcontractor or Supplier, and manufacturer as appropriate.
 - 7. Identify, as applicable, Contract Document section and paragraph to which Submittal applies.
 - 8. Identify Submittal type; submit only one type in each Submittal package.
 - 9. Identify and indicate each deviation or variation from Contract Documents. Identify system limitations which may be detrimental to successful performance of completed Work.
- C. Copies:
 - 1. CONTRACTOR shall determine, with ENGINEER, an acceptable method of submitting hard copies and electronic copies prior to issuance of submittals.
 - 1. Hard copies:
 - a. Two (2) unless otherwise specified in individual sections.
 - 2. Electronic copies:
 - a. Acceptable electronic media, in order of preference, include email, FTP or share files, or one (1) copy on a Flash Drive or digital video disc (DVD).
 - b. All files and plans should be submitted in Adobe PDF (.pdf) format. Please convert documents to PDF directly from work processing wherever possible. If it is necessary to scan a paper copy to PDF, please make sure you enable Optical Character Recognition (OCR) in the scanning program; this will make the PDF document searchable. Photographs may be submitted in JPEG (.jpg) format.
 - c. All file names should be descriptive of the document contents.
 - 3. Samples:
 - a. Two (2), unless otherwise specified in individual Specification sections.

SECTION 01 33 00
SUBMITTAL PROCEDURES

- b. CONTRACTOR is responsible for safe and proper delivery of samples and shall prepay cartage charges.
- D. Resubmissions: Clearly identify each correction or change made.
- E. Incomplete Submittal Submissions:
 - 1. ENGINEER will return the entire Submittal for CONTRACTOR's revision/correction and resubmission.
 - 2. Submittals which do not clearly bear CONTRACTOR's stamp, signed or initialed certification 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 will be returned to CONTRACTOR unreviewed.
- F. Non-specified Submissions: Submissions not required under these Contract Documents will not be reviewed or processed.
- G. ENGINEER's Review: ENGINEER will act upon CONTRACTOR's Submittal and transmit response to CONTRACTOR not later than 30 days after receipt excluding delivery time to and from CONTRACTOR, unless otherwise specified. Resubmittals will be subject to the same review time.
- H. Schedule Delays:
 - 1. No adjustment of Contract Times or Price will be allowed due to ENGINEER's review of Submittals, unless all of the following criteria are met:
 - a. CONTRACTOR has notified ENGINEER in writing that timely review of Submittal in question is critical to progress of Work, and has received ENGINEER's written acceptance to reflect such on current accepted submission and progress schedule. Written agreement by ENGINEER to reduce Submittal review time will be made only for unusual and CONTRACTOR-justified reasons. Acceptance of a progress schedule containing Submittal review times less than specified or less than agreed to in writing by ENGINEER will not constitute ENGINEER's acceptance of the review times.
 - b. ENGINEER has failed to review and return first submission of a Submittal within agreed time indicated and accepted by ENGINEER.
 - 2. No adjustment of Contract Times or Price will be allowed due to delays in progress of Work caused by rejection and subsequent resubmission of Submittals, including multiple resubmissions.

1.3 SHOP DRAWINGS AND SAMPLES

- A. Description: Reference General Conditions article 6.17- "Shop Drawings and Samples".
- B. Excessive Shop Drawing Review: One resubmission of Shop Drawings will be performed by ENGINEER, as appropriate, at no cost to CONTRACTOR. Subsequent additional resubmissions of that Shop Drawing will be reviewed by ENGINEER; however ENGINEER will document work hours required to perform such additional review(s) and will report these costs to OWNER. CONTRACTOR shall reimburse OWNER for these costs.
- C. Substitute and "Or Equal" Items: Meet requirements of General Conditions article 6.05- "Substitutes and 'Or-Equals'."
- D. General: Submit to ENGINEER as required by individual Specification sections.
- E. Identify and Indicate:

**SECTION 01 33 00
SUBMITTAL PROCEDURES**

1. Pertinent Drawing sheet(s) and detail number(s), products, units and assemblies, and system or equipment identification or tag numbers.
2. Critical field dimensions and relationships to other critical features of Work.
3. Samples: Source, location, date taken, and by whom.
4. Each deviation or variation from Contract Documents in accordance with General Conditions article 6.17.C.3 – “Submittal Procedures.”

F. Design Data:

1. Design systems, equipment, and components, including supports and anchorages, in accordance with the provisions of the latest edition of all uniform codes, including Uniform Building Code and to withstand seismic loads in addition to other loads.
2. Provide an appropriately licensed professional engineer to perform design, oversee preparation of Shop Drawings, manufacturing, and installation, as appropriate, and to stamp and certify that Shop Drawings conform with design requirements and requirements of Laws and Regulations and governing agencies.
3. When specified, provide Project-specific information as necessary to clearly show calculations, dimensions, logic and assumptions, and referenced standards and codes upon which design is based.

1.4 ADMINISTRATIVE SUBMITTALS

- A. Description: Submittals that are not Shop Drawings or Samples, or that do not reflect quality of product or method of construction. May include, but not limited to those Submittals identified below.
- B. Schedule of Submittal Submissions:
1. Prepare and submit, preliminary list of submissions grouped by Contract Document article/paragraph number or Specification section number, with identification, numbering and tracking system as specified under Paragraph Identification of Submittals and as approved by ENGINEER.
 2. Include only the following required submissions:
 - a. Shop Drawings and Samples.
 - b. Training plans.
 - c. Test Procedures.
 - d. Operation and maintenance manuals.
 - e. Record documents.
 - f. Specifically required certificates, warranties, and service agreements.
- C. Applications for Payment and Schedule of Values: Meet requirements of Section 01 20 00 – “Price and Payment Procedures.”
- D. Construction Photographs: In accordance with Section 01 31 00 – “Coordination and Sequencing,” and as may otherwise be required in the Contract Documents.
- E. Schedules:
1. Progress Schedule(s): Meet the requirements of Section 01 32 00 – “Progress Schedule.”
 2. Schedule of Operation and Maintenance Manuals: Meet requirements of Section 01 70 00 – “Project Closeout.”
 3. Schedule of Training OWNER’s Personnel: Meet instruction requirements of Section 01 70 00 – “Project Closeout.”
 4. Schedule of Functional and Performance Testing and of Startup Schedule and Plan: Meet requirements of Section 01 91 00 – “Commissioning.”
- F. Training Materials: Meet the demonstration and instruction requirements of Section 01 70 00 – “Project Closeout.”

SECTION 01 33 00 SUBMITTAL PROCEDURES

G. Submittals Required by Laws, Regulations, and Governing Agencies:

1. Submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable federal, state, or local governing agency or their representative.
2. Transmit to ENGINEER for OWNER's records one copy of correspondence and transmittals (include enclosures and attachments) between CONTRACTOR and governing agency.

1.5 CERTIFICATES

A. Manufacturer's Certificate of Compliance:

1. Shall be submitted when specified in individual Specification sections or where products are specified to a recognized standard or code, submit prior to shipment of product or material to the site.
2. ENGINEER may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.
3. Shall be signed by product manufacturer certifying that materials, manufacture, and product specified conforms to or exceeds specified requirements and intent for which product will be used. Submit supporting reference data, affidavits, and certifications as appropriate.
4. May reflect recent or previous test results on material or product, but must be acceptable to ENGINEER.

B. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in the individual Specification sections.

C. Manufacturer's Certificate of Proper Installation: As required in Section 01 70 00 – "Project Closeout." Coordinate with Section 01 91 00 – "Commissioning."

1.6 TEST REPORTS

A. Description: Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

B. Written Test Reports of Each Test and Inspection: As a minimum, include the following:

1. Date of test and date issued, Project title and number, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
2. Date and time of sampling or inspection and record of temperature and weather conditions.
3. Identification of product and Specification section, location of Sample, test or inspection in the Project, type of inspection or test with referenced standard or code, certified results of test.
4. Compliance with Contract Documents, and identifying corrective action necessary to bring materials and equipment into compliance.
5. Provide an interpretation of test results, when requested by ENGINEER.

C. Field Samples: Provide as required by individual Specifications and as may be required by ENGINEER during progress of Work.

1.7 QUALITY CONTROL SUBMITTALS

A. Operation and Maintenance Manual: As required in Section 01 70 00 – "Project Closeout."

**SECTION 01 33 00
SUBMITTAL PROCEDURES**

- B. Statements of Qualification: Evidence of qualification, certification, or registration. As required in these Contract Documents to verify qualifications of professional land surveyors, ENGINEER's, materials testing laboratories, specialty Subcontractors, trades, specialists, consultants, installers, and other professionals.
- C. Plans and Methods for Groundwater Control: Written report for designing, furnishing, installing, operating, maintaining, and eventual removal of groundwater control and monitoring equipment and systems.

1.8 CONTRACT CLOSEOUT SUBMITTALS

- A. General: In accordance with Section 01 70 00 – “Project Closeout.”

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Quality assurance and control of installation
 - 2. References
 - 3. Field samples
 - 4. Inspection and testing laboratory services
 - 5. Manufacturers' field services and reports
- B. Related Sections include but are not necessarily limited to:
 - 1. Section 01010 - Summary of Project
 - 2. Section 01300 – Submittals
 - 3. Divisions 02

1.2 REFERENCES

- A. Conform to reference standard by date of issue current on date of Contract Documents.

1.3 SUBMITTALS

- A. Shop Drawings:
- B. Field Samples:
 - 1. Install field samples at the site as required by individual specifications Sections for review.
 - 2. Acceptable samples represent a quality level for the Work.
 - 3. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Engineer.
- C. Inspection and Testing:
 - 1. Owner will appoint, employ, and pay for services of inspection and testing for soil and concrete unless otherwise noted.
 - a. All pressure and water tightness testing shall be Contractor's expense.
 - 2. Inspections, tests, and other services specified in individual specification Sections will be accomplished under the direction of the Engineer.
 - 3. Reports will be submitted through the Engineer, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
 - 4. Furnish samples of materials, design mix, equipment, tools, storage, and assistance as requested.
 - a. Notify Engineer 48 hours prior to expected time for operations requiring services.
 - b. Arrange with independent firm and pay for additional samples and tests required for Contractor's use.
 - 5. Retesting required because of non-conformance to specified requirements shall be performed under the direction of the Engineer. Payment for retesting will be charged to the Contractor by deducting inspection or testing charges from the Contract Sum/Price.
- D. Manufacturers' Field Reports:
 - 1. Submit qualifications of observer to Engineer 30 days in advance of required observations. Observer subject to approval of Engineer.

SECTION 01 45 00
QUALITY CONTROL

2. When specified in individual specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to initiate instructions when necessary.
3. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
4. Submit report in duplicate within 30 days of observation to Engineer for review

1.4 QUALITY ASSURANCE

A. Control of Installation

1. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
2. Comply fully with manufacturers' instructions, including each step-in sequence.
3. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
4. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
5. Perform work by persons qualified to produce workmanship of specified quality.
6. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

END OF SECTION

TESTING AGENCY SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. CONTRACTOR shall be responsible for providing Construction Quality Control Testing of all soils, asphalt pavement, concrete, etc. as required by the Project or 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 REFERENCES

- A. ASTM D 3740: Standard Recommended Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ASTM D 4561: Standard Practice for Quality Control Systems for and Inspection and Testing Agency for Bituminous Paving Materials.
- C. ASTM E 329: Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.3 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.

1.4 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.
- B. Concrete Technician: Approved by ENGINEER or ACI certified.

1.5 CONTRACTOR SUBMITTALS

- A. Prior to start of Work, submit testing agency's name, address, telephone number and the following:
 - 1. Person charged with engineering managerial responsibility.
 - 2. Professional engineer on staff to review services.

SECTION 01 45 23
TESTING AGENCY SERVICES

3. Level of certification of technicians.

1.6 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.

1.7 RESPONSIBILITIES OF TESTING AGENCY

- A. Calibrate testing equipment at least annually with devices of 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.

1.8 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.

1.9 MEASUREMENT AND PAYMENT

- A. Testing agency services shall be measured or paid as provided in Section 01 22 00- Measurement and Payment.

-END OF SECTION-

TEMPORARY CONSTRUCTION UTILITIES AND ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temporary Utilities: Electricity, telephone service, water, and sanitary facilities.
2. Temporary Controls: Barriers, enclosures and fencing, protection of the work, and dust and water control.
3. Construction Facilities: Access roads, parking, progress cleaning, project signage, and temporary buildings.
4. Safety: Overall safety for project activities

1.2 TEMPORARY ELECTRICITY

A. Provide and pay for temporary power service from utility source to all required areas including all field offices. No power service currently exists on the well site but does exist at the Booster Station Well Site. Contractor shall pay all monthly service costs until final acceptance. If the Contractor does not wish to run a service line to the test site area, a generator for temporary power is acceptable.

1.3 TEMPORARY HEAT

A. Provide and pay for heat devices and heat as required to maintain specified conditions for construction operations.

1.4 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.5 TEMPORARY WATER SERVICE

- A. Provide, maintain, and pay for suitable quality water service. Connect to existing water source for construction operations.
- B. Water used to test, flush, and disinfect new pipelines will be available at no cost by Owner, for first attempt. Additional attempts will require payment to Owner at wholesale rates for any and all water used.

1.6 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures in accordance with State and Local health and sanitation requirements and regulations.

1.7 STAGING AREAS

A. A staging area has not been identified outside of easements shown on the plans. Any materials, equipment, or construction vehicles stored or used onsite shall be placed in locations that do not interfere with normal traffic or off-road accesses. If staging is to occur on private property, Engineer shall receive from the Contractor a copy of a signed agreement between the Contractor and property owner where staging is to occur prior to staging.

1.8 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas to allow for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations.

SECTION 01500
TEMPORARY CONSTRUCTION UTILITIES AND ENVIRONMENTAL CONTROLS

B. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.9 FENCING

A. The Lower Well site is fenced with barbed wire fencing on its west side. Barbed wire fencing or other fencing is located on west side of SR23. Contractor shall protect fencing from damage due to construction activities. Contractor shall also protect entrance gates from damage due to construction activities. Any damage to the existing fences and or gates shall be repaired at the time of damage to maintain a fenced site during all construction activities.

1.10 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.11 DUST CONTROL

A. Provide equipment and arrange for water to adequately control dust on project site.

B. Comply with local government requirements for pollutants.

C. Contractor shall be responsible for maintaining the site and adjoining paved surfaces in a dust free condition.

1.12 TRAFFIC CONTROL

A. Contractor shall provide traffic control for all phases of the project. Contractor shall prepare and submit traffic control plans to UDOT, county, city, or agency with jurisdiction over each project area. Contractor shall not proceed with work until traffic control plan is approved.

1.13 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification Sections.

B. Prohibit traffic from revegetated areas.

1.14 SECURITY

A. Provide security and facilities to protect Work, and existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.15 ACCESS ROADS

A. Maintain the existing access road to the facility in current condition.

B. Protect adjacent residential landscaping from damage during all construction activities.

C. Provide means of removing mud from vehicle wheels before leaving the site and entering streets.

1.16 PARKING

A. Provide temporary parking areas to accommodate construction personnel.

B. When site space is not adequate, provide additional off- site parking.

C. Do not allow vehicle parking on existing pavement.

D. Do not allow vehicle parking on existing roads in the West River Subdivision.

1.17 PROGRESS CLEANING

SECTION 01 50 00

TEMPORARY CONSTRUCTION UTILITIES AND ENVIRONMENTAL CONTROLS

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove waste materials, debris, and rubbish from site bi-weekly and dispose off-site.
- C. **400 East** shall be washed with water regularly to keep the roadway clean and safely passable.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary above grade or buried utilities, equipment, facilities, and materials, prior to Final Application for Payment inspection.
- B. Remove underground installations to a minimum depth of 2 feet.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.19 SAFETY AND PROTECTION

- A. Refer to Article 06.13 thru 06.16 of General Conditions for responsibility of Contractor for safety and protection.
- B. OSHA regulations to apply on this project.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

MOBILIZATION / DEMOBILIZATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes various tasks associated with project execution and close out. Mobilization shall generally include: preparatory work and materials necessary for obtaining clearances for the Work; moving personnel, equipment, supplies and incidentals to and from the Project Site; quality control; clean-up; temporary utilities and quarters; permits, bonds and insurance; dust abatement, storm water control, and noise abatement; waste and rubbish disposal and control; sanitation; and project close-out operations.

1.2 RELATED WORK AND REFERENCED SECTIONS

Section 01 60 00 - Protection and Restoration of Existing Improvements

PART 2 - MATERIALS

2.1 VISUAL RECORDS

- A. Visual records shall be made on professional quality, standard MP4 or similar format recording. Video's shall be labeled to indicate the area covered by the pre- and post-construction photography.

PART 3 - EXECUTION

3.1 VISUAL RECORDS

- A. Prior to any disturbance of the area, the Contractor shall produce photographic log of all areas, including but not limited to rights-of-way, streets and roadways, haul-roads and access routes, storage areas, construction sites, and buildings or structures, which will be, or may be, affected by the Work. Such photography will be of a quality to allow accurate determination of location, size, and condition of existing features and improvements taken prior to any occupancy or execution of Work by the Contractor.

3.2 CONNECTION LOCATION AND DOCUMENTATION

The Contractor shall document fitting, valve, and connection locations on the tie sheets and provide offsets from permanent fixed objects to buried installations for relocation.

3.3 MOBILIZATION

- A. Mobilization shall be measured by the lump sum.

3.4 VISUAL RECORDS

SECTION 01 51 00
MOBILIZATION / DEMOBILIZATION

A. Pre-and Post-Construction Photography shall be incidental to the work.

3.5 CONNECTION DOCUMENTATION

A. Connection Documentation shall be incidental to the work.

3.6 BASIS OF PAYMENT

A. The accepted quantity(s) shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Mobilization	Lump Sum

B. payment schedule

C. The amount bid or identified in a schedule of values for Mobilization shall not exceed 10% of the total contract bid amount. The following payment schedule percentages shall be based on amount bid or identified in a schedule of values for Mobilization up to a maximum of 10% of the total contract bid. Any portion of the mobilization bid amount which exceeds 10% of the total contract bid amount, will be paid to the Contractor after final acceptance of the Work, with the last mobilization payment. (See "overage amount" in the payment schedule table below).

D. Partial payments for Mobilization will be made in accordance with the payment schedule table below.

MOBILIZATION PAYMENT SCHEDULE

Payment	Amount	When Paid
1 ST	25% of mobilization	With first partial payment after 3% of the original contract amount earned by the Contractor.
2 ND	25% of mobilization	When amount earned by Contractor is 10% of the original contract price.
3 RD	25% of mobilization	When amount earned by Contractor is 50% of the original contract price.
4 TH (last)	25% of mobilization + "overage amount"	When project is complete and accepted.

END OF SECTION

PROTECTION AND RESTORATION OF EXISTING FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

Section Includes:

1. This section is intended to include requirements associated with protection and restoration of existing facilities such as underground facilities, surface improvements, and survey markers.

Related Sections include but are not necessarily limited to:

1. Section 01500 - Construction Facilities and Temporary Controls
2. Section 02221 – Trenching, Backfill and Compaction for Utilities

1.2 NOTIFICATION OF UTILITIES

- A. Utilities are to be contacted by Contractor prior to any excavation activities requesting locations on underground utilities.

1.3 INTERRUPTION TO UTILITIES

The location of existing utilities and structures shown on the Plans is approximate. Immediately prior to construction, the Contractor shall arrange to have utilities not belonging to the City located and marked, including but not limited to:

1. Gas lines
2. Water lines
3. Telephone lines
4. Power lines
5. Cable television lines
6. Drainage facilities
7. Irrigation lines
8. Sewer lines

Any underground facilities located by utilities or indicated in Contract Documents shall be treated according to paragraph 4.3.1 of General Conditions.

Any underground facilities not located by utilities and not indicated in Contract Documents shall be treated according to paragraph 4.3.2 of General Conditions.

Exact locations and depths of all underground utilities shall be verified, by uncovering, prior to commencing any Work activities. When such exploratory excavations show the underground utility locations as indicated in Contract Documents to be in error, the Contractor shall so notify the Engineer in writing.

Where utilities are to be relocated, Contractor shall make proper application and notify Engineer of specified time and conditions of necessitated Work.

All restorations made to utilities shall be inspected and approved by an authorized representative of the utility before and being concealed by backfill or other Work.

SECTION 01 60 00
PROTECTION AND RESTORATION OF EXISTING FACILITIES

1.4 RESTORATION OF PAVEMENT

Paved areas removed as part of Work or otherwise damaged by Contractor shall be replaced with similar materials, matching thickness of adjacent pavement, except where specifically directed otherwise by the entity issuing the permit or as noted in Contract Documents, whichever is more stringent.

1.5 PROTECTION OF STREET MARKERS

Survey markers or other existing street markers shall not be destroyed, removed, or otherwise disturbed 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 for easy and accurate restoration.

All survey markers or points disturbed without proper notification and/or authorization by the Engineer shall be accurately restored by the Owner at the Contractor's expense after all Work is complete.

~ END OF SECTION ~

PROJECT CLOSE OUT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Contract closeout requirements including:
 - 1. Final Cleaning.
 - 2. Disinfection of systems.
 - 3. Preparation and submittal of closeout documents.
 - 4. Final completion certification.

1.2 FINAL CLEANING

- A. Perform final cleaning prior to inspections for Substantial Completion.
- B. Employ skilled workers who are experienced in cleaning operations.
- C. Use cleaning materials, which are recommended by manufacturers of surfaces to be cleaned.
- D. Prevent scratching, discoloring, and otherwise damaging surfaces being cleaned.
- E. Clean roofs, gutters, downspouts, and drainage systems.
- F. Broom clean exterior paved surfaces and rake clean other surfaces of sitework.
- G. Police yards and grounds to keep clean.
- H. Remove dust, cobwebs, and traces of insects and dirt.
- I. Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete and other foreign materials from sight-exposed surfaces, and fixtures and equipment.
- J. Remove non-permanent protection and labels.
- K. Clean permanent filters or screens and replace disposable filters when heating, ventilation, and air conditioning units were operated during construction.
- L. Clean ducts, blowers and coils when units were operated without filters during construction.
- M. Clean light fixtures and replace burned out or dim lamps.

1.3 WASTE DISPOSAL

- A. Arrange for and dispose of surplus materials, waste products, and debris off-site.
 - 1. Prior to making disposal on private property, obtain written permission from OWNER of such property.
- B. Do not fill ditches, washes or drainage ways, which may create drainage problems.
- C. Do not create unsightly or unsanitary nuisances during disposal operations.
- D. Maintain disposal site in safe condition and good appearance.
- E. Complete leveling and cleanup prior to final acceptance of the Work.

1.4 TOUCH-UP AND REPAIR

SECTION 01 70 00
PROJECT CLOSE OUT

- A. Touch-up or repair finished surfaces on structures, equipment, fixtures and installations that have been damaged prior to inspection for Substantial Completion.
- B. Refinish or replace entire surfaces which cannot be touched-up or repaired satisfactorily.

1.5 FINAL CLEANING FACILITIES

- A. Clean pipe, before running of clean water testing, or before acceptance testing goes on stream when clean water testing is not required.

1.6 CLOSEOUT DOCUMENTS

- A. Submit the following Closeout Submittals upon completion of the Work and at least 7-days prior to submitting Application for Final Payment:
 - 1. Evidence of Compliance with Requirements of Governing Authorities.
 - 2. Project Record Documents.
 - 3. Operation and Maintenance Manuals.
 - 4. Warranties and Bonds.
 - 5. Evidence of Payment and Release of Liens as required in the Conditions of the Contract.
 - 6. Release of claims as outlined in Conditions of the Contract.
 - 7. Certificate of Final Completion.

1.7 EVIDENCE OF COMPLIANCE WITH REQUIRMENTS OF GOVERNING AUTHORITIES

- A. Submit the following:
 - 1. Bacteriological test results
 - 2. Pressure test results
 - 3. Materials testing results
 - 4. Any other results from performance and/or quality testing activities performed over the course of the Project.

1.8 PROJECT RECORD DOCUMENTS

- A. Maintain at Project site, available to OWNER and ENGINEER, one copy of the Contract Documents, shop drawings, and other submittals, in good order.
 - 1. Mark and record field changes and detailed information contained in submittals and change orders.
 - 2. Record actual depths, horizontal and vertical location of underground pipes, duct banks and other buried utilities. Reference dimensions to permanent surface features.
 - 3. Identity specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.
 - 4. Identify location of spare conduits including beginning, ending and routing through pull boxes, and manholes. Record spare conductors, including number and size, within spare conduits, and filled conduits.
 - 5. Provide schedules, lists, layout drawings, and wiring diagrams.
 - 6. Make annotations with erasable colored pencil conforming to the following color code:

Additions:	Red
Deletions:	Green
Comments:	Blue

Dimensions:	Graphite
-------------	----------

- B. Maintain documents separate from those used for construction. Label documents "RECORD DOCUMENTS".
- C. Keep documents current. Record required information at the time the material and equipment is installed and before permanently concealing.
- D. Deliver record documents with transmittal letter containing date, Project title, CONTRACTOR's name and address, list of documents, and signature of CONTRACTOR.
- E. During progress meetings, record documents will be reviewed to ascertain that changes have been recorded.

1.9 WARRANTIES AND BONDS

- A. Provide executed Warranty or Guaranty Form if required by Contract Documents.
- B. Provide specified additional warranties, guarantees, and bonds from manufacturers and suppliers.

1.10 CERTIFICATE OF FINAL COMPLETION

- A. Upon Substantial Completion, ENGINEER will submit a list of known items (Punchlist) still to be completed or corrected prior to contract completion.
- B. List of items to be completed or corrected will be amended as items are resolved by CONTRACTOR.
- C. When all items have been completed or corrected, submit written certification that the entire work is complete in accordance with the Contract Documents and request final inspection.

END OF SECTION

WATER FOR CONSTRUCTION

Part 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish and apply water for: dust control, pre-wetting, mixing or compacting earth materials for road, site, and/or trench construction, and for all other needs associated with the Work.

Part 2 - MATERIALS

- A. Water shall be free of dirt and silt or any substances injurious to plant life. A separate supply of potable water shall be provided for drinking when it becomes necessary to provide water for workers and sanitary water for construction purposes.

Part 3 - CONSTRUCTION REQUIREMENTS

- A. Water provided for construction shall be obtained from a source approved by the Owner and Engineer and be of sufficient quantity and quality to provide for the anticipated needs of the Contract.
- B. Water hauling equipment shall have watertight tanks of known capacity and shall be equipped with a pressure pump and spray system with the capability of applying the whole load uniformly. The spray system shall have a positive shut-off control. The water tank shall have a minimum capacity of 1,000 U.S. Gallons, and the capacity shall be clearly marked on the tank. The Contractor may be required to verify the tank capacity.
- C. A water meter may be used for water dispensing, providing its measurement can be verified.

Part 4 - METHOD OF MEASUREMENT

- A. Unless indicated otherwise in the Bid Schedule, no separate measurement will be made for water used for pre-wetting, mixing, compaction of earth materials or for dust control, or for other needs associated with the Work.
- B. When shown in the Bid Schedule, water shall be measured to the nearest 1/10th of 1000 gallons in calibrated tanks or tanks with approved metering devices that indicate volume in 100-gallon quantities.

Part 5 - BASIS PAYMENT

- A. The accepted quantities will be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Water	M Gallons (1,000 US Gallons)

END OF SECTION

CONCRETE – SMALL PROJECTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete and grout.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.

1.2 DEFINITIONS

- A. Per ACI 116R except as modified herein:
 - 1. Concrete fill: Non-structural concrete.
 - 2. Concrete Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.
 - 3. Exposed concrete: Exposed to view after construction is complete.
 - 4. Indicated: Indicated by Contract Documents.
 - 5. Non-exposed concrete: Not exposed to view after construction is complete.
 - 6. Required: Required by Contract Documents.
 - 7. Specified strength: Specified compressive strength at 28 days.
 - 8. Submitted: Submitted to Engineer

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01300.
 - 2. Concrete mix designs proposed for use. Concrete mix design submittal to include the following information:
 - a. Sieve analysis and source of fine and coarse aggregates.
 - b. Test for aggregate organic impurities.
 - c. Test for deleterious aggregate per ASTM C289.
 - d. Proportioning of all materials.
 - e. Type of cement with mill certificate for cement.
 - f. Type of fly ash with certificate of conformance to specification requirements.
 - g. Slump.
 - h. Air content.
 - i. Brand, type, ASTM designation, and quantity of each admixture proposed for use.
 - j. 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
 - k. Shrinkage test results.
 - l. Standard deviation value for concrete production facility.
 - 3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Manufacturers and types:
 - 1) Curing agents.
 - 2) Chemical sealer.
 - 3) Bonding and patching mortar.
 - 4) Non-shrink grout with cure/seal compound.
 - 5) Waterstops.

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1.4 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
 - a. 116R, Cement and Concrete Terminology.
 - b. 212.3R, Chemical Admixtures for Concrete.
 - c. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - d. 305R, Hot Weather Concreting.
 - e. 318, Building Code Requirements for Structural Concrete.
 - f. 347R, Recommended Practice for Concrete Formwork.
2. ASTM International (ASTM):
 - a. A82, Standard Specification Steel Wire, Plain, for Concrete Reinforcement.
 - b. A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (Including Supplementary Requirements S1).
 - c. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - d. C33, Standard Specification for Concrete Aggregates.
 - e. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - f. C94, Standard Specification for Ready-Mixed Concrete.
 - g. C138, Standard Method of Test for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
 - h. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
 - i. C150, Standard Specification for Portland Cement.
 - j. C157, Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.
 - k. C171, Standard Specification for Sheet Materials for Curing Concrete.
 - l. C172, Standard Practice for Sampling Freshly Mixed Concrete.
 - m. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - n. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - o. C260, Standard Specification for Air Entraining Admixtures for Concrete.
 - p. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
 - q. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - r. C494, Standard Specification for Chemical Admixtures for Concrete.
 - s. C595, Standard Specification for Blended Hydraulic Cements.
 - t. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 - u. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - v. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - w. D1056, Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber.
 - x. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - y. E329, Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
3. United States Army Corps of Engineers (COE):
 - a. CRD-C572, Polyvinyl Waterstops.

B. Quality Control:

1. Concrete testing agency.
 - a. Contractor to employ and pay for services of a testing laboratory to:

- 1) Perform materials evaluation.
 - 2) Design concrete mixes.
 - b. Concrete testing agency to meet requirements of ASTM E329.
 2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
 - a. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.
 3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
 - a. Do not use revised concrete mixes until submitted to and approved by Engineer.
- C. Qualifications:
1. Ready mixed concrete batch plant certified by National Ready Mixed Concrete Association (NRMCA).

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage of Material:
1. Cement and fly ash:
 - a. Store in moisture-proof, weathertight enclosures.
 - b. Do not use if caked or lumpy.
 2. Aggregate:
 - a. Store to prevent segregation and contamination with other sizes or foreign materials.
 - b. Obtain samples for testing from aggregates at point of batching.
 - c. Do not use frozen or partially frozen aggregates.
 - d. Do not use bottom 6 IN of stockpiles in contact with ground.
 - e. Allow sand to drain until moisture content is uniform prior to use.
 3. Admixtures:
 - a. Protect from contamination, evaporation, freezing, or damage.
 - b. Maintain within temperature range recommended by manufacturer.
 - c. Completely mix solutions and suspensions prior to use.
 4. Reinforcing steel:
 - a. Support and store all rebars above ground.
- B. Delivery:
1. Concrete:
 - a. Prepare a delivery ticket for each load for ready-mixed concrete.
 - b. Truck operator shall hand ticket to Owner's Representative at the time of delivery.
 - c. Ticket to show:
 - 1) Mix identification mark.
 - 2) Quantity delivered.
 - 3) Amount of each material in batch.
 - 4) Outdoor temp in the shade.
 - 5) Time at which cement was added.
 - 6) Numerical sequence of the delivery.
 - 7) Amount of water added.

PART 2 - PRODUCTS

2.1 MANUFACTURERS'

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Nonshrink, nonmetallic grout:
 - a. Sika "SikaGrout 212."
 - b. Gifford Hill "Supreme Grout."
 - c. Master Builders "Masterflow 713."

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2. Epoxy grout:
 - a. Master Builders "Brutem MPG."
 - b. Euclid Chemical Company, "High Strength Grout."
 - c. Fosroc, "Conbextra EPHF".
3. Expansion joint fillers:
 - a. Permaglaze Co.
 - b. Rubatex Corp.
 - c. Williams Products, Inc.
4. Waterstops:
 - a. Greenstreak Plastic Products, Inc.
5. Form coating:
 - a. Richmond "Rich Cote."
 - b. Industrial Lubricants "Nox-Crete Form Coating."
 - c. Protex "Pro-Cote."
6. Prefabricated forms:
 - a. Simplex "Industrial Steel Frame Forms."
 - b. Symons "Steel Ply."
 - c. Universal "Uniform."

2.2 MATERIALS

- A. Portland Cement: Conform to ASTM C150 Type I or II.
- B. Fly Ash:
 1. ASTM C618, Class F or Class C.
 2. Nonstaining.
 - a. Hardened concrete containing fly ash to be uniform light gray color.
 3. Maximum loss on ignition: 4 percent.
 4. Compatible with other concrete ingredients.
- C. Admixtures:
 1. Air entraining admixtures: ASTM C260.
 2. Water reducing, retarding, and accelerating admixtures:
 - a. ASTM C494 Type A through E.
 - b. Conform to provisions of ACI 212.3R.
 - c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no cost to Owner.
 - d. Follow manufacturer's instructions.
 - e. Use chloride free admixtures only.
 3. Maximum total water soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials and admixtures by weight percent of cement:
 - a. 0.10 all concrete.
 4. Do not use calcium chloride.
 5. Pozzolanic admixtures: ASTM C618.
 6. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.
- D. Water: Potable, clean, free of oils, acids and organic matter.
- E. Aggregates:
 1. Normal weight concrete: ASTM C33, except as modified below.
 2. Fine aggregate: Clean natural sand.
 - a. No manufactured or artificial sand.
 3. Coarse aggregate: Crushed rock, natural gravel, or other inert granular material.
 - a. Maximum amount of clay or shale particles: 1 percent.
 4. Gradation of coarse aggregate:
 - a. Lean concrete and concrete topping: Size #7.
 - b. All other concrete: Size #57 or #67.

- F. Concrete Grout:
 - 1. Nonshrink nonmetallic grout:
 - a. Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added.
 - b. Grout to produce a positive but controlled expansion.
 - c. Mass expansion not to be created by gas liberation.
 - d. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.
 - 2. Epoxy grout:
 - a. 3-component epoxy resin system.
 - 1) Two liquid epoxy components.
 - 2) One inert aggregate filler component.
 - b. Each component packaged separately for mixing at jobsite.
- G. Reinforcing Steel:
 - 1. Reinforcing bars: ASTM A615, Grade 60.
- H. Forms:
 - 1. Prefabricated or job built.
 - 2. Wood forms:
 - a. New 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
 - b. Built-in-place or prefabricated type panel.
 - c. 4 x 8 FT sheets for built-in-place type except where smaller pieces will cover entire area.
 - d. When approved, plywood may be reused.
 - 3. Metal forms:
 - a. Metal forms excluding aluminum may be used.
 - b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.
 - 4. Chamfer strips: Clear white pine, surface against concrete planed.
 - 5. Form release: Nonstaining and shall not prevent bonding of future finishes to concrete surface.
- I. Waterstops:
 - 1. Hydrophilic.
 - 2. Hollow configuration with a minimum of two chambers.
 - 3. Thickness:
 - a. Dry 3/8 IN.
 - 4. Expansion characteristics: expand eight times dry thickness when not confined.
 - 5. Self adhesive.
- J. Chairs, Runners, Bolsters, Spacers, and Hangers:
 - 1. Stainless steel, epoxy coated, or plastic coated metal.
 - a. Plastic coated: Rebar support tips in contact with the forms only.
- K. Membrane Curing Compound: ASTM C309, Type I-D.
 - 1. Resin based, dissipates upon exposure to UV light.
 - 2. Curing compound shall not prevent bonding of any future coverings, coatings or finishes.
 - 3. Curing compounds used in water treatment plant construction to be nontoxic and taste and odor free.
- L. Expansion Joint Filler:
 - 1. In contact with water or sewage:
 - a. Closed cell neoprene.
 - b. ASTM D1056, Class SC (oil resistant and medium swell) of 2 to 5 psi compression deflection (Grade SCE41).
 - 2. Other use:
 - a. Fiber expansion joint filler.
 - b. ASTM D1751.

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2.3 CONCRETE MIXES

A. General:

1. All concrete to be ready mixed concrete conforming to ASTM C94.
2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
3. All concrete to be normal weight concrete.

B. Strength:

1. Provide specified strength and type of concrete for each use in structure(s) as follows:

TYPE	WEIGHT	SPECIFIED STRENGTH*
Concrete Fill	Normal weight	3000 psi
Lean Concrete	Normal weight	3000 psi
Concrete Topping	Normal weight & Lightweight	4000 psi
Precast Concrete	Normal weight & Lightweight	5000 psi
All other general use Concrete	Normal weight	4500 psi

*Minimum 28-day compressive strength.

- C. Air Entrainment:** Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:

MAX AGGREGATE SIZE	TOTAL AIR CONTENT PERCENT
1 IN or 3/4 IN	5 to 7
1/2 IN	5 1/2 to 8

1. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.

D. Slump: 4 IN maximum, 1 IN minimum.

1. Measured at point of discharge of the concrete into the concrete construction member.
2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
3. Determine slump per ASTM C143.

E. Selection of Proportions:

1. General - Proportion ingredients to:
 - a. Produce proper workability, durability, strength, and other required properties.
 - b. Prevent segregation and collection of excessive free water on surface.
2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

SPECIFIED STRENGTH	MINIMUM CEMENT, LB/CY			MAXIMUM WATER CEMENT RATIO BY WEIGHT
	MAXIMUM 1/2	AGGREGAT E 3/4	SIZE, IN 1	
3000	---	517	517	0.45
4000	611	611	611	0.45
5000	---	686	665	0.40

3. Substitution of fly ash:

- a. Maximum of 25 percent by weight of cement at rate of 1 LB fly ash for 1 LB of cement.
 - 4. Sand cement grout:
 - a. Three parts sand.
 - b. One part Portland cement.
 - c. Entrained air: Six percent plus or minus one percent.
 - d. Sufficient water for required workability.
 - e. Minimum 28-day compressive strength: 3,000 psi.
 - 5. Normal weight concrete: Proportion mixture to provide desired characteristics using one of methods described below:
 - a. Method 1 (Trial Mix): Per ACI 318, Chapter 5, except as modified herein:
 - 1) Air content within range specified above.
 - 2) Record and report temperature of trial mixes.
 - 3) Proportion trial mixes per ACI 211.1.
 - b. Method 2 (Field Experience): Per ACI 318, Chapter 5, except as modified herein:
 - 1) Field test records must be acceptable to Engineer to use this method.
 - 2) Test records shall represent materials, proportions and conditions similar to those specified.
 - 6. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of Paragraph 5.3 of ACI 318 using the standard deviation of the proposed concrete production facility as described in Paragraph 5.3.1 of ACI 318.
- F. Allowable Shrinkage: 0.048 percent per ASTM C157.

PART 3 - EXECUTION

3.1 FORMING AND PLACING CONCRETE

- A. Formwork:
 - 1. Contractor is responsible for design and erection of formwork.
 - 2. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
 - a. Allowable tolerances: As recommended in ACI 347R.
 - 3. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
 - a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
 - 4. Openings: Provide openings in formwork to accommodate work of other trades.
 - a. Accurately place and securely support items built into forms.
 - 5. Chamfer Strips: Place 3/4 IN chamfer strips in forms to produce 3/4 IN wide beveled edges on permanently exposed corners of members.
 - 6. Clean and adjust forms prior to concrete placement.
 - 7. Tighten forms to prevent mortar leakage.
 - 8. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.
- B. Reinforcement:
 - 1. Position, support and secure reinforcement against displacement.
 - 2. Locate and support with chairs, runners, bolsters, spacers and hangers, as required.
 - 3. Set wire ties so ends do not touch forms and are directed into concrete, not toward exposed concrete surfaces.
 - 4. Lap splice lengths: ACI 318 Class B top bar tension splices unless indicated otherwise on the Drawings.
 - 5. Extend reinforcement to within 2 IN of concrete perimeter edges.
 - a. If perimeter edge is earth formed, extend reinforcement to within 3 IN of the edge.
 - 6. Minimum concrete protective covering for reinforcement: As shown on Drawings.
 - 7. Do not weld reinforcing bars.

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- C. Construction, Expansion, and Contraction Joints:
1. Provide at locations indicated.
 2. Locate construction joints in floor slabs and foundation base slabs so that concrete placements are approximately square and do not exceed 2500 SF.
 3. Install construction joints perpendicular to main reinforcement with all reinforcement continued across construction joints.
 4. At least 48 HRS shall elapse between placing of adjoining concrete construction.
 5. Thoroughly clean and remove all laitance and loose and foreign particles from construction joints.
 6. Before new concrete is placed, coat all construction joints with an approved bonding adhesive used and applied in accordance with manufacturer's instructions.
- D. Embedments:
1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
 2. Use setting diagrams, templates and instructions for locating and setting.
- E. Placing Concrete:
1. Place concrete in compliance with ACI 304R and 304.2R.
 2. Place in a continuous operation within planned joints or sections.
 3. Begin placement when work of other trades affecting concrete is completed.
 4. Place concrete by methods which prevent aggregate segregation.
 5. Do not allow concrete to free fall more than 4 FT.
 6. Where free fall of concrete will exceed 4 FT, place concrete by means of tremie pipe or chute.
- F. Consolidation:
1. Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.
- G. Protection:
1. Protect concrete from physical damage or reduced strength due to weather extremes.
 2. In cold weather comply with ACI 306R except as modified herein.
 - a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.
 - b. Minimum concrete temperature at the time of mixing:
- | OUTDOOR TEMPERATURE
AT PLACEMENT (IN
SHADE) | CONCRETE
TEMPERATURE AT
MIXING |
|---|--------------------------------------|
| Below 30 DegF | 70 DegF |
| Between 30-45 DegF | 60 DegF |
| Above 45 DegF | 50 DegF |
- c. Do not place heated concrete that is warmer than 80 DegF.
 - d. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 DegF for 7 days or 70 DegF for 3 days.
 - e. Do not allow concrete to cool suddenly.
3. In hot weather comply with ACI 305R except as modified herein.
 - a. At air temperature of 90 DegF and above, keep concrete as cool as possible during placement and curing.
 - b. Do not allow concrete temperature to exceed 90 DegF at placement.
 - c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
 - d. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R, Figure 2.1.5.

H. Curing:

1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.
2. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.
3. Provide protection as required to prevent damage to concrete and to prevent moisture loss from concrete during curing period.
4. Provide curing for minimum of 7 days.
5. Form materials left in place may be considered as curing materials for surfaces in contact with the form materials except in periods of hot weather.
6. In hot weather follow curing procedures outlined in ACI 305R.
7. In cold weather follow curing procedures outlined in ACI 306R.
8. If forms are removed before 7 days have elapsed, finish curing of formed surfaces by one of above methods for the remainder of the curing period.
9. Curing vertical surfaces with a curing compound: Cover vertical surfaces with a minimum of two coats of the curing compound.
 - a. Allow the preceding coat to completely dry prior to applying the next coat.
 - b. Apply the first coat of curing compound immediately after form removal.
 - c. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - d. A vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.

I. Form Removal:

1. Remove forms after concrete has hardened sufficiently to resist damage from removal operations or lack of support.
2. Where no reshoring is planned, leave forms and shoring used to support concrete until it has reached its specified 28-day compressive strength.

3.2 CONCRETE FINISHES

A. Tolerances:

1. Class A: 1/8 IN in 10 FT.
2. Class B: 1/4 IN in 10 FT.

B. Surfaces Exposed to View:

1. Provide a smooth finish for exposed concrete surfaces and surfaces that are:
 - a. To be covered with a coating or covering material applied directly to concrete.
 - b. Scheduled for grout cleaned finish.
2. Remove fins and projections, and patch voids, air pockets, and honeycomb areas with cement grout.
3. Fill tie holes with nonshrink nonmetallic grout.

C. Surfaces Not Exposed to View:

1. Patch voids, air pockets and honeycomb areas with cement grout.
2. Fill tie holes with nonshrink nonmetallic grout.

D. Troweled Finish:

1. Float finish surface.
2. Next power trowel, and finally hand trowel.
3. Produce a smooth surface which is relatively free of defects with first hand troweling.
4. Perform additional trowelings by hand after surface has hardened sufficiently.
5. Final trowel when a ringing sound is produced as trowel is moved over surface.
6. Thoroughly consolidate surface by hand troweling.
7. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Class A tolerance.
8. On surfaces intended to support floor coverings remove any defects of sufficient magnitude that would show through floor covering by grinding.

3.3 GROUT

A. Preparation:

SECTION 03 00 00
CONCRETE- SMALL PROJECTS

1. Nonshrinking nonmetallic grout:
 - a. Clean concrete surface to receive grout.
 - b. Saturate concrete with water for 24 HRS prior to grouting.
 2. Epoxy grout: Apply only to clean, dry, sound surface.
- B. Application:
1. Nonshrinking nonmetallic grout:
 - a. Mix in a mechanical mixer.
 - b. Use no more water than necessary to produce flowable grout.
 - c. Place in accordance with manufacturer's instructions.
 - d. Completely fill all spaces and cavities below the bottom of baseplates.
 - e. Provide forms where baseplates and bedplates do not confine grout.
 - f. Where exposed to view, finish grout edges smooth.
 - g. Except where a slope is indicated on Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.
 - h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.
 - i. Wet cure grout for 7 days, minimum.
 2. Epoxy grout:
 - a. Mix and place in accordance with manufacturer's instructions.
 - b. Completely fill all cavities and spaces around dowels and anchors without voids.
 - c. Obtain manufacturer's field technical assistance as required to ensure proper placement.

3.4 FIELD QUALITY CONTROL

- A. Owner will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.
1. Contractor to cooperate with Owner in obtaining and testing samples.
- B. Tests During Construction:
1. Strength test - procedure:
 - a. Four cylinders, 6 IN DIA x 12 IN DIA or 4 IN DIA x 8 IN DIA, will be taken from each sample per ASTM C172 and C31.
 - b. Cylinders will be tested per ASTM C39:
 - 1) One at 7 days.
 - 2) 28 days.
 - 3) One spare to be discarded after 28 days if not used.
 2. Strength test - frequency:
 - a. Not less than one test each day concrete placed.
 - b. Not less than one test for each 50 CY or major fraction thereof placed in one day.
 - c. Not less than one test for each type of concrete poured.
 - d. Not less than one test for each concrete structure exceeding 2 CY volume.
 3. Slump test: Per ASTM C143.
 - a. Determined for each strength test sample.
 - b. Additional slump tests may be taken.
 4. Air content: Per ASTM C231, C173, and C138.
 - a. Determined for each strength test sample.
 5. Temperature: Determined for each strength test sample.
- C. Evaluation of Tests:
1. Strength test results: Average of 28-day strength of two cylinders from each sample.
 - a. If one cylinder manifests evidence of improper sampling, molding, handling, curing or testings, strength of remaining cylinder will be test result.
 - b. If both cylinders show any of above defects, test will be discarded.
- D. Acceptance of Concrete:
1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:

- a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
- b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.
2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures as directed by Engineer.
 - a. Perform additional tests and/or corrective measures at no additional cost to Owner.

3.5 SCHEDULES

- A. Form Types:
 1. Surfaces exposed to view:
 - a. Prefabricated or job-built wood forms.
 - b. Laid out in a regular and uniform pattern with long dimensions vertical and joints aligned.
 - c. Produce finished surfaces free from offsets, ridges, waves, and concave or convex areas.
 - d. Construct forms sufficiently tight to prevent leakage of mortar.
 2. Surfaces normally submerged or not normally exposed to view:
 - a. Wood or steel forms sufficiently tight to prevent leakage of mortar.
 3. Other types of forms may be used:
 - a. For surfaces not restricted to plywood or lined forms.
 - b. As backing for form lining.
- B. Grout:
 1. Nonshrinking nonmetallic grout: General use.
 2. Epoxy grout:
 - a. Grouting of dowels and anchor bolts into existing concrete.
 - b. Other uses indicated on Drawings.
 3. Sand cement grout: Keyways of precast members.
- C. Concrete:
 1. Precast concrete: Where indicated on Drawings.
 2. Normal weight concrete: All other locations; All *concrete*.
- D. Concrete Finishes:
 1. Grout cleaned finish: Where indicated on Drawings.
 2. Slab finishes:
 - a. Troweled finish: All slabs.

END OF SECTION

PAINTING AND FINISHES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers furnishing and applying paints and coatings to all specified surfaces.
- B. Painting in the well houses shall include piping, valves, fittings, walls and floors.

1.2 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

1.3 SUBMITTALS

- A. CONTRACTOR shall supply shop drawings for approval on all paint materials prior to installation. 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.

1.4 QUALITY ASSURANCE

- A. All inspection for quality assurance shall ultimately be the responsibility of the CONTRACTOR. The OWNER retains the right to observe, accept, or reject the work based on the results of the CONTRACTOR's inspection or inspection by the Construction Manager, at the 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 the CONSTRUCTION MANAGER.
- C. Inspection by the OWNER, or Construction Manager, or the waiver of inspection of any particular portion of the work, shall not be construed to relieve the CONTRACTOR of his responsibility to perform the work in accordance with these specifications.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply paint in extreme heat, temperatures below 40 degrees F, nor in dust, smoke-laden atmosphere, damp or humid weather.
- 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.

SECTION 09 91 00
PAINTING AND FINISHES

1.6 MEASUREMENT AND PAYMENT

- A. There shall be no separate measurement and payment for this section. Full compensation for painting shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which painting and finishing relate.

PART 2 - PRODUCTS

2.1 PAINT, SEALERS AND SURFACE FINISH MATERIALS

- A. All paints shall be Sherwin Williams® or approved equal except for the interior concrete floor surfaces and interior floor surfaces of the foundation walls which shall be Tnemec Company Inc. and the exposed water piping which shall be Wasser Corporation. If recommended by the paint manufacturer for a particular surface, primer shall be applied according to the paint manufacturer's recommendations. Paint shall be applied according to the following schedule, unless directed otherwise by CONSTRUCTION MANAGER.
- B. 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 A" finish. Products for the "Class A" finish are identified or specified in Section 03 30 00 - Cast-In-Place Concrete.
- C. Interior Above Grade 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.
- D. Floor Coating: Floor surfaces shall be painted with a primer/sealer followed by
two or more coats of polyurethane floor enamel. Volume of solids of
polyurethane shall be not less than 38 percent.
- E. External masonry and concrete sealer and coating: All exterior masonry and above grade concrete surfaces shall be coated with TEX-COTE Graffiti Gard III's Exterior/Interior Graffiti Repellent System (two component, solvent, aliphatic Urethane System), as manufactured by Textured Coatings of America, Inc. The TEX-Cote Graffiti Gard III's system shall consist of two basic coatings: 1. TY-Cote Clear - Base Coat which acts as a "fill coat" for the substrate and maintains clarity, and 2. TEX-COTE Graffiti Gard III's - Finish Coating, a two component, solvent, aliphatic urethane system clear finish.

Application	Reference	# of Coats	Min. Dry Thickness per Coat	Color	I.D. No.
Water Piping and Fittings	Wasser Ferrox	1 st 2 nd 3 rd	3-5 mil 5-7 mil 2-4 mil	Wisconsin Blue	MC-Zinc MC-CR MC-Ferrox
Valves and Hand wheels	Wasser Ferrox	2	2.0 mil	Wisconsin Blue	MC-Zinc MC-CR MC-Ferrox
Motor	B54Z Series	2	2.0 mil	Blue	
Electrical Conduit	A26 Series	2	1.5 mil	White	SW101
Interior Electrical Panels	A26 Series	2	1.5 mil	Gray	
Floors	Tnemec, Tneme-Liner, Series 61	2	10 mil	Gray	Per Owner
Masonry Walls	See Specs				
Wall, Trim, and Ceiling	A27W15	2	1.2 mil	White	SW101
Doors & Frames (both interior and exterior surfaces)	Primer: Macropoxy 646 Series, Final: Tile-Clad HS B62WZ Series	2	3.0		Per Owner

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. All painted or coated surfaces shall be prepared in accordance with the recommendations of the manufacturer of the material being used.
- B. Concrete floors shall be cured a minimum of 28 days and thoroughly etched with muriatic acid as recommended by the paint manufacturer. After etching, the muriatic acid shall be thoroughly removed with clean water. The concrete shall be allowed to dry not less than 48 hours following cleaning before application of the coating.
- C. Perform sandblasting for 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 Steel Structures Painting Council.

SECTION 09 91 00
PAINTING AND FINISHES

3.2 PROTECTION OF MATERIALS NOT TO BE PAINTED

- A. Remove, mask or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
- B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
- C. Protect working parts or mechanical and electrical equipment from damage.
- D. Mask openings to motors to prevent paint and other materials from entering the motors.

3.3 APPLICATION

- A. Exposed Metal Piping, Fittings and Valves shall be painted in accordance with the manufacturer's recommendations.
 - 1. Minimum Dry Film Thickness: See Section 2.01.A
 - 2. Each coat shall be free of runs, skips or "holidays". All excess paint and/or drips on floors, walls, and other surfaces which are not designated for paint shall be removed.
- B. Floor painting shall extend to the top of the foundation wall (a minimum of 8" above finished floor along wall areas).
- C. All work shall be done in accordance with the manufacturer's recommendations.

- END OF SECTION -

POTABLE WATER WELL EQUIPPING

Part 1 - GENERAL

1.1 DESCRIPTION

This section covers the equipping of a potable water well which shall include furnishing all materials, equipment, testing and labor to raise the well casing to elevation 4540.5±, equip the well with turbine type motor, pump, pump column, electrical connection, 1/4-inch diameter drop pipe level transducer, and disinfection.

1.2 GENERAL SCOPE OF WORK

Furnish and install the following components:

- 200 Hp submersible vertical turbine pump and motor assembly, electrical cable, drop pipe, level transducer, fittings, etc.

Disinfect the well and piping systems per AWWA standards;

1.3 SUBMITTALS

All submittals shall be made in accordance these Specifications and any other requirements stated herein.

1.4 DEFINITIONS

Definitions are presented in the Utah Administrative Code, R309.

Part 2 - MATERIALS

All materials shall meet the requirements of ANSI/AWWA A – 100 (NSF 61).

2.1 WATER FOR CONSTRUCTION

- a) Water required for equipping the well shall be provided by the Contractor; the Contractor will be responsible for furnishing all materials and equipment deemed necessary for transporting the water to the well site (unless otherwise provided by the city).

2.2 TURBINE PUMP AND MOTOR

The turbine pump and motor assembly shall be "SIMFLO" multi-stage, stainless steel pump, Model Number: SL11H (7 stages) or an approved equal. The pump and motor shall operate at 450 feet of pressure head, 1800 RPM at 1000 GPM, at greater than 80% or better efficiency, and at 200 HP.

Static water level has NOT been determined. Motor cable and appurtenant equipment and materials shall be included hereunder. Motor cable shall be sufficiently long to accommodate its connection within the well control panel.

2.3 LEVEL MONITORING SYSTEM

SECTION SP 13 11 00
POTABLE WATER WELL EQUIPPING

The pitless adapter shall be provided with a "Global Water" water level transducer and digital display model WL 400, or an approved equal. The level sensor shall sense water levels in the well between 0 feet and 100 feet.

2.4 COLUMN PIPE.

The Contractor will provide and install the column pipe along with a rubber torque arrestor which will aid in radial stabilization of the column pipe and pump.

Part 3 - CONSTRUCTION REQUIREMENTS

3.1 DISINFECTION OF THE WELL

All parts and materials to be installed in the well shall be cleaned and disinfected prior to their incorporation into the well. Well column pipe shall be scrubbed if necessary to remove any oil or grease, and sprayed with a chlorine solution, then rinsed with clean water before installation. Upon completion of the well equipping, the Contractor shall chlorinate the well in accordance with the standards or ANSI/AWWA C-654.

3.2 WELLHEAD, EQUIPMENT REMOVAL, AND CLEANUP

WELLHEAD - The well casing shall extend not less than 18-inches above the concrete floor elevation as shown in the DRAWINGS. There shall be no openings in the casing wall below its top. Measurement piping, electrical access ports, and grouted make-up pipes shall be installed in conformance the requirements of APWA and with these plans and specifications, the more stringent shall apply.

Part 4 - METHOD OF MEASUREMENT

Measurement of the various pay items associated with water well construction will be made according to the following schedule:

Well Pump & Motor	By the lump sum,
Column Pipe	By measuring the linear feet of pipe set in place and accepted in the well hole.
Drop Pipe	By measuring the linear feet of pipe set in place and accepted in the well hole.
Level Transducer	By the lump sum

Part 5 - BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price.

Pay Item	Unit
Well Pump & Motor	Lump Sum
(Size) Column Pipe	Linear Foot
Drop Pipe	Linear Foot
Level Transducer	Lump Sum

END OF SECTION

SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA) LOWER WELL SITE

PART 1 - GENERAL

1.1 DESCRIPTION

This section includes the Supervisory Control and Data Acquisition (SCADA) hardware, software and accessories.

Definitions

1. City and/or Owner: River Heights City
2. SCADA/Telemetry Contractor: Intermountain Environmental (601 West 1700 South Suite 120, Logan, Utah 84321). Contact at (435) 755-0744.
3. Others: General (& Electrical) Contractor for the work at the Lower Well and upgrading at certain facilities and sites throughout River Heights.
4. SCADA: Supervisory Control and Data Acquisition

1.2 SITE CONDITIONS

Examination of the site shall be made by the Contractor, who shall compare it with the drawings and specifications and satisfy himself as to the conditions under which the work is to be performed. He shall, at such time, ascertain and check all conditions which may affect his work. No allowance shall subsequently be made in his behalf for any extra expenses to which he may be put due to failure or neglect on his part to make such examination.

1.3 SCOPE OF WORK

The Contractor is to ensure that all required hardware, real-time controllers, human-machine interfacing ("HMI"), software, installation, calibration, and testing for all SCADA equipment is provided hereunder for a functional SCADA system. The Contractor is also responsible to ensure that all programming of software and programming of the SCADA system as required for full operation of the SCADA system is provided and checked. The Contractor is responsible to ensure that all electrical components (120/240 VAC wire/conduit and equipment) as required for the operation of the SCADA equipment are furnished and installed.

1.4 GUARANTEE/WARRANTY

The following guarantee is a part of the specification and shall be binding on the part of the Contractor.

"The Contractor guarantees that this installation is free from defects. He agrees to replace or repair, to the satisfaction of the Owner, any part of this installation which may fail or be determined unacceptable within a period of **three (3) years** after final acceptance."

Electrical/SCADA systems and equipment shall not be considered acceptable for substantial completion until they have performed in service continuously without malfunction for least thirty (30) days.

SECTION 13 40 00
SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA)

1.5 OPERATING INSTRUCTION MANUALS

An Operation and Maintenance Manual for the SCADA system and hardware shall be bound in a hard-backed binder and provided to the Owner in pdf format:

1. Provide a master index at the beginning of the manual showing all items included.
2. The first section of the manual shall consist of names, addresses and telephone number of the Controls Engineer, Panel Shop, General Contractor, and Electrical Contractor.
3. Provide a section for each different type of item of equipment.

Descriptive literatures (manufacturer's catalog data) of each manufactured item shall be included. Literature shall show capacities and size of equipment used and shall be marked indicating each specific item with all applicable data underlined

Operating instructions shall include:

1. General description of the electrical system.
2. Where applicable step-by-step procedure to follow in putting each piece of electrical equipment in operation.
3. Provide record drawings for the electrical control system showing the wiring of all related electrical control items, such as fuses, interlocks, electrical switches and relays. Record drawings shall be included in the Operations manual both in printed and electronic versions.
4. Test results of all items requiring testing as called for in the technical section of specifications.

Maintenance instructions shall include:

1. Manufacturer's maintenance instructions for each piece of electrical equipment installed in the project. Instructions should include installation instructions, parts numbers and lists, operation instructions of equipment, name of vendor, and maintenance and lubrication instructions.
2. A summary list of each piece of electrical equipment requiring lubrication, showing the name of the equipment, location, type and frequency of lubrication
3. A complete list of all electrical equipment used indicating name, model, serial number and nameplate data of each item, together with number and name of each system with which the item is associated.

Spare Parts Listing:

1. List of all recommended spare parts and modules for any control or power distribution equipment.
2. list of all fuses used in all equipment. List shall specify each type, size, voltage and current rating of each fuse. List shall also specify how many fuses of each type were used in the project, where they were installed and what equipment they supply.
3. List of all light bulbs used in the project. List shall specify type, size, voltage and wattage of each lamp or bulb installed. List shall specify how many of each lamp and the location where they are installed. List shall also specify recommended replacement intervals.

1.6 DISPOSITION OF EXISTING EQUIPMENT REMOVED FROM SERVICE

Existing equipment and materials such as cables, switches, existing instrumentation, conductors, etc., which are removed and not reused in the new installation shall remain the property of the Owner. Contractor shall deliver such equipment to storage place as directed. Items not wanted by the Owner shall be removed from the site by the contractor.

PART 2 - SCOPE OF SERVICES

The Owner's existing water distribution system SCADA and telemetry package was furnished and installed by Intermountain Environmental under a previous water improvement project. The Owner requests that Intermountain Environmental also furnish and install the SCADA well and site controls for this project under these contract documents.

2.1 LOWER WELL SITE ADDITION, OPERATION, AND INTEGRATION

A. Provide Lower Water Well integration including the following:

1. Onsite system startup assistance
2. PLC Programming for control panel
3. Well startup and operations testing
4. On-site testing

PART 3 - EXECUTION

3.1 BASIC SEQUENCE OF OPERATIONS

The Contractor shall perform the following basic sequence of operations to complete the installation of the SCADA system:

1. Select components and devices to be used in SCADA system.
2. Submit devices for review and approval.
3. Wire power, communications, input and output devices
4. Field check I/O wiring and perform loop checks
5. Program the Master Station HMI software and database
6. Program the RTU PLC's as required for the site
7. Testing and debug programming
8. Field test and start up PLC's
9. Provide owner with documentation and training on functional operation of the PLC system (O&M)
10. Provide Owner documentation as required.

The Owner and Engineer shall be involved at all phases of the installation. The Contractor shall plan on two review meetings with the Owner, integrator and the engineer to cover the final design, and functional operation. Minor adjustments by the Owner, Integrator or Engineer shall be made at no additional cost.

3.2 MINIMUM LOWER WELL INTEGRATION PROJECT LOOP REQUIREMENTS

A) Lower Well / Controls / Monitoring

1. RTU door open
2. Utility power fail status
3. RTU DC power fail status
4. Well water level: a) Log and trend drawdown level, b) Operator level setpoints, c) Low level alarm
5. Well high discharge pressure shutdown
6. Well flow meter: a) Flow rate, b) Flow totalizer, c) Log and trend flow
7. Well VFD: a) Operation/start/stop/speed, b) Automation, c) Setpoints
8. System pressure: a) Instantaneous, b) Log and trends, c) Setpoints
9. Pump-to-Waste Valve: a) Open/closed/delay/cycle
10. Pump-to-Waste Pipe Drain Valve: a) Open/closed
11. Vault entry alarm/notification

SECTION 13 40 00
SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA)

~ END OF SECTION ~

PIPE & PIPING SYSTEMS

Part 1 - GENERAL

1.1 DESCRIPTION

This section is a materials specification and is included for guidance in selecting materials for pipe and related fittings and appurtenances used in the construction of water and sewer systems.

1.2 RELATED WORK

Includes but is not limited to:

Section 02 22 20 - Waterline Pipe Installation

Section 15 23 00 - Waterline Valves and Hydrants

1.3 SUBMITTALS

The Contractor shall submit for review complete information, showing all pipe, materials, fittings, gaskets, couplings, coatings, linings, supports, mechanical restraints, thrust blocks and configuration prior to the delivery of any components to the project. All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall accompany each delivery of material.

1.4 DEFINITIONS

Not used.

Part 2 - MATERIALS

2.1 NSF COMPLIANCE

All pipe and materials furnished and installed for culinary use shall comply with National Sanitary Foundation (NSF) Standard 61. Also, all plastic pipe must be approved by the NSF for potable water use and shall carry the factory "NSF " stamped label on the pipe indicating such approval.

2.2 POLYVINYL CHLORIDE PIPE (PVC)

1. PVC PIPE FOR WATER LINE CONSTRUCTION – Shall be as follows:

- For sizes less than 4 inches OD, PVC pipe shall be Schedule Rated pressure pipe meeting the requirements of ASTM D1785 of the schedule and size shown on the Drawings.
- PVC pipe 4 inches and larger, shall be rigid, thermoplastic Class Rated pressure pipe meeting the requirements of ANSI/AWWA Standard C900 or C905 (latest revision). The pressure class or the dimensional ratio and the size shall be as shown on the Drawings.
- While Class Rated and Pressure Rated pipe materials are not interchangeable, when specifically allowed in the Contract Documents, for size 4" and larger, rigid thermoplastic Pressure Rated pressure pipe, meeting the requirements of ASTM D2241, may be furnished and installed. Operating pressure for this pipe shall be as shown on the Drawings.

SECTION 5 11 00 PIPE & PIPING SYSTEMS

2. FITTINGS FOR PVC PIPE:

Unless specifically authorized otherwise, fittings for 4 inch and larger size PVC pipe in underground service shall be ductile iron (DI) and shall meet the requirements of NSF 61 and ANSI/AWWA C-153. They shall have a standard coating of cement mortar on the interior surfaces in complies with AWWA C-104. DI fittings meeting these requirements may be used with smaller PVC piping. PVC fittings meeting the requirements of ANSI/AWWA C-907 may be used with PVC pipe smaller than 4 inches, and, in some instances, where specifically authorized, with PVC pipe sizes 4 inches through 8-inches.

2.3 DUCTILE IRON PIPE

1. INTERIOR COATING: The interior surface of all DI pipe shall be coated with a standard coating of cement-mortar in accordance with ANSI/AWWA Standard C-104 unless required otherwise in the Contract Documents. Field coating of DI pipe will not be acceptable.
2. BURIED PIPE: Unless shown otherwise on the Drawings, shall be as follows:
3. Buried ductile iron pipe shall be Thickness Class 51.
4. Shall meet requirements of ANSI/AWWA C-151.
5. Joints shall be bell and spigot or mechanical, which meet the requirements of ANSI/AWWA C-111.

EXPOSED PIPE – Shall meet these requirements, unless shown otherwise on the Drawings:

1. Exposed ductile iron pipe shall be Thickness Class 53.
2. Pipe shall comply with ANSI/AWWA Standard C-151.
3. Pipe joints shall be flanged, meeting the requirements of ANSI/AWWA C-115, or mechanical type couplings (MTC), meeting the requirements of ANSI/AWWA C-606. MTC shall be Victaulic grooved couplings, as manufactured by Victaulic Company of America or approved equal), unless shown otherwise on the drawings.
4. 3" to 12" compact flanged fittings shall be ductile iron and shall be produced in accordance with laying lengths specified in ANSI/AWWA C10/A21.10. Flange surface shall be faced and drilled in accordance with ANSI Class 125 B16.1. Nominal body thickness shall be Manufacturer's Standard, but shall not be less than those specified in ANSI/AWWA C153/A21.53 "Standards for Ductile Iron Compact Fittings". Flange thickness shall be in accordance with the Manufacturer's Standards. Working pressure rating shall be 250 psi for water. Fittings shall be made in the United States of America and shall not have been refurbished or reworked by anyone other than the manufacturer. When greater than 250 psi is called for on the plans, then the Supplier shall furnish higher class rated flanges. Standard Class 125 template for drilling shall be used for all flanges. Drilling templates shall be in multiples of four, so that fittings may be made to face in any quarter. Boltoles shall straddle the centerline and shall be equally spaced. Misalignment of boltholes of two opposing flanges shall not exceed 0.12 inches. Blind flanges 12 inches and over shall be provided with lifting eyes. Insulated flanges shall be provided where required.
5. Gaskets shall be full faced, 1/16-inch thick compressed sheets of Aramid fiber base, with nitrile binder and non stick coating, suitable for temperatures to 700°, pressures to 1000 psig and a pH range of 1 to 11. Blind flange gaskets shall cover the entire inside face of the flange and shall be cemented in place. Gaskets shall be as manufactured by John Crane, style 2160; Garlock, style 3000; or approved equal.

2.4 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

1. PIPE – Shall be as follows:
 - PE pipe shall be classified as a Type III, Grade P-34, Class C, Category 5, according to ASTM D1248. All PE pipe shall be manufactured according to ASTM D2513, D3035, F714, or API 15LE and AWWA C906.

**SECTION 15 11 00
PIPE & PIPING SYSTEMS**

- Pipe shall be made of high density, high molecular weight resin. PE plastic shall have a cell classification of 345434C as defined by ASTM D3350/AWWA C906. It shall be rated as PE3408 according to the requirements of the Plastics Pipe Institute. Internal pressure rating shall be as specified elsewhere in the project documents.
- 2. PE pipe shall be classified as a Type III, Grade P-34, Class C, Category 5, according to ASTM D1248. All PE pipe shall be manufactured according to ASTM D2513 D3035, F714, or API 15LE and AWWA C906.
- 3. Pipe shall be made of high density, high molecular weight resin. PE plastic shall have a cell classification of 345434C as defined by ASTM D3350/AWWA C906. It shall be rated as PE3408 according to the requirements of the Plastics Pipe Institute. Internal pressure rating shall be as specified elsewhere in the project documents.
- 4. FITTINGS FOR HDPE – Molded fittings shall be made of pre-blended virgin resins in accordance with the materials specifications of ASTM D1248. PE3408 fittings shall be made from a Type III, Class C, Category 5, Grade P-34 plastic resin having a cell classification of 345434C according to ASTM D3350. Socket fusion fittings shall be manufactured in compliance with ASTM D2683 and butt fusion fittings with ASTM D3261. Measurements of fittings shall be as required by ASTM D2122. All fittings shall be compatible for heat fusion with any pipe manufactured for like or similar resins.

Heat welded Flange Adapter Couplings shall be used for transition to other type piping material. The Contractor shall follow the manufacturer's recommendations, as well as specified procedures herein in fusing fittings to the polyethylene pipe.

- 5. Heat welded Flange Adapter Couplings shall be used for transition to other type piping material. The Contractor shall follow the manufacturers recommendations, as well as specified procedures herein in fusing fittings to the polyethylene pipe.

2.5 GALVANIZED IRON PIPE AND FITTINGS

- 1. Shall be of the schedule rating shown on the Drawings and shall be used only in exposed, non-corrosive atmospheres where piping diameters are less than 4 inches.

2.6 PIPE AND FITTINGS FOR WATER SERVICE LINES

- 1. Shall meet the requirements provided in Section 15234 for water service connections.

2.7 PIPE FOR GRAVITY SEWER SYSTEMS

Gravity sewer pipelines may be constructed with PVC or polyethylene (PE) plastic sewer pipe and fittings. Such materials shall be of the type, configuration and size shown on the Drawings and/or on the Bid Schedule.

PVC PIPE: All PVC sewer pipe and fittings shall meet the standards of ASTM D3034 and F679. Such pipe shall be manufactured with a rubber gasketed joining system which meets ASTM D3212 and shall be furnished with a standard dimensional ratio of 35 (SDR 35) for wall thickness, unless shown otherwise on the Drawings.

PE PIPE: All PE sewer pipe and shall be smooth, solid wall, high density polyethylene pipe manufactured from PE 3408 material conforming to ASTM D1248, Type III, Class C, Category 5, Grade P34 with a P3408 rating from the Plastic Pipe Institute. Fittings for this pipe shall be molded from a polyethylene compound equal to or exceeding the properties of the pipe being supplied.

2.8 PIPE FOR PRESSURE SEWER SYSTEMS

SECTION 5 11 00 PIPE & PIPING SYSTEMS

Pressure sewer pipelines shall be constructed with DI, PVC, or PE plastic sewer pipe. Fittings and materials shall be of the type, SDR rating, (or pressure class) and size shown on the Drawings and/or on the Bid Schedule.

PVC PIPE - All PVC pipe for pressure sewer lines shall be rigid, pressure rated, thermoplastic pipe which meets the standards of ASTM D2241. Fittings for PVC pipelines shall be Class 50, cement mortar lined, rubber gasketed, DI which meet the requirements of ANSI/AWWA C-153 and C-104.

PE PIPE - PE pipe for pressure sewer lines shall be smooth, solid wall, high density polyethylene pipe manufactured from PE 3408 material conforming to ASTM D1248, Type III, Class C, Category 5, Grade P34 with a P3408 rating from the Plastic Pipe Institute. Fittings for this pipe shall be molded from a polyethylene compound equal to or exceeding the properties of the pipe being supplied.

2.9 PIPE FOR FITTINGS AND IRRIGATION SYSTEMS

Shall be either DI or Pressure Rated PVC, of the type and class shown on the Drawings, for line diameters 4-inches and greater. Buried lines smaller than 4 inches in diameter shall be Schedule Rated PVC as shown on the Drawings.

2.10 PIPE FOR DRAIN SYSTEMS

Piping for sub-drainage may be constructed with polyvinyl chloride (PVC) or polyethylene (PE) plastic non-pressure drainage or sewer pipe and fittings. Such materials shall be of the type, configuration and size shown on the Drawings and/or on the Bid Schedule.

PVC PIPE - All PVC drainage pipe and fittings shall meet the standards of ASTM F794. Such pipe shall be manufactured with a rubber gasketed joining system which meets ASTM D3212 and may be furnished with ribbed, corrugated or smooth exterior walls with smooth interior wall surfaces, unless shown otherwise on the Drawings. Rubber gasketed joints will not be required for collection pipe applications with perforated or slotted pipe sections.

PE PIPE - All PE drainage pipe shall be solid, corrugated or ribbed wall high-density polyethylene pipe with smooth interior wall surfaces. Material shall conform to ASTM D1248, Type III, Class C, Category 5, Grade P34 with a P3408 rating from the Plastic Pipe Institute. Fittings for this pipe shall be molded from a polyethylene compound and with equivalent properties and configurations specifically designed to fit the pipe being supplied. shall be of the schedule rating shown on the Drawings and shall be used only in exposed, non-corrosive atmospheres where piping diameters are less than 4 inches.

2.11 PIPE MISCELLANEOUS FITTINGS AND MATERIALS

PIPE SUPPORTS - Floor mounted pipe supports for suspended, exposed piping systems shall be adjustable stanchion type supports designed to cradle the pipe diameter by 170 degrees. The support shall fit ductile iron or steel diameters snugly, without excessive gaps between the support and the pipe. Support saddle width shall be a minimum of 2 inches wide. The support must offer a minimum of 3 inches of final adjustment, after installation. Supports shall be supplied with independent base and adjustment collar designed to accept standard sized Schedule 40 galvanized steel pipe for coarse adjustment. Supports shall be fabricated from A36 mild steel, and shall have an electro-galvanized finish. Floor mounted pipe supports shall be the Standon Model S92 or C92 as manufactured by Material Resources, Inc., 22700 N. W. Quatama Street, Hillsboro Oregon 97124, or approved equal. The standard required model shall be the S92. Non-standard materials or model numbers shall be as specified on the Drawings.

"Y" STRAINERS - shall be constructed of high-tensile ASTM A126 Class B Cast Iron with blow-off connections and self-aligning cylindrical screens and shall be equal to Watts Regulator Series 77F or better quality.

FASTENERS – Fastener requirements are as follows:

2. Unless otherwise required in these Specifications or shown on the Drawings, all bolting hardware for buried pipe, fittings, valves, and components shall be of manufacturer's standard materials.
3. Unless otherwise required in these Specifications or shown on the Drawings, all bolting materials for exposed pipe, fittings, valves, and components shall be Type 316 stainless steel. Where space restrictions preclude the use of regular bolts, stainless steel threaded studs may be used on all valve flange connections.
4. In all instances where stainless steel threaded fasteners are used, a coating of an approved, permanent anti-seize compound shall be applied to the fastener to prevent galling and to assist in disassembly.
5. All bolts and/or studs shall extend through the nuts at least 1/4 inch.

COUPLINGS – Couplings shall meet the following requirements:

6. Unless prescribed otherwise on the Drawings or in these Specifications, couplings shall meet the requirements of ANSI/AWWA C-219. All flexible couplings shall meet the minimum requirements of Smith Blair 400 series.
7. Sleeves shall have a smooth inside taper and there shall be no surface irregularities on any sealing surface. Gaskets shall be suitable for the project application.
8. Flexible couplings for buried DI and PVC pipe sizes 2 through 16 inches in diameter shall be fabricated of steel or ductile iron. For pipe sizes larger than 16 inches, flexible couplings shall be of steel. Coupling components for use in potable water systems shall be factory coated with an FDA approved, bonded epoxy coating, applied to an average 12 mil thickness.
9. Flexible couplings for exposed pipe shall be manufactured of steel, unless shown otherwise on the Drawings, or approved by the Engineer. Coupling components for use in potable water systems shall be factory coated with an FDA approved, fusion-bonded epoxy coating, applied to an average 12 mil thickness.

RESTRAINT HARNESS – Where required, restraint harness for bell and spigot pipe joints shall be as manufactured by EBAA Iron Co. or an approved equal. The restraint shall consist of a split bell ring to go behind the bell and a split, serrated ring to grip the pipe on the other side of the joint. The harness shall be held together with clamping bolts and tie bolts. The rings shall be fabricated of 60-42-10 DI conforming to ASTM A-536. Clamping bolts shall be grade 5 galvanized machine bolts. Tie bolts are of low alloy steel. The harness shall have a minimum working pressure of 150 psi. Harness size shall be as shown in the schedule on the Drawings or as specified in the Special Provisions.

VALVES AND FITTINGS - Shall be as specified in their respective sections in these Specifications.

BOXES AND ENCLOSURES – Shall be of the size, type, and configuration indicated on the Drawings and Contract Documents.

~ END OF SECTION ~

DIVISION 26 - ELECTRICAL

260500	COMMON WORK RESULTS FOR ELECTRICAL
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260523	CONTROL-VOLTAGE ELECTRICAL POWER CABLES
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
260548	VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
260573	OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY
262200	LOW-VOLTAGE TRANSFORMERS
262416	PANELBOARDS
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SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 1270 mm (50 inches) and no side more than 400 mm (16 inches), thickness shall be 1.3 mm (0.052 inch).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 1270 mm (50 inches) and 1 or more sides equal to, or more than, 400 mm (16 inches), thickness shall be 3.5 mm (0.138 inch).

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Carbon steel or Stainless steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 50 mm (2 inches) above finished floor level.
- G. Size pipe sleeves to provide 6.4-mm (1/4-inch) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 25-mm (1-inch) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 25-mm (1-inch) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.

- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. Alpha Wire.
 - 3. Belden Inc.
 - 4. Encore Wire Corporation.
 - 5. General Cable Technologies Corporation.
 - 6. Southwire Incorporated.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.
- D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Type SOW with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Gardner Bender.
 - 3. Hubbell Power Systems, Inc.
 - 4. Ideal Industries, Inc.
 - 5. Ilsco; a branch of Bardes Corporation.
 - 6. NSi Industries LLC.
 - 7. O-Z/Gedney; a brand of the EGS Electrical Group.
 - 8. 3M; Electrical Markets Division.
 - 9. Tyco Electronics.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance, Feeders, and Branch Circuits: Type THHN-2-THWN-2, single conductors in raceway.
- B. Cord Drops and Portable Appliance Connections: Type SOW, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION 260519

SECTION 260523

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. UTP cabling.
 - 2. RS-485 cabling.
 - 3. Low-voltage control cabling.
 - 4. Control-circuit conductors.
 - 5. Identification products.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.
- D. RCDD: Registered Communications Distribution Designer.
- E. UTP: Unshielded twisted pair.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

- A. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262 by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

1. Flame Travel Distance: 60 inches (1520 mm) or less.
 2. Peak Optical Smoke Density: 0.5 or less.
 3. Average Optical Smoke Density: 0.15 or less.
- B. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- C. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 UTP CABLE

- A. Comply with division 27 section “Communications Horizontal Cabling”

2.4 UTP CABLE HARDWARE

- A. Comply with division 27 section “Communications Horizontal Cabling”

2.5 TWIN-AXIAL DATA HIGHWAY CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, quantity as required for application, No. 20 AWG, stranded (7x28) tinned-copper conductors.
 2. Plastic insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. Plastic jacket.
 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 6. Flame Resistance: Comply with NFPA 262.

2.6 RS-485 CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 2. Fluorinated ethylene propylene insulation.
 3. Unshielded.
 4. Fluorinated ethylene propylene jacket.
 5. Flame Resistance: NFPA 262.

2.7 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with NFPA 262.

2.8 CONTROL-CIRCUIT CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Encore Wire Corporation.
 - 2. General Cable Technologies Corporation.
 - 3. Southwire Company.
- B. Class 1 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.
- C. Class 2 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.
- D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.

2.9 SOURCE QUALITY CONTROL

- A. Comply with Division 27 section "Communications Horizontal Cabling" for UTP cabling.
- B. Cable will be considered defective if it does not pass tests and inspections.

PART 3 - EXECUTION

3.1 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
 - 1. Outlet boxes shall be no smaller than 4 inches (102 mm) square by 2-1/8 inches (53 mm) deep with extension ring sized to bring edge of ring to within 1/8 inch (3.1 mm) of the finished wall surface.
 - 2. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.
- D. Raceway Installation in Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard if entering the room from overhead.
 - 4. Extend conduits 3 inches (75 mm) above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C Series of standards.
 - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems."
 - 3. Terminate all conductors and optical fibers; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Cables may not be spliced.
 - 5. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
 - 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
 - 9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Monitor cable pull tensions.
 - 10. Support: Do not allow cables to lay on removable ceiling tiles.
 - 11. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
- C. UTP Cable Installation:
 - 1. Comply with division 27 section "Communications Horizontal Cabling"
- D. Installation of Control-Circuit Conductors:
 - 1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- E. Optical-Fiber Cable Installation:
 - 1. Comply with division 27 section "Communications Horizontal Cabling"
- F. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 30 inches (760 mm) apart.
 - 3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.
- G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches (305 mm).
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches (305 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

3.4 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 1. Class 1 remote-control and signal circuits; No 14 AWG.
 2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.5 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."

- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.6 GROUNDING

- A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Visually inspect UTP and optical-fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 260523

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.3 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Ground rods.
 - 2. Grounding arrangements and connections for separately derived systems.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 4. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid or stranded conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches (600 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at ground rods and as otherwise indicated.
 - 3. Connections to Ground Rods: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- F. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.
 - 1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Section 260548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with conduit clamps.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 6 inches (150 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 4000-psi (27.5-MPa), 28-day compressive-strength concrete.
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. Anamet Electrical, Inc.
 - 4. Electri-Flex Company.
 - 5. O-Z/Gedney; a brand of EGS Electrical Group.
 - 6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
 - 7. Republic Conduit.
 - 8. Robroy Industries.
 - 9. Southwire Company.
 - 10. Thomas & Betts Corporation.
 - 11. Western Tube and Conduit Corporation.
 - 12. Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
- F. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 1. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- G. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.
 - 3. Arnco Corporation.
 - 4. CANTEX Inc.
 - 5. CertainTeed Corp.
 - 6. Condux International, Inc.
 - 7. Electri-Flex Company.
 - 8. Kraloy.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Niedax-Kleinhuis USA, Inc.
 - 11. RACO; a Hubbell company.
 - 12. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Continuous HDPE: Comply with UL 651B.
- E. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman; a Pentair company.
 - 3. Mono-Systems, Inc.

- 4. Square D; a brand of Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 3R, Type 4, or Type 12 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type and Flanged-and-gasketed type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. FSR Inc.
 - 6. Hoffman; a Pentair company.
 - 7. Hubbell Incorporated; Killark Division.
 - 8. Kraloy.
 - 9. Milbank Manufacturing Co.
 - 10. Mono-Systems, Inc.
 - 11. O-Z/Gedney; a brand of EGS Electrical Group.
 - 12. RACO; a Hubbell Company.
 - 13. Robroy Industries.
 - 14. Spring City Electrical Manufacturing Company.
 - 15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
 - 16. Thomas & Betts Corporation.
 - 17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- J. Gangable boxes are prohibited.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R, Type 4, or Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:
 - 1. NEMA 250, Type 3R, Type 4, or Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation; Hubbell Power Systems.
 - d. NewBasis.
 - e. Oldcastle Precast, Inc.; Christy Concrete Products.
 - f. Synertech Moulded Products; a division of Oldcastle Precast, Inc.
 - 2. Standard: Comply with SCTE 77.
 - 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 - 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 - 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 6. Cover Legend: Molded lettering, "ELECTRIC".

7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 1. Aboveground: GRC.
 2. Underground Conduit: RNC, Type EPC-40-PVC, direct buried unless noted as concrete encased on drawings.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 1. Exposed: GRC. Raceway locations include the following:
 2. Concealed in Ceilings and Interior Walls and Partitions: GRC.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 4. Damp or Wet Locations: GRC.
 5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 3R, 4, or 4X stainless steel in damp, wet, or corrosive locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- G. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from RNC, Type EPC-40-PVC to GRC before rising above floor.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal

bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

- N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- R. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- V. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit foreequipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
 2. Install backfill.
 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
 4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

- a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
- 5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - 2. Sealing Elements: EPDM or Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel or Stainless steel.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Presealed Systems.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260548

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Restrained spring isolators.
 - 3. Channel support systems.
 - 4. Restraint cables.
 - 5. Hanger rod stiffeners.
 - 6. Anchorage bushings and washers.
- B. Related Sections include the following:
 - 1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: D.
 - 1. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.
 - a. Component Importance Factor:
 - 1) General: 1.0.
 - 2) Life Safety (EM): 1.5
 - b. Component Response Modification Factor:

- 1) Fixtures: 1.5
- 2) Equipment: 2.5
- 3) Conduit and Cables: 5.0.

c. Component Amplification Factor: 2.5.

2. Design Spectral Response Acceleration at Short Periods (0.2 Second): 173%.
3. Design Spectral Response Acceleration at 1.0-Second Period: 76%.

1.5 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Ace Mountings Co., Inc.
 2. Amber/Booth Company, Inc.
 3. California Dynamics Corporation.
 4. Isolation Technology, Inc.
 5. Kinetics Noise Control.
 6. Mason Industries.
 7. Vibration Eliminator Co., Inc.
 8. Vibration Isolation.
 9. Vibration Mountings & Controls, Inc.
- B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 1. Resilient Material: Oil- and water-resistant rubber.

2.2 SEISMIC-RESTRAINT DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Amber/Booth Company, Inc.
 - 2. California Dynamics Corporation.
 - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 4. Hilti Inc.
 - 5. Loos & Co.; Seismic Earthquake Division.
 - 6. Mason Industries.
 - 7. TOLCO Incorporated; a brand of NIBCO INC.
 - 8. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four Insert number times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
 9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.

- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification for conductors.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Colors for Raceways Carrying Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING."
- D. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.
- H. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.
- I. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
3. Arc Flash Hazard Warning: Manufacturer standard indicating hazardous conditions when exposed.

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.7 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- K. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Feeders from an external source More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot (3-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral: White with colored stripe matching associated phase color
 - 5) Ground: Green
 - c. Colors for 480/277-V Circuits:

- 1) Phase A: Brown.
 - 2) Phase B: Yellow.
 - 3) Phase C: Violet.
 - 4) Neutral: Gray with colored stripe matching associated phase color
 - 5) Ground: Green with gray stripe
- d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags or self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- E. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

- a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
- d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
- b. Enclosures and electrical cabinets.
- c. Access doors and panels for concealed electrical items.
- d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
- e. Emergency system boxes and enclosures.
- f. Enclosed switches.
- g. Enclosed circuit breakers.
- h. Push-button stations.
- i. Power transfer equipment.
- j. Contactors.
- k. Remote-controlled switches, dimmer modules, and control devices.
- l. Power-generating units.

END OF SECTION 260553

SECTION 262200

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: Distribution, dry-type transformers rated 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
 - 2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
- B. Shop Drawings:
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 - 3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For transformers, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acme Electric Corporation.
 - 2. Eaton.
 - 3. Federal Pacific.
 - 4. General Electric Company.
 - 5. Hammond Power Solutions Inc.
 - 6. SIEMENS Industry, Inc.; Energy Management Division.
 - 7. Sola/Hevi-Duty; a brand of Emerson Electric Co.
 - 8. Square D; by Schneider Electric.
- B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Transformers Rated 15 kVA and Larger: Comply with NEMA TP 1 energy-efficiency levels as verified by testing according to NEMA TP 2.
- D. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
- E. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Copper.
- F. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.
- G. Shipping Restraints: Paint or otherwise color code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Cores: One leg per phase.
- D. Enclosure: Totally enclosed, nonventilated.
 - 1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
 - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
- E. Transformer Enclosure Finish: Comply with NEMA 250.
 - 1. Finish Color: Gray.
- F. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- G. Insulation Class, Smaller than 30 kVA: 185 deg C, UL-component-recognized insulation system with a maximum of 115-deg C rise above 40-deg C ambient temperature.
- H. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150-deg C rise above 40-deg C ambient temperature.
- I. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:
 - 1. 30 to 50 kVA: 45 dBA.
 - 2. 51 to 150 kVA: 50 dBA.

2.4 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.
 - 1. Resistance measurements of all windings at the rated voltage connections and at all tap connections.
 - 2. Ratio tests at the rated voltage connections and at all tap connections.
 - 3. Phase relation and polarity tests at the rated voltage connections.
 - 4. No load losses, and excitation current and rated voltage at the rated voltage connections.
 - 5. Impedance and load losses at rated current and rated frequency at the rated voltage connections.
 - 6. Applied and induced tensile tests.
 - 7. Regulation and efficiency at rated load and voltage.
 - 8. Insulation Resistance Tests:

- a. High-voltage to ground.
 - b. Low-voltage to ground.
 - c. High-voltage to low-voltage.
- 9. Temperature tests.
- B. Factory Sound-Level Tests: Conduct prototype sound-level tests on production-line products.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- B. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" or Section 033053 "Miscellaneous Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
 - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- C. Secure transformer to concrete base according to manufacturer's written instructions.
- D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- E. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Remove and replace units that do not pass tests or inspections and retest as specified above.
- C. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. SPD: Surge Protective Device

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.
 - 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C)] to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner no fewer than two weeks in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without Owner's written permission.
 - 3. Comply with NFPA 70E.

1.11 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in SManufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Schneider Electric USA, Inc.
- B. Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
 - 4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- D. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

- 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.3 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, power and feeder distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- C. Mains: As indicated on drawings.
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: As indicated on drawings.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - e. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
 - f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 - 2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to panelboards.
 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.
- H. Install filler plates in unused spaces.
- I. Stub spare conduits as follows:
1. (1) 3/4" spare conduit for each (3) spare breakers
 2. (1) 3/4" spare conduit for each (3) spaces
 3. (1) 1" spare conduit for each (20) spaces or fraction thereof counting all possible spaces in the panel.
 4. For panels with 200-amp capacity or more provide (1) 2" spare conduit for each multiple of 200-amps or fraction thereof.
 5. Stub conduits into accessible attics, above ceilings, or in other location directed by owner.
- J. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- C. Tests and Inspections:
1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION 262416

SECTION 262726
WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Weather-resistant receptacles.
 - 3. Wall-switch and exterior occupancy sensors.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton (Arrow Hart).
 - 2. Hubbell Incorporated; Wiring Device-Kellems.
 - 3. Leviton Manufacturing Co., Inc.
 - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
- B. Corrosion-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement and FS W-C-596.
 - 1. Description: Corrosion resistant face, yoke, and assembly.

2.4 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

2.5 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

2.6 CORD AND PLUG SETS

- A. Description:
 - 1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
 - 3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
- C. Pilot-Light Switches, 20 A:
 - 1. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

2.8 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Unfinished Spaces: Galvanized steel.
 - 3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.9 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Corrosion Resistant Devices: Yellow
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

- 2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, machine, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262913

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes the following enclosed controllers rated 600 V and less:
 - 1. Full-voltage manual.
- B. Related Section:
 - 1. Section 262923 "Variable-Frequency Motor Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on variable torque loads in ranges up to 200 hp.

1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.
- G. SCR: Silicon-controlled rectifier.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

- A. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Routine maintenance requirements for enclosed controllers and installed components.
 - 2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
 - 3. Manufacturer's written instructions for setting field-adjustable overload relays.
 - 4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 30 deg C (minus 22 deg F) and not exceeding 40 deg C (104 deg F).

2. Altitude: Not exceeding 2010 m (6600 feet).

1.11 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- B. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - c. Rockwell Automation, Inc.; Allen-Bradley brand.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D; a brand of Schneider Electric.
 2. Configuration: Nonreversing.
 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type or melting alloy type.
 4. Red pilot light.
- C. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - c. Rockwell Automation, Inc.; Allen-Bradley brand.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D; a brand of Schneider Electric.
 2. Configuration: Nonreversing.
 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button; bimetallic type or melting alloy type.
 4. Red pilot light.
 5. Two, reversible, N.O./N.C. auxiliary contact.

2.2 ENCLOSURES

- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
 - 1. Dry and Clean Indoor Locations: Type 1.
 - 2. Outdoor Locations: Type 3R.
 - 3. Wash-Down Areas: Type 4X, stainless steel.
 - 4. Other Wet or Damp Indoor Locations: Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.3 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 - 1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.
 - a. Push Buttons: Recessed types; maintained or momentary as indicated.
 - b. Pilot Lights: LED types; colors as indicated; push to test.
 - c. Selector Switches: Rotary type.
- B. Reversible N.C./N.O. auxiliary contact(s).
- C. Cover gaskets for Type 1 enclosures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- C. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 ADJUSTING

- A. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

3.6 PROTECTION

- A. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 263213

ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes packaged engine-generator sets for emergency and standby power supply with the following features:
 - 1. Diesel engine.
 - 2. Unit-mounted cooling system.
 - 3. Unit-mounted and remote-mounted control and monitoring.
 - 4. Fuel system.
- B. Related Requirements:
 - 1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- B. EPS: Emergency power supply.
- C. EPSS: Emergency power supply system.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Include thermal damage curve for generator.
 - 3. Include time-current characteristic curves for generator protective device.
 - 4. Include fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
 - 5. Include generator efficiency at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
 - 6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor, with air supply temperature of 95, 80, 70, and 50 deg F. Provide drawings showing requirements and limitations for location of air intake and exhausts.
 - 7. Include generator characteristics, including, but not limited to kw rating, efficiency, reactances, and short-circuit current capability.

- B. Shop Drawings:
1. Include plans and elevations for engine-generator set and other components specified. Indicate access requirements affected by height of subbase fuel tank.
 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Identify fluid drain ports and clearance requirements for proper fluid drain.
 4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
 6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Seismic Qualification Certificates: For engine-generator set, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails identify center of gravity and total weight including full fuel tank, external silencer, subbase-mounted fuel tank, and each piece of equipment not integral to the engine-generator set, and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Source quality-control reports, including, but not limited to the following:
1. Certified summary of prototype-unit test report.
 2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
 3. Report of sound generation.
 4. Report of exhaust emissions showing compliance with applicable regulations.
 5. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- D. Field quality-control reports.
- E. Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
 - b. Operating instructions laminated and mounted adjacent to generator location.
 - c. Training plan.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: One for every 10 of each type and rating but no fewer than one of each.
 - 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
 - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved by manufacturer.
- B. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cummins Power Generation.
- B. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Engine-generator set housing, subbase fuel tank, engine-generator set, batteries, battery racks, silencers, and sound attenuating equipment, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Component Importance Factor: 1.5.
- B. ASME Compliance: Comply with ASME B15.1.
- C. NFPA Compliance:
 - 1. Comply with NFPA 37.
 - 2. Comply with NFPA 70.
 - 3. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- D. UL Compliance: Comply with UL 2200.

- E. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.
- F. Noise Emission: Comply with applicable state and local government requirements for maximum noise level inside adjacent building due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
- G. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: 5 to 50 deg C.
 - 2. Relative Humidity: Zero to 95 percent.
 - 3. Altitude: Sea level to 4500 feet (1830 m).

2.3 ASSEMBLY DESCRIPTION

- A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- C. EPSS Class: Engine-generator set shall be classified as a Class 48 in accordance with NFPA 110.
- D. Induction Method: Turbocharged.
- E. Governor: Adjustable isochronous, with speed sensing.
- F. Emissions: Comply with EPA Tier 3 requirements.
- G. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
 - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- H. Dimensions: Generator package maximum allowable dimensions:
 - 1. 180" Long
 - 2. 69" Wide
- I. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.
 - 2. Output Connections: Three-phase, four wire.
 - 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- J. Generator-Set Performance:
 - 1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 - 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.

3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.4 ENGINE

- A. Fuel: Fuel oil, Grade DF-2.
- B. Rated Engine Speed: 1800 rpm.
- C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).
- D. Lubrication System: The following items are mounted on engine or skid:
 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- E. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
- F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
 1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
 - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

- G. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1. Minimum sound attenuation of 25 dB at 500 Hz.
 - 2. Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be 78 dBA or less.
- H. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- I. Starting System: 12-V electric, with negative ground.
 - 1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
 - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 - 4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
 - 5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 - 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
 - 7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
 - 8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 A minimum continuous rating.
 - 9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:
 - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F (minus 40 deg C) to 140 deg F (plus 60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 DIESEL FUEL-OIL SYSTEM

- A. Comply with NFPA 30.
- B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in Section 231113 "Facility Fuel-Oil Piping." Cast iron, aluminum, copper, and galvanizing shall not be used in the fuel-oil system.

- C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.
- D. Fuel Filtering: Remove water and contaminants larger than 1 micron.
- E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- F. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:
 - 1. Tank level indicator.
 - 2. Fuel-Tank Capacity: Minimum 4-hours at full load plus fuel required for periodic maintenance operations between fuel refills
 - 3. Leak detection in interstitial space.
 - 4. Vandal-resistant fill cap.
 - 5. Containment Provisions: Comply with requirements of authorities having jurisdiction.
 - 6. Dimension restrictions as noted on drawings

2.6 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.
- B. Provide minimum run time control set for 30 minutes with override only by operation of a remote emergency-stop switch.
- C. Comply with UL 508A.
- D. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine-generator set battery.
- E. Indicating Devices : As required by NFPA 110 for Level 1 system, including the following:
 - 1. AC voltmeter.
 - 2. AC ammeter.
 - 3. AC frequency meter.
 - 4. EPS supplying load indicator.
 - 5. Ammeter and voltmeter phase-selector switches.
 - 6. DC voltmeter (alternator battery charging).
 - 7. Engine-coolant temperature gage.
 - 8. Engine lubricating-oil pressure gage.
 - 9. Running-time meter.
 - 10. Current and Potential Transformers: Instrument accuracy class.
- F. Protective Devices and Controls in Local Control Panel: Shutdown devices and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:
 - 1. Start-stop switch.
 - 2. Overcrank shutdown device.
 - 3. Overspeed shutdown device.
 - 4. Coolant high-temperature shutdown device.
 - 5. Coolant low-level shutdown device.

6. Low lube oil pressure shutdown device.
 7. Air shutdown damper shutdown device when used.
 8. Overcrank alarm.
 9. Overspeed alarm.
 10. Coolant high-temperature alarm.
 11. Coolant low-temperature alarm.
 12. Coolant low-level alarm.
 13. Low lube oil pressure alarm.
 14. Air shutdown damper alarm when used.
 15. Lamp test.
 16. Contacts for local and remote common alarm.
 17. Coolant high-temperature prealarm.
 18. Generator-voltage adjusting rheostat.
 19. Main fuel tank low-level alarm.
 - a. Low fuel level alarm shall be initiated when the level falls below that required for operation for the duration required in "Fuel Tank Capacity" Paragraph in "Diesel Fuel-Oil System" Article.
 20. Run-Off-Auto switch.
 21. Control switch not in automatic position alarm.
 22. Low cranking voltage alarm.
 23. Battery-charger malfunction alarm.
 24. Battery low-voltage alarm.
 25. Battery high-voltage alarm.
- G. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- H. Connection to Datalink: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication. Provide connections for datalink transmission of indications to remote data terminals via ModBus.
- I. Common Remote Panel with Common Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel. Remote panel shall be powered from the engine-generator set battery.
- J. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- K. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.
- B. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
 2. Trip Settings: Selected to coordinate with generator thermal damage curve.
 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.

- 4. Mounting: Adjacent to or integrated with control and monitoring panel.
- C. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.
 - 1. Indicate ground fault with other generator-set alarm indications.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide 12 lead alternator.
- E. Range: Provide broad range of output voltage by adjusting the excitation level.
- F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- G. Enclosure: Dripproof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.
 - 1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
 - 2. Maintain voltage within 30 percent on one step, full load.
 - 3. Provide anti-hunt provision to stabilize voltage.
 - 4. Maintain frequency within 10 percent and stabilize at rated frequency within 2 seconds.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 12 percent, maximum.

2.9 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - 1. Material: Standard neoprene or Natural rubber separated by steel shims.
 - 2. Shore "A" Scale Durometer Rating: As recommended by manufacturer.
 - 3. Number of Layers: Three.
 - 4. Minimum Deflection: 1 inch (25 mm).
- B. Comply with requirements in Section 232116 "Hydronic Piping Specialties" for vibration isolation and flexible connectors materials for steel piping.
- C. Comply with requirements in Section 233113 "Metal Ducts" for vibration isolation and flexible connector materials for exhaust shroud and ductwork.

- D. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.10 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 - 2. Test generator, exciter, and voltage regulator as a unit.
 - 3. Full load run.
 - 4. Maximum power.
 - 5. Voltage regulation.
 - 6. Transient and steady-state governing.
 - 7. Single-step load pickup.
 - 8. Safety shutdown.
 - 9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than two working weeks in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Owner's written permission.

3.3 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Equipment Mounting:
 - 1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 - 2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
 - 3. Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators. These items are specified in Section 077200 "Roof Accessories."
- C. Install packaged engine-generator to provide access, without removing connections or accessories, for periodic maintenance.
- D. Install packaged engine-generator with elastomeric isolator pads having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases.
- E. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.
 - 1. Install flexible connectors and steel piping materials according to requirements in Section 232116 Hydronic Piping Specialties."
 - 2. Insulate muffler/silencer and exhaust system components according to requirements in Section 230719 "HVAC Piping Insulation."
 - 3. Install isolating thimbles where exhaust piping penetrates combustible surfaces with a minimum of 9 inches (225 mm) clearance from combustibles.
- F. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints.
- G. Installation requirements for piping materials and flexible connectors are specified in Section 232116 "Hydronic Piping Specialties." Copper and galvanized steel shall not be used in the fuel-oil piping system.
- H. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.
- B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine-generator to allow service and maintenance.
- C. Connect engine exhaust pipe to engine with flexible connector.
- D. Connect fuel piping to engines with a gate valve and union and flexible connector.
 - 1. Diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems are specified in Section 231113 "Facility Fuel-Oil Piping."
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90 degree bend in flexible conduit routed to the generator set from a stationary element.
- G. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.5 IDENTIFICATION

- A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections.
- C. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs. Certify compliance with test parameters.
 - a. Visual and Mechanical Inspection
 - 1) Compare equipment nameplate data with drawings and specifications.
 - 2) Inspect physical and mechanical condition.
 - 3) Inspect anchorage, alignment, and grounding.
 - 4) Verify the unit is clean.
 - b. Electrical and Mechanical Tests
 - 1) Perform insulation-resistance tests in accordance with IEEE 43.
 - a) Machines larger than 200 horsepower (150 kilowatts). Test duration shall be 10 minutes. Calculate polarization index.
 - b) Machines 200 horsepower (150 kilowatts) or less. Test duration shall be one minute. Calculate the dielectric-absorption ratio.
 - 2) Test protective relay devices.
 - 3) Verify phase rotation, phasing, and synchronized operation as required by the application.
 - 4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
 - 5) Conduct performance test in accordance with NFPA 110.
 - 6) Verify correct functioning of the governor and regulator.
 - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 6. Exhaust Emissions Test: Comply with applicable government test criteria.
 7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 8. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 9. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations 25 feet (7.6 m) from edge of the generator enclosure, and at two locations inside the building adjacent to the generator room, and compare measured levels with required values.
- D. Coordinate tests with tests for transfer switches and run them concurrently.
- E. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- F. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.
- G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
- H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- I. Remove and replace malfunctioning units and retest as specified above.
- J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- L. Refill fuel tank after testing is completed.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213

SECTION 263600
TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes transfer switches rated 600 V and less, including the following:
 - 1. Automatic transfer switches.
 - 2. Remote annunciation systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
 - 1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and testing agency.
- B. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Features and operating sequences, both automatic and manual.
 - 2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
- B. Source Limitations: Obtain automatic transfer switches and remote annunciators through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA ICS 1.
- E. Comply with NFPA 70.
- F. Comply with NFPA 110.
- G. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Contactor Transfer Switches:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cummins Power Generation.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
- H. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- J. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- E. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

- F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.
- G. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.
- H. Automatic Transfer-Switch Features:
1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 5. Test Switch: Simulate normal-source failure.
 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
 10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
 11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
 12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 260548.16 "Seismic Controls for Electrical Systems."
- B. Floor-Mounting Switch: Anchor to floor by bolting.
 - 1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."
- C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.
- D. Identify components according to Section 260553 "Identification for Electrical Systems."
- E. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.

- d. Perform manual transfer operation.
- 3. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
- 4. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.
- C. Coordinate tests with tests of generator and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- E. Remove and replace malfunctioning units and retest as specified above.
- F. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training."
- B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

SECTION 265100

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Exit signs.
 - 3. Lighting fixture supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Ballast, including BF.
 - 4. Energy-efficiency data.
 - 5. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Section 233713 "Diffusers, Registers, and Grilles."
 - 6. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 - 7. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Installation instructions.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

- B. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. LED Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE5 and NEMA LE5A as applicable
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

- E. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp and ballast characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
 - c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
 - e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
 - f. CCT and CRI for all luminaires.

2.3 LED LUMINAIRES

- A. Solid State Drivers and LED: Comply with DOE LM 79
 - 1. Total Harmonic Distortion Rating: Less than 10 percent
 - 2. Transient Voltage protection
 - 3. Power factor: 0.90 or higher
 - 4. Temperatures: Minus 40 deg F (minus 40 deg C) and higher
 - 5. Heat sink to remove heat from circuits
 - 6. L70 compliant to 70,000 hours minimum
 - 7. Dimmable
 - a. Dimming Range: 100 to 1 percent of rated lamp lumens
 - b. Input watts: Can be reduced to 20 percent of normal
 - c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.4 EMERGENCY POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast or driver. Comply with UL 924.
 - 1. Emergency Connection: Operate one lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - 2. Nightlight Connection: Operate one fluorescent lamp continuously.
 - 3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - 6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers

- simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- B. External Type (only allowed where required for exterior emergency fixtures): Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from lighting fixture. Comply with UL 924.
1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Nightlight Connection: Operate one fluorescent lamp in a remote fixture continuously.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type.
 5. Housing: NEMA 250, Type 1 enclosure.
 6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- C. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:
 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 2. Install lamps in each luminaire.
- B. Suspended Lighting Fixture Support:
 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

VARIABLE SPEED DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of this contract, including general and supplementary conditions and division 16 specification sections, apply to work of this section.
- B. Information contained on the drawings and/or schedules shall detail the additional specific requirements for the Variable Speed Drive (VSD) system equipment.

1.2 SCOPE OF WORK

- A. It is the intent of this specification to set the minimum acceptable requirements for the design, construction, installation, commissioning and vendor support requirements for the VSD systems herein specified.
- B. The VSD Vendor should supply to the control panel vendor VSD systems for integration into the individual control panel systems. The VSD vendor should coordinate all necessary documentation, accessories, mounting hardware, etc. for a complete and operable system. The installation, of the control panel system, will be performed by the Owner. The VSD vendor should coordinate system start-up and commissioning with the Owner as herein described.

1.3 CODES AND STANDARDS

- A. Equipment supplied under this specification shall conform to the latest applicable codes and standards of the following:
 - 1. NEC - (NFPA 70) - National Electric Code.
 - 2. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
 - 3. NEMA AB 1 - Molded Case Circuit Breakers.
 - 4. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
 - 5. ANSI C37 - Standards for Circuit Breakers, Switchgear, Relays, Substations and Fuses.
 - 6. ANSI C57 - Distribution, Power, and Regulating Transformers. (includes Reactors)
- B. The fully assembled VSD system shall carry the UL label certifying UL-508 standards. An equivalent safety-labeling program by ETL or CSA documenting compliance with these industry standards shall be acceptable.

1.4 ACCEPTABLE SUPPLIERS

- A. The following VFD manufacturer's equipment have been pre-approved to meet the products section of this specification:
 - 1. Mitsubishi Electronics America, Inc., by Energy Management Corp
 - 2. Magnatek GPD by QED
 - 3. Toshiba

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4. Allen Bradley
5. Cutler Hammer

PART 2 - PRODUCTS

2.1 GENERAL

- A. This portion of the specification outlines the overall fabrication, performance and functional requirements of VSDs supplied for positive speed control of standard NEMA design B induction motors.
- B. It is the intent of this section to specify non-proprietary designs and hardware that assure modern "state of the art" equipment which provides a high level of performance and reliability for the greatest long term, total value to the owner.

2.2 SYSTEM DESCRIPTION

- A. The VSD system shall be supplied as a complete, pre-integrated, stand-alone package produced by a single manufacturer regularly engaged in the production of same and who maintains full system support responsibility.
 1. The VSD system manufacturer shall integrate all components and equipment required to conform to these specification features and functions as a single UL (or equivalent) labeled system. Vendors providing equipment requiring panel shop or job site modifications or additions that would not be valid under the original equipment manufacturer's (OEM's) safety labeling will not be acceptable.
 2. Pre-integrated equipment shall include but not be limited to incoming line reactors, rectifier units, inverter units, control circuitry, operator interfaces, protective equipment, and other accessories and auxiliary items necessary to meet the highest standards for the type of service specified herein.

2.3 CONSTRUCTION

A. SPACE AND ENVIRONMENT:

1. All VSD system components shall be housed in a grounded, dead front, free-standing or wall mounted, NEMA 12 enclosure. The VSD system size shall not exceed the size allotments specified on the drawings nor shall any portion of the system exceed a height of 90 inches. Entry shall be provided for incoming line and load cables as required or as shown on the drawings.
2. VSD systems mounted indoors shall be properly ventilated and sized to operate continuously at the specified job site elevation in an ambient environment of 0OC to 40OC, 0-90% RH. VSD systems mounted outdoors shall include environmental control provisions as required (or as shown on the plans) to operate in an ambient of -30OC to 50OC, 0-100% RH.

B. SUPPLY POWER:

1. All components of the VSD system shall be selected to operate continuously without any system trip or damage based on the nominal power specifications and requirements shown on the drawings or schedules. The above conditions must be maintained under the following expected variations:
 - a. Plus or minus 10% voltage fluctuation.
 - b. Plus or minus 3% frequency variation (5% if served by a back-up generator).
 - c. Distorted voltage waveform with up to 7% total voltage harmonic distortion.
2. The VSD system shall employ voltage sag ride-through coordination under normal operating (average load) conditions to prevent nuisance trips with the following utility interruptions (based on preliminary IEEE working group P1346 data):
 - a. 0% voltage for 1 cycle.
 - b. 60% voltage for 10 cycles.
 - c. 87% voltage continuous.

C. DEVICES and WIRING:

1. The VSD system shall employ door mounted industrial control operator devices, programming unit, and other devices per the layout shown on the drawings and as required to meet all functional and feature requirements of this specification. Operator pilot lights, switches and pushbuttons (if required) shall be industrial oil tight industry standard devices. Overall NEMA 12 Cabinet shall be provided to accommodate all control/instrumentation components as detailed on drawings.
2. Control voltages shall be 120 volts or less supplied by machine tool type transformers employing both primary and secondary fusing. ASD control transformer VA sizes shall be increased by 10% or as necessary to accommodate external impedance when plans show connections to external safety interlocks or other control devices.
3. The VSD system factory wiring shall be permanently marked with hot emboss stamping or an equivalent marking system. All devices shall be labeled and identified with correct setting selections. All component identification and wiring shall be documented in the operation and maintenance manual.

D. LOAD:

1. The VSD system shall be capable of starting and continuously driving the specified maximum motor load as identified on the drawings and schedules. A constant torque load shall be assumed for drive sizing purposes.
2. VSDs driving variable torque loads shall be programmed to optimize load patterns which maximize system efficiency and minimize motor heating and stresses. VSDs driving constant torque or other loads shall be programmed to optimize load patterns for system or process performance as required.
3. All VSD systems shall have an overload capacity of a minimum of 120% for one minute.

E. EFFICIENCY AND POWER FACTOR:

1. The VSD solid state converter and inverter power switching components and control shall be selected to achieve 95% efficiency or better at full load and full speed. Other auxiliary devices required on the drawings or in these specifications including filters, line reactors, cooling or heating devices etc. shall be of a design to optimize efficiency as intended under this specification.
2. The displacement power factor (as measured at the input to the VSD system) shall be 95% or better across the operational speed range.

F. PROTECTION:

1. Short circuit protection shall be provided to the VSD system through an externally operated, door interlocked fused disconnect, circuit breaker or motor circuit protector (MCP) rated at 65,000 AIC minimum. The door interlock handle must be capable of being locked off to meet NEC.
2. Overcurrent protection shall be provided in the VSD system through electronic motor overload (MOL) circuits with instantaneous trip, inverse time trip, and current limit functions. These shall be adjustable and optimized for the application.
3. In addition to the overcurrent protection above, the VSD system shall provide over and under-voltage protection, over-temperature protection, ground fault protection, and control or microprocessor fault protection. These protective circuits shall cause an orderly shutdown of the VSD, provide indication of the fault condition, and require a manual reset (except under-voltage) before restart. Under-voltage from a power loss shall be set to automatically restart after return to normal. The history of the previous three faults shall remain in memory for future review.
4. External protective faults including safeties or motor over-temperature may be interfaced to the VSD system and annunciated if shown on the drawings.

G. SYSTEM CONTROLS AND INTERFACE TERMINATIONS:

1. If shown on the drawings, the VSD system may require integrated transducers, controllers, sequencers, bypass methods, filters and communication interfaces among others. Such devices (shown on the drawings as part of the VSD system) shall be completely pre-integrated requiring the owner to make only the typical field connections required as customer connections.
2. Items shown on the drawings or schedules as "future" shall be available from the VSD system manufacturer in kit form for future owner integration into the VSD system.
3. The VSD system customer terminations shall be clearly identified with terminal numbers and a permanent-wiring diagram located in the VSD system enclosure.

2.4 FEATURES

A. The VSD interface keypad shall be mounted to control panel face and hard-wired to the VSD unit. This device shall annunciate VSD faults and operating conditions as described herein in a "real English" format without the use of codes. This unit shall provide the VSD user function interface as described herein. The following operator control and indication features shall be provided standard (unless shown differently on the drawings) as part of each VSD system:

1. Frequency (speed) indication.
2. Motor voltage indication.
3. Motor current indication.
4. VSD run indication.
5. VSD fault and diagnostic indication.

B. The following customer connections and interface terminations shall be provided standard (unless shown differently on the drawings) as part of each VSD system:

1. VSD remote start/stop connection.
2. External safeties connection.
3. VSD run annunciation.
4. VSD fault annunciation.
5. VSD speed reference input connection (4-20mA or as shown on drawings).

- C. The following parameter adjustments shall be available at the VSD key pad to tune the VSD system:
1. Minimum and maximum speeds.
 2. Acceleration and deceleration times.
 3. Over-current trip point.
 4. Current limit response to overload.
 5. Maximum base motor voltage.
 6. Input speed reference signal gain and bias.
 7. Output speed reference signal gain and bias.
- D. The VSD shall be capable of starting into a rotating motor at any speed.
- E. The VSD shall auto restart after a power failure.
- F. For maintenance purposes, the VSD system shall be capable of starting, stopping, and running with stable operation with the motor completely disconnected (no load).
- G. Each VSD system shall be provided with a series line reactor.

PART 3 - EXECUTION

3.1 EQUIPMENT PROTECTION AND STORAGE

- A. The VSD system manufacturer shall furnish written instructions for the unloading, storing, handling, installation and any special considerations to keep the equipment free from damage prior to the authorized commissioning start-up.
- B. The VSD systems shall be received, unloaded, stored, protected and installed into the control panels by the Control Panel Vendor.
- C. This Vendor shall inspect the VSD systems upon delivery and store them in a clean, dry space and as per the manufacturer's requirements. The VSD system electrical contractor shall maintain the factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

3.2 INSTALLATION

- A. Properly sized overload elements, fuses, circuit breakers, etc. shall be installed and verified for actual motor and circuit protection.
- B. Required interlock wiring and connections between the VSD system, and safety devices shall be the responsibility of the Control Panel Vendor.

3.3 SYSTEM COMMISSIONING AND CERTIFICATION

- A. The VSD system start-up shall be performed by a service technician or engineer certified by the manufacturer. The following adjustments and tests shall be performed as a minimum with certified copies included in the maintenance and operation manual:
1. Verify that the input voltage is within the manufacturer's specification tolerances.
 2. Verify that the motor rotation is correct in all modes of operation.
 3. Verify all operator devices, programming and monitoring functions to be fully operational.

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4. Verify operation of all field signal control connections.
5. Measure and record system output voltage and current at 50% and 100% speed. Tune the output voltage to correspond to motor nameplate rating at full speed. Check full load current measurements against nameplate data.
6. Make all parameter adjustments to tune and optimize the VSD system to the application. Record all configuration values as part of this report.
7. Make any/all other applicable tests with recorded results recommended by the VSD vendor.

B. Owner training shall be provided for each model and type of VSD system provided. Training shall consist of both classroom and actual equipment hands-on training. The training shall be certified on the approved form and included in the operation and maintenance manuals.

3.4 DOCUMENTATION

A. The operation and maintenance manuals shall consist of the following instructions and information:

1. Unloading, handling, installation, and special consideration instructions.
2. Operating functional descriptions and operating instructions.
3. Bill of materials with all spare parts ordering information and availability.
4. Start-up and system commissioning reports.
5. Training certification.

3.5 WARRANTY

A. The VSD system vendor shall supply a complete parts and labor warranty (including travel expenses) for 1 year from the date of start-up or 1.5 years from the date of shipment (whichever comes first).

1. The warranty shall cover the entire VSD system including power devices, controllers, filters etc. enclosed as part of the system package.
2. For equipment or components manufactured by other than the complete VSD system manufacturer, (which comprises more than 25% of the cost of the VSD system), the original equipment manufacturer shall be identified with it's nearest office and warranty obligation.

B. In place of the one-year warranty, a two-year warranty/service contract shall be quoted as an option at bid time. This service contract shall be renewable in two-year increments thereafter. The service contract shall be executable by the owner, at the fixed bid price anytime during the first 6 months of operation after start-up.

1. The extended warranty/service contract shall include necessary repairs or loaner replacement assuring complete restoration of operation within 24 hours from the time a service call is requested. A \$100.00 per day penalty shall be applied for failure to comply after the acknowledged service request.
2. The extended warranty/service contract shall include job site visits twice yearly to inspect, clean, tune (optimize parameters) and repair (if necessary) each VSD system supplied under this contract.
3. The extended warranty/service contract shall include basic orientation and operator training review with the owner's designated personal as part of this visit.
4. The extended warranty/service contract shall include a 200% performance bond in the owner's favor for the term of the service contract.

PART 4 - BASIS OF PAYMENT

- A. No separate payment shall be made for furnishing or installing electrical systems, components, or materials required to be installed within the pay limits for a building or enclosure identified in the BID schedule to be furnished by the Contractor.

END OF SECTION

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.

1.2 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 yard areas.

1.3 MEASUREMENT AND PAYMENT

- A. Measurement and payment for clearing, grubbing and stripping shall not be paid as a unit item, but considered as included in the contract unit or lump sum prices for the various items of the contract to which it relates.

PART 2 - PRODUCTS – NOT APPLICABLE

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 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.

SECTION 31 11 00
CLEARING, GRUBBING, AND STRIPPING

3.2 GRUBBING

- A. All stumps, roots, debris, deleterious 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 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 sodded shall have a minimum thickness of 3 inches (or thicker if required elsewhere in these documents or on the drawings) of topsoil.

3.4 DISPOSAL

- A. No open burning of combustible materials will 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 -

SITE GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. This work consists of site grading and related activities

1.2 MEASUREMENT AND PAYMENT

- A. Site grading shall be not be paid as a separate item but shall be paid as part of the items to which it relates.

PART 2 - PRODUCTS

2.1 EMBANKMENT MATERIAL

- A. Embankment materials are defined as those complying with the Unified Soil Classification 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 land owner 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 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 preexisting 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.

SECTION 31 22 00
SITE GRADING

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 drawings, of the subgrade shall be scarified and compacted to 95% minimum Modified Proctor density as determined by ASTM D-1557.
- 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 96% minimum Modified Proctor Density as determined by ASTM D-1557. Embankment under roadways, to a minimum depth of four feet, shall be compacted to 96% minimum as determined by ASTM D-1557.
- 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 recompact 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 drawings.

- END OF SECTION -

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 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 Drawings, or as modified in the Field by ENGINEER.

1.2 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. T 88 Particle Size Analysis of Soils
 2. T 180 Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in (457 mm) Drop
 3. T 191 Density of Soil In-Place by the Sand-Cone Method
 4. T 205 Density of Soil In-Place by the Rubber-Balloon Method
 5. T 238 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 6. T 239 Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. D 422 Particle-Size Analysis of Soils
 2. D 698 Test Method of Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.5-kg) Rammer and 12-in. (305-mm) Drop
 3. D 1556 Density of Soil in Place by the Sand-Cone method
 4. D 1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
 5. D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity -Flow Applications
 6. D 2487 Classification of Soils for Engineering Purposes
 7. D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 8. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.3 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.

SECTION 31 23 15
EXCAVATION AND BACKFILL FOR BURIED PIPELINES

- 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, 12 inches above the top of the pipe, and 1 foot laterally beyond both sides of the pipe.
- C. Trench 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.

1.4 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 or RPR at the beginning of each work day for the previous day's testing of subgrades, embankments and backfill Materials.
 - 2. Copies of all Laboratory Test Reports shall be submitted to ENGINEER or RPR within 24 hours of the completion of the test.
 - 3. Submit gradations and proctors for Pipe Zone Material and Trench 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.

1.5 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.

Sieve Size (Square Opening)	Percent By Weight Passing Screen
2-inch	100
1-1/2 inch	10 - 50
3/4-inch	0 - 25
No. 4	0-10
No. 200	0 - 3

- B. Pipe Zone Material: All material in the pipe zone shall be clean sand mixture 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. Pipe zone material shall conform to the following gradation:

U.S. Standard Sieve Size (Square Opening)	Percent By Weight Passing Screen
3/8 - inch	100
No. 100	25
No. 200	15

SECTION 31 23 15
EXCAVATION AND BACKFILL FOR BURIED PIPELINES

C. Trench Backfill Above the Pipe Zone

1. Trench backfill above the pipe zone shall consist of native fill material meeting the AASHTO A-1-a classification, shall have a maximum particle size no greater than 2 inches in any dimension and shall be capable of meeting the compaction requirements. Trench 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 the ENGINEER may be objectionable or deleterious.

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 barriers

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

3.3 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 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 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.

3.4 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. 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 2 inches 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 the CONTRACTOR in his performance of the work, the resulting material shall be excavated and replaced by the CONTRACTOR without additional cost to the 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.

3.5 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.

3.6 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.

SECTION 31 23 15
EXCAVATION AND BACKFILL FOR BURIED PIPELINES

B. Joining pipe:

1. Use methods of joining conduit sections insuring 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 insure that the spigot is not over-inserted and that previously assembled pipe joints are not disturbed.

3.7 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 96 percent of the maximum Modified Proctor density (ASTM D-1557), unless otherwise specified on the drawings.
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 Backfill Above the Pipe Zone: Trenches shall be backfilled to the grade shown with Trench Backfill material as specified.
1. Trench 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 96 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 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 90 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 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 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 8 inches of the trench shall be filled with topsoil and landscaped materials. Topsoil may be native material stripped prior to excavation of the trench. Backfill material shall be placed and compacted as specified above.
 2. Roadways shall be completed with the type and thickness of materials as indicated or shown on the drawings. In State Highways, asphalt replacement shall be in accordance with UDOT requirements.

	1 1/2" UBC	Asphalt
All Roadways	8" Min Thickness	Match Existing Plus 1-Inch (4" Min, 6" Max)

3.8 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:

SECTION 31 23 15
EXCAVATION AND BACKFILL FOR BURIED PIPELINES

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 96 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 insure 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 700 feet unless approved by the Engineer, and must be backfilled in a timely manner.

3.9 DEWATERING

A. Water removal shall be in accordance with Section 31 23 19 - Dewatering.

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 effect 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.

- 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. Additional Quality Assurance 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 ENGINEER wishes to test and shall backfill and recompact the excavation after the test is complete at no additional cost.
- 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 -

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 REFERENCES

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

B. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

- | | | |
|----|-------|--|
| 1. | T 88 | Particle Size Analysis of Soils |
| 2. | T 180 | Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in (457 mm) Drop |
| 3. | T 191 | Density of Soil In-Place by the Sand-Cone Method |
| 4. | T 205 | Density of Soil In-Place by the Rubber-Balloon Method |
| 5. | T 238 | Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |
| 6. | T 239 | Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | | |
|----|--------|---|
| 1. | D 422 | Particle-Size Analysis of Soils |
| 2. | D 698 | Test Method of Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.5-kg) Rammer and 12-in. (305-mm) Drop |
| 3. | D 1556 | Density of Soil in Place by the Sand-Cone method |
| 4. | D 1557 | Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop |
| 5. | D 2487 | Classification of Soils for Engineering Purposes |
| 6. | D 2922 | Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |
| 7. | D 3017 | Water Content of Soil and Rock in Place 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.

SECTION 31 23 16
EXCAVATION AND BACKFILL FOR STRUCTURES

1.3 SUBMITTALS

- A. The following shall be submitted in accordance with Section 01 33 00 Submittal Procedures:
1. Copies of laboratory test reports shall be submitted to Engineer within 24 hours of the completion of the test.
 2. Submit gradations and proctors for structural fill materials and backfill materials.
 3. Copies of Field Density Test reports shall be submitted to the ENGINEER or OWNER's RPR at the beginning of each work day for the previous day's testing of all materials.

PART 2 - PRODUCTS

2.1 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 the 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.

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 structure 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 3000 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. 3/4" Washed Rock placed inside manholes and under concrete vaults shall be placed and compacted to at least 96 percent of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D-1557.
- D. 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.
- E. The CONTRACTOR shall be responsible for arranging for the placing and compacting of approved fill material in accordance with these Specifications. If the Testing Agency should determine that the CONTRACTOR is failing to meet the minimum requirements, the CONTRACTOR shall stop operations and make adjustments as necessary to produce a satisfactorily compacted fill at no additional cost to the OWNER.
- F. 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.

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 Drawings.

3.6 COMPACTION TESTS

- A. It shall be the responsibility of the CONTRACTOR to accomplish the specified compaction for backfill, structural fill, Untreated Base Course and other earthwork. It shall be the responsibility of the 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.

- END OF SECTION -

GEOTEXTILE FABRIC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers furnishing and placing the geotextile fabric in accordance with these specifications and in conformity with the lines, grades, and dimensions shown on the drawings and/or as directed by ENGINEER.

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 by basic designation only.
- B. American Society for Testing and Materials (ASTM)
ASTM C-127 Specific Gravity and Absorption of Coarse Aggregate.
ASTM C-535 Resistance to Degradation of Large-Size Coarse Aggregate by
Abrasion and Impact in the Los Angeles Machine.

1.3 STORAGE OF MATERIALS

- A. During shipment, handling and storage, geotextile fabric shall be protected from ultraviolet light exposure, precipitation, or other inundation, mud dirt, dust puncture, cutting or any other damaging or deleterious conditions. To that effect, geotextile 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 fabric is exposed. CONTRACTOR shall be responsible for the replacement of damaged or unacceptable materials at no cost to OWNER.

PART 2 - PRODUCTS

2.1 GEOTEXTILE FABRIC

- A. Fabric shall be as shown on the Contract Drawings.

PART 3 - EXECUTION

3.1 GEOTEXTILE FABRIC

- A. Prior to placement of geotextile fabric, the subgrade to the geotextile fabric shall be compacted and graded to the lines and grades shown on the drawings and/or as directed by the Engineer.
- B. Geotextile fabric shall be installed in the manner recommended by the manufacturer. A minimum of 12 inches of overlap shall be provided at seams.

-END OF SECTION-

RIP RAP

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers furnishing and placing loose riprap materials in accordance with these specifications and in conformity with the lines, grades, and dimensions shown on the drawings and/or as directed by the Engineer.

1.2 MEASUREMENT AND PAYMENT

- A. Site grading shall be not be paid as a separate item but shall be paid as part of the items to which it relates.

1.3 REFERENCES

- A. The latest editions 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)

ASTM C-127 Specific Gravity and Absorption of Coarse Aggregate.

ASTM C-535 Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

1.4 STORAGE OF MATERIALS

- A. Materials shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials.

PART 2 - PRODUCTS

2.1 LOOSE RIPRAP

- A. Riprap shall consist of quarry stone which is sound and durable against disintegration under conditions to be met in handling and placing, and is hard and tenacious and otherwise of suitable quality to ensure permanency in the specified kind of work
- B. Riprap sources shall be approved by the Engineer prior to use. Concrete masonry or concrete pavement may not be used for riprap. Riprap shall be well graded with additional gradation requirements for riprap as follows:

SECTION 31 37 00
RIPRAP

LOOSE RIPRAP GRADATIONS

<u>Designation</u>	<u>% Smaller by Weight</u>	<u>Inches</u>
Riprap, D50 = 8 inches	70-100	14
	50-70	12
	35-50	8
	2-10	3

PART 3 - EXECUTION

3.1 GENERAL

- A. Prior to placement of loose riprap, the loose riprap shall be placed and graded to the lines and grades shown on the drawings.
- B. Prior Riprap shall generally be placed starting at the lowest elevations and working upward. Riprap shall be placed to the minimum thickness designated on the drawings and shall be positioned in such a manner that will provide uniform distribution of the various sizes of stone and produce a well-keyed mass of rock with the least practical amount of void space. The surface shall be leveled as necessary, to produce a reasonably uniform appearance and the required thickness.

- END OF SECTION -

UNTREATED BASE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work consists of the placement of Sub-Base and Untreated Base Course material at designated road ways and all driving surfaces as indicated on the Drawings.

1.2 REFERENCES

- A. The latest edition of the following publication forms a part of this specification to the extent referenced. The publication is referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND
TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 88- Particle Size Analysis of Soils
AASHTO T 180- Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg)
Rammer and an 18-in (457 mm) Drop
AASHTO T 191- Density of Soil In-Place by the Sand-Cone Method
AASHTO T 205- Density of Soil In-Place by the Rubber-Balloon Method
AASHTO T 238- Density of Soil and Soil-Aggregate in Place by Nuclear
Methods
(Shallow Depth)
AASHTO T 239- Moisture Content of Soil and Soil-Aggregate in Place by
Nuclear
Methods (Shallow Depth)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422- Particle-Size Analysis of Soils
ASTM D 698- Test Method of Moisture-Density Relations of Soils and Soil-
Aggregate Mixtures Using 5.5 lb. (2.5-kg) Rammer and 12-in.
(305-mm) Drop)
ASTM D 1556- Density of Soil in Place by the Sand-Cone Method
ASTM D 1557- Moisture-Density Relations of Soils and Soil-Aggregate
Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm)
Drop
ASTM D 2487- Classification of Soils for Engineering Purposes
ASTM D 2922- Density of Soil and Soil-Aggregate in Place by Nuclear
Methods (Shallow Depth)
ASTM D 3017- Water Content on Soil and Rock in Place by Nuclear Methods
(Shallow Depth)

- B. The latest edition of the Utah Department of Transportation Standard Specification for Road and Bridge Construction (UDOT).

SECTION 32 11 23
UNTREATED BASE COURSE

1.3 SUBMITTALS

A. Untreated Base Course (State approved 1 1/2" Gradation).

PART 2 - PRODUCTS

2.1 MATERIALS

A. **Untreated Base Course:** Untreated Base Course Materials shall meet the UDOT Specifications for 1 1/2" gradation as shown in Table 1.

SIEVE SIZE	1 1/2" GRADATION (PERCENT PASSING)
1 1/2 inch	100
1 inch	90 - 100
3/4 inch	70 - 85
1/2 inch	65 - 80
3/8 inch	55 - 75
No. 4	40 - 65
No. 16	25 - 40
No. 200	7 - 11

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. Prior to placement of untreated base course materials, the foundation area to receive untreated base course materials shall be scarified to a minimum depth of 8-inches and recompact to 96% minimum laboratory density as determined by ASTM D-1557.

3.2 UNTREATED BASE COURSE MATERIAL PLACEMENT

- A. No Untreated Base Course material shall be placed on sub-grade materials until the sub-grade has been checked and accepted by ENGINEER.
- B. Road base material placed on driving surfaces shall be compacted to a minimum density of 96% in accordance with ASTM D-1557 to provide a uniform graded smooth surface.
- C. Untreated Base Course material shall be placed to a minimum thickness eight (8) inches or as shown on the drawings.

3.3 FIELD QUALITY CONTROL

- A. CONTRACTOR shall be responsible for directing proper placement of all road base materials. CONTRACTOR shall be responsible for the stability of the road base materials during placement and shall replace any portions which have become displaced due to careless or negligent work on the part of CONTRACTOR, or to damage resulting from natural causes, such as storms.
- B. Whenever the work areas to receive Sub-Base and/or Untreated Base Course material are covered with snow, the snow must be removed prior to placing the road base and/or Untreated Base Course, and deposited outside the immediate construction areas at CONTRACTOR's expense.

- END OF SECTION -

PIPING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General
- B. Wall pipes
- C. Sleeves
- D. Solid sleeve couplings
- E. Sleeve type couplings
- F. Flanged adapters
- G. Equipment dismantling joint
- H. Mechanical couplings (split type, shouldered end)
- I. Tapping sleeves and saddles
- J. Unions
- K. Heat traced piping
- L. Buried galvanized and black steel pipe

1.2 GENERAL REQUIREMENTS

- A. CONTRACTOR shall furnish and install to the required line and grade all piping, together with all fittings and appurtenances, required for a complete installation. All piping located outside the face of structures or building foundations and all piping embedded in concrete within a structure shall be considered exterior piping.
- B. CONTRACTOR shall furnish and install fittings, couplings, connections, sleeves, adapters, harness rods, and closure pieces as required to connect pipelines of dissimilar materials and/or sizes herein included under this Section and other concurrent Contracts for a complete installation.
- C. CONTRACTOR shall furnish all labor, materials, equipment, tools, and services required for the furnishing, installation, and testing of all piping as shown on the Drawings, specified in this Section, and required for the Work. Piping shall be furnished and installed of the material, sizes, classes, and at the locations shown on the Drawings and/or designated in the Specifications. Piping shall include all fittings, adapter pieces, couplings, closure pieces, harnessing rods, hardware, bolts, gaskets, wall sleeves, wall pipes, hangers, supports, and other associated appurtenances for required connections to equipment, valves, or structures for a complete installation.
- D. Piping assemblies under 4-inch size shall be generally supported on walls and ceilings, unless otherwise shown on the Drawings or ordered by ENGINEER, being kept clear of openings and positioned above "headroom" space. Where practical, such piping shall be run in neat clusters, plumb and level along walls, and parallel to overhead beams.

SECTION 33 02 01
PIPING GENERAL REQUIREMENTS

- E. CONTRACTOR shall provide taps on piping where required or shown on the Drawings. Where pipe or fitting wall thickness is insufficient to provide the required number of threads, a boss or pipe saddle shall be used.
- F. The Work shall include, but not be limited to, the following:
1. Connections to existing pipelines.
 2. Test excavations necessary to locate or verify existing pipe and appurtenances.
 3. Installation of all new pipe and materials required for a complete installation.
 4. Cleaning, testing, and disinfecting as required.

1.3 SUBMITTALS

- A. CONTRACTOR shall furnish to OWNER a material certification stating that the pipe materials and specials comply with the applicable standards (ASTM, AWWA, etc.) for fabrication and testing.
- B. CONTRACTOR shall submit laying schedules and detailed drawings in plan and profile for all piping as specified and shown on the Drawings. Shop drawings shall include, but not be limited to, complete piping layout, pipe material, sizes, class, locations, necessary dimensions, elevations, supports, hanger details, pipe joints, and the details of fittings including methods of joint restraint. No fabrication or installation shall begin until Shop Drawings are approved by ENGINEER.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All specials and every length of pipe shall be marked with the manufacturer's name or trademark, size, class, and the date of manufacture. Special care in handling shall be exercised during delivery, distribution, and storage of pipe to avoid damage and unnecessary stresses. Damaged pipe will be rejected and shall be replaced at CONTRACTOR's expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.
- B. Testing of pipe before installation shall be as described in the corresponding ASTM or AWWA specifications and in the applicable standard specifications listed in the following Sections. Testing after the pipe is installed shall be as specified.
- C. Joints in piping shall be of the type specified in the appropriate piping schedule.
- D. All buried exterior piping shall have restrained joints for thrust protection unless otherwise specified or shown on the Drawings. All exposed exterior piping shall have flanged joints, unless otherwise specified or shown on the Drawings.
- E. The Drawings indicate work affecting existing piping and appurtenances. CONTRACTOR shall excavate test pits as required of all connections and crossings which may affect CONTRACTOR's work prior to ordering pipe and fittings to determine sufficient information for ordering materials. CONTRACTOR shall take whatever measurements that are required to complete the Work as shown or specified.

2.2 WALL PIPES

- A. Where wall sleeves or wall pipes occur in walls that are continuously wet on one or both sides, they shall have water stop flanges at the center of the casting or as shown on the Drawings. Ends of wall pipes shall be flange, mechanical joint, plain end, or bell as shown on the Drawings, or as required for connection to the piping.

B. Wall pipes shall be of the same material as the piping to which they are connected. If welded waterstop flanges are employed, welds shall be 360 degree continuous on both sides of the flange. Unless otherwise shown on the Drawings, waterstop flanges shall conform to the minimum dimensions shown below:

C.

Pipe Size	Waterstop Flange Diameter	Waterstop Flange Thickness
4" - 12"	OD + 3.10"	0.50"
14" - 24"	OD + 4.15"	0.75"
30" - 36"	OD + 4.50"	1.00"
42" - 48"	OD + 5.00"	1.25"
54"	OD + 5.90"	1.50"

2.3 SLEEVES

- A. Unless otherwise shown, all piping passing through walls and floors shall be installed in sleeves or wall castings accurately located before concrete is poured, or placed in position during construction of masonry walls. Sleeves passing through floors shall extend from the bottom of the floor to a point 3-inches above the finished floor, unless shown otherwise. Water stop flanges are required on all sleeves located in floors or walls which are continually wet or under hydrostatic pressure on one or both sides of the floor or wall.
- B. Sleeves shall be cast iron, black steel pipe, or fabricated steel in accordance with details shown on the Drawings. If not shown on the Drawings, CONTRACTOR shall submit to ENGINEER details of sleeves he proposes to install, and no fabrication or installation thereof shall take place until ENGINEER's approval is obtained. Steel sleeves shall be fabricated of structural steel plate in accordance with the standards and procedures of AISC and AWS. Steel sleeve surfaces shall receive a commercial sandblast cleaning and then be shop painted in accordance with Section 09 91 00 – "Painting and Finishes."
- C. When shown on the Drawings or otherwise required, the annular space between the installed piping and sleeve shall be completely sealed against a maximum hydrostatic pressure of 20 psig. Seals shall be mechanically interlocked, solid rubber links, trade name "Link-Seal", or equal. Rubber link, seal type, size, and installation thereof shall be in strict accordance with the manufacturer's recommendations. For non-fire rated walls and floors, pressure plate shall be glass-reinforced, nylon plastic, with EPDM rubber seal and 304 stainless steel bolts and nuts. For fire rated walls and floors, two independent seals shall be provided consisting of low carbon steel, zinc galvanized pressure plates, silicon rubber seals and low carbon steel, zinc galvanized bolts and nuts.

2.4 SOLID SLEEVE COUPLINGS

- A. Solid sleeve couplings shall be used to connect buried service piping where shown on the Drawings. Solid sleeves shall be ductile iron, long body and shall conform to the requirements of ANSI A21.10 (AWWA C110), and shall be Style A11760 by American Cast Iron Pipe Co., or equal.

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PIPING GENERAL REQUIREMENTS

2.5 SLEEVE TYPE COUPLINGS

- A. Sleeve type flexible couplings shall be installed where shown on the Drawings or otherwise required to resist internal pressures. In addition to that specified herein, harnessed sleeve type couplings shall be provided on all exposed piping 3-inches and larger in diameter that spans any expansion joint in a building or structure. Materials shall be of high strength steel. Coupling shall be rated for the same pressures as the connecting piping. Gaskets shall be rubber. Bolts and nuts shall be alloy steel, corrosion-resistant and prime coated. Couplings shall be shop primed as specified in Section 09 91 00 – “Painting and Finishes.”
- B. Harness couplings to adjacent flanges as shown, specified, or otherwise required to restrain all pressure piping. Dimensions, sizes, spacing, and materials for lugs, tie rods, washers, and nuts shall conform to the standards for the pipe size and design pressure specified. No less than two bolts shall be furnished for each coupling. Tie bolts, nuts, and washers shall be ASTM A193, Grade B7 steel or better. Harness rods shall have lengths less than 10 feet between adjacent flanged joints on fittings and shall be coated in accordance with Section 09 91 00 – “Painting and Finishes.”
- C. Couplings shall be Style 38 by Dresser Industries, or equal.

2.6 FLANGED ADAPTERS

- A. All flanged adapter's 12-inches in diameter and smaller shall be locking type flanged adapters. Pressure and service shall be the same as connecting piping. Materials shall be cast iron for pipes up to 12-inches diameter and high strength steel for pipes larger than 12-inches diameter. Bolts and nuts shall be alloy steel, corrosion resistant and prime coated. Flanged adapters shall be shop primed as specified in Section 09 91 00 – “Painting and Finishes.”
- B. Flanged adapters shall be harnessed as shown on the Drawings.
- C. Flanged adapters shall be Style 127 or 128 by Dresser Industries, or equal.

2.7 EQUIPMENT DISMANTLING JOINT

- A. Equipment connection fittings shall provide both lateral and angular misalignment adjustment between equipment connection flanges and the connection to field piping systems by providing individually adjustable flexible joints at each connection. In addition, equipment connection fittings shall provide full pressure thrust restraint between the field piping connection and equipment connection flanges. Equipment connection fittings shall be by Viking Johnson, modified as specified to provide the required features.
- B. Equipment connection fittings shall each consist of a single sleeve of plain end piping, conforming to the requirements of the specified piping system, of sufficient length to span the gap between the connection at the equipment and the connection at the field piping, with gasketed flange adapters at each end. Thrust restraints shall be provided using threaded rod, with nuts and washers (each face, each end) spanning between flanges. Male rod nuts and female washers shall be rounded to provide ball-joint type self-aligning feature. Lock washers shall be provided for each thrust restraint nut.

- C. Thrust rod diameter and material shall be selected to provide sufficient freedom of movement through all bolt holes to allow unrestricted maximum adjustment of equipment connection fittings, to accommodate piping misalignment without transmitting any shear to the thrust rods, and also to permit full development of thrust restraint at all thrust rod tension take-ups on both sides of the flanges. Thrust rods, nuts, and washers shall be Type 316 stainless steel, all selected to develop full rated piping system pressure thrust forces. Dry film molybdenum disulfide anti-galling compound shall be factory applied to ends of thrust rods, covering all threads subject to nut travel and tightening. Flange gaskets shall be full face type. Follower gaskets shall be compression wedge type. Design of equipment connection fittings shall conform to AWWA C219.
- D. Sleeves shall be carbon steel or as specified for the specific piping system. Pressure rating of flange adapters shall equal or exceed the pressure rating of mating flanges. All portions of equipment connection fittings, with the exception of threaded parts, shall be coated and lined with fusion bonded epoxy conforming to AWWA C550 and NSF 61.

2.8 MECHANICAL COUPLINGS (SPLIT TYPE, SHOULDERED END)

- A. Mechanical couplings shall be made of malleable iron and shall be rated for the same pressures as the connecting piping. Gaskets shall be rubber. Bolts and nuts shall be heat treated carbon steel track bolts and shall be plated. Coupling shall be coated as specified in Section 09 91 00 – “Painting and Finishes.” Couplings shall be Style 44 by Victaulic Company or equal.

2.9 TAPPING SLEEVES AND SADDLES

- A. Tapping sleeves shall be similar to Mueller Outlet Seal, American Uniseal, or Kennedy Square Seal. All sleeves shall have a minimum working pressure of 150 psi. All sleeves larger than 12-inches shall be ductile iron. All taps shall be machine drilled, no burned taps will be allowed.
- B. Tapping saddles may be used on mains 16-inches and larger where the required tap size does not exceed one-half the size of the main. Tapping saddles shall be manufactured of ductile iron providing a factor of safety of at least 2.5 at a working pressure of 250 psi. Saddles shall be equipped with a standard AWWA C110 flange connection on the branch. Sealing gaskets shall be O-ring type, high quality molded rubber having an approximate seventy durometer hardness, placed into a groove on the curved surface of the tapping saddle. Straps shall be of alloy steel. Tapping saddles shall be by American, US Pipe, or equal. All taps shall be machine cut, no burned taps will be allowed.

2.10 UNIONS

- A. For ductile iron, carbon steel and gray cast iron pipes assembled with threaded joints and malleable iron fittings, unions shall conform to ANSI B16.39. For copper piping, unions shall have ground joints and shall conform to ANSI B16.18. For PVC/CPVC piping, unions shall be socket weld type with Viton O-ring.

2.11 HEAT TRACED PIPING

- A. Exposed pipe to insulate shall also be protected from freezing by heat tracing. Freeze protection heat tracing shall consist of twin 16 AWG copper brass wires with a semiconductor polymer core where electrical resistance varies with temperature.

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- B. The heat tracing shall have a fluoropolymer outer jacket for corrosion resistance. The heat tracing shall be rated for three watts per foot output, self-regulating with a maximum temperature of 150 degrees F, equal to a Chromalox SRL3-1CT383400. Maximum length for tape shall be 300 feet for each circuit. Temperature controller shall be provided to sense pipe temperature to determine on or off condition of heat tracing. Temperature control shall be equal to a Chromalox RTBC-2-384729. The heat tracing system shall operate on 120VAC.

2.12 BURIED GALVANIZED AND BLACK STEEL PIPE

- A. Wrapping. Prior to wrapping the pipe with PVC tape, the pipe 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All piping shall be installed by skilled workmen and in accordance with the best standard practice for piping installation as shown on the Drawings, specified, or recommended by the pipe manufacturer. Proper tools and appliances for the safe and convenient handling and installing of the pipe and fittings shall be used. Great care shall be taken to prevent any pipe coating from being damaged on the inside or outside of the pipe and fittings. All pieces shall be carefully examined for defects, and no piece shall be installed which is known to be cracked, damaged, or otherwise defective. If any defective piece should be discovered after having been installed, it shall be removed and replaced with a sound one in a satisfactory manner by CONTRACTOR at his own expense. Pipe and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are accepted in the complete Work. All piping connections to equipment shall be provided with unions or coupling flanges located so that piping may be readily dismantled from the equipment. At certain applications Dresser, Victaulic, or other couplings may be used. All piping shall be installed in such a manner that it will be free to expand and contract without injury to itself or to structures and equipment to which it is connected. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade and shall be supported and braced against movement, temporary or permanent. All exposed piping shall be installed with vertical and horizontal angles properly related to adjoining surfaces or pipes to give the appearance of good workmanship. Unless otherwise shown or approved, provide a minimum headroom clearance under all piping of 7 feet 6 inches.
- B. Unless otherwise shown or specified, all waste and vent piping shall pitch uniformly at a ¼-inch per foot grade and accessible cleanouts shall be furnished and installed as shown and as required by local building codes. Installed length of waste and vent piping shall be determined from field measurements in lieu of the Drawings.
- C. All excavation shall be made in such a manner and to such widths as will provide ample room for properly installing the pipe and permit thorough compaction of backfill around the pipe. All excavation and trenching shall be done in strict accordance with these Specifications and with all applicable parts of the OSHA regulations.

- D. Enlargements of the trench shall be made as needed to give ample space for operations at pipe joints. The width of the trench shall be limited to the maximum dimensions shown on the Drawings, except where a wider trench is needed for the installation of and work within sheeting and bracing. Except where otherwise specified, excavation slopes shall be flat enough to avoid slides which will cause disturbance of the subgrade, damage to adjacent areas, or endanger the lives or safety of persons in the vicinity.
- E. Hand excavation shall be employed wherever ENGINEER deems it necessary for the protection of existing utilities, poles, trees, pavements, or obstructions.
- F. No greater length of trench in any location shall be left open, in advance of laying pipe, than shall be authorized or directed by ENGINEER and, in general, such length shall be limited to approximately 100 feet. CONTRACTOR shall excavate the trenches to the full depth, width, and grade indicated on the Drawings including the relevant requirements for bedding. The trench bottoms shall then be examined by ENGINEER as to the condition and bearing value before any pipe is laid or bedding placed.
- G. No pressure testing shall be performed until the pipe has been properly backfilled in place. All pipes passing through walls and/or floors shall be provided with wall pipes or sleeves in accordance with the Specifications and the details shown on the Drawings. All wall pipes shall be ductile iron and shall have a waterstop located in the center of the wall. Each wall pipe shall be of the same class, thickness, and interior coating as the piping to which it is joined. All buried wall pipes shall have a coal tar outside coating on exposed surfaces.
- H. Joint deflection shall not exceed 75% of the manufacturer's recommended deflection. Excavation and backfilling shall conform to the requirements of Division 31. Maximum trench widths shall conform to the trench width excavation limits shown on the Drawings. All exposed, buried, or submerged piping shall be adequately supported and braced by means of hangers, concrete piers, pipe supports, or otherwise as may be required by the location.
- I. Following proper preparation of the trench subgrade, pipe and fittings shall be carefully lowered into the trench so as to prevent dirt and other foreign substances from gaining entrance into the pipe and fittings. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall any of the materials be dropped or dumped into the trench.
- J. Water shall be kept out of the trench until jointing and backfilling are completed. When Work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no water, earth, or other substances will enter the pipes, fittings, or valves. Pipe ends left for future connection shall be valved, plugged, or capped and anchored as required.
- K. The full length of each section of pipe shall rest solidly upon the bed of the trench, with recesses excavated to accommodate bells, couplings, joints, and fittings. Before joints are made, each pipe shall be well bedded on a solid foundation, and no pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid by CONTRACTOR at his own expense. Pipe shall not be laid in water or when trench conditions are unsuitable.
- L. At the close of each workday the end of the pipeline shall be tightly sealed with a cap or plug. This plug shall be kept in place until laying of pipe is resumed.

3.2 JOINTS IN PIPING

- A. Restrained/push-on joints shall include a single rubber gasket which fits into the bell end of the pipe. The gasket shall be wiped clean, flexed, and then placed into the socket. Any bulges in the gasket that might interfere with the entry of the plain end of the pipe shall be removed.

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PIPING GENERAL REQUIREMENTS

- B. A thin film of lubricant shall be applied to the gasket surface which will come into contact with the spigot end of the pipe. The lubricant shall be furnished by the pipe manufacturer. The plain end of the pipe, which is tapered for ease of assembly, shall be wiped clean and a thick film of lubricant applied to the outside. The pipe shall be aligned and carefully entered into the socket until it just makes contact with the gasket. The joint assembly shall be completed by entering the pipe past the gasket until it makes contact with the bottom of the socket. The pipe shall be pulled home with an approved jack assembly as recommended by the pipe manufacturer.
- C. Mechanical joints shall be made up with gaskets, glands, and bolts. When a joint is to be made up, the bell or socket and plain end shall be cleaned and washed with a solution of mild soap in water. The gland and gasket shall be slid onto the plain end and the end then entered into the socket until it is fully home on the centered ring. The gasket shall then be painted with soapy water and slid into position, followed by the gland. All bolts shall be inserted and made up hand tight and then tightened alternately to bring the gland into position evenly. Excessive tightening of the bolts shall be avoided. All nuts shall be pulled up using a torque wrench which will not permit unequal stresses in the bolts. Torque shall not exceed the recommendations of the pipe manufacturer. Care shall be taken to assure that the pipe remains fully home while the joint is being made. Joints shall conform to applicable AWWA standards.
- D. Flanged joints shall be brought to exact alignment and all gaskets and bolts or studs inserted in their proper places. Bolts or studs shall be uniformly tightened around the joints. Where stud bolts are used, the bolts shall be uniformly centered in the connections and equal pressure applied to each nut on the stud. Pipes in all lines subject to temperature changes shall be cut short and cold sprung into place to compensate for expansion when hot.
- E. Threaded and/or screwed joints shall have long tapered full depth threads to be with the appropriate paste or jointing compound, depending on the type of fluid to be present in the pipe. All pipe up to, and including 1-1/2-inches, shall be reamed to remove burr and stood on end and well pounded to remove scale and dirt. Wrenches on valves and fittings shall be applied directly over the joint being tightened. Not more than three pipe threads shall be exposed at each connection. Pipe in all lines subject to temperature changes shall be cut short and cold sprung into place to compensate for expansion when hot. Joints in all piping used for chlorine gas shall be made up with glycerine/litharge cement. Joints in PVC/CPVC piping shall be laid and joints made with compounds recommended by the pipe manufacturer. Installation shall conform to the requirements of ASTM D2774 and ASTM D2855. Unions are required adjacent to valves and equipment.
- F. Soldered joints shall have the burrs removed and both the outside of pipe and the inside of fittings shall be thoroughly cleaned by proper tools recommended for that purpose. Flux shall be applied to both pipe and inside of fittings and the pipe placed into fitting and rotated to insure equal distribution of flux. Joints shall be heated and solder applied until it shows uniformly around the end of joints between fitting and pipe. All joints shall be allowed to self-cool to prevent chilling of the solder. Combination flux and solder paste manufactured by a reputable manufacturer is acceptable. Unions are required adjacent to valves and equipment.
- G. Welded joints shall be made by competent operators in a first class workmanlike manner, in complete accordance with ANSI B31.1 and AWWA C206. Welding electrodes shall conform to ANSI A233, and welding rod shall conform to ASTM A251. Only skilled welders capable of meeting the qualification tests for the type of welding which they are performing shall be employed. Tests, if so required, shall be made at the expense of CONTRACTOR if so ordered by ENGINEER. Unions are required adjacent to valves and equipment.

- H. Copper joints shall be thoroughly cleaned and the end of pipes uniformly flared by a suitable tool to the bevels of the fitting used. Wrenches shall be applied to the bodies of fittings where the joint is being made and in no case to a joint previously made. Dimensions of tubing and copper piping shall be in complete accordance with the fittings used. No flare joints shall be made on piping not suited for flare joints. Installations for propane gas shall be in accordance with NFPA 54 and/or 58.
- I. Solvent or adhesive welded joints in plastic piping shall be accomplished in strict accordance with the pipe manufacturer's recommendations, including necessary field cuttings, sanding of pipe ends, joint support during setting period, etc. Care shall be taken that no droppings or deposits of adhesive or material remain inside the assembled piping. Solvent or adhesive material shall be compatible with the pipe itself, being a product approved by the pipe manufacturer. Sleeve-type expansion joints shall be installed in exposed piping to permit 1-inch minimum expansion per 100 feet of pipe length. Unions are required adjacent to valves and equipment.
- J. Dielectric unions shall be installed wherever dissimilar metals are connected except for bronze or brass valves in ferrous piping.
- K. Eccentric reducers shall be installed where air or water pockets would otherwise occur in mains due to change in pipe size.

3.3 FLUSHING AND TESTING

- A. All piping shall be properly flushed and tested unless specifically exempted elsewhere in the Specifications or otherwise approved by ENGINEER. Air and gas piping shall be flushed and tested with compressed air. Liquid conveying pipelines shall be flushed and tested with water, except for gravity sewer and storm drain piping which shall be tested as specified in the individual pipe specifications. Test pressures shall be as shown in the piping schedules.
- B. CONTRACTOR shall furnish and install all means and apparatus necessary for getting the air or water into the piping for flushing and testing, including pumps, compressors, gauges, meters, any necessary plugs and caps, blow-off piping and fittings, etc., complete with any necessary blocking to prevent pipe movement during flushing and testing. CONTRACTOR shall provide water for all flushing and testing. Raw water or non-potable water may be used for flushing and testing piping not connected to the potable water system. Only potable water shall be used for flushing and testing the potable water system.
- C. At the conclusion of the installation work, CONTRACTOR shall thoroughly clean all new liquid conveying piping by flushing with water to remove all dirt, stone, pieces of wood, etc. which may have entered the pipe during installation. If after this cleaning any obstructions remain, they shall be corrected by CONTRACTOR at his own expense. Liquid conveying piping shall be flushed at the rate of at least 2.5 feet per second for duration suitable to ENGINEER.
- D. Air and gas piping shall be completely and thoroughly cleaned of all foreign matter, scale, and dirt prior to start-up of the air or gas system. Air and gas piping shall be flushed by removing end caps from the distribution lines and operating one compressor.
- E. All pipe testing shall be as specified in Section 33 13 00 – "Piping – Flushing, Leakage Testing, and Disinfection."

- END OF SECTION -

DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Ductile iron pipe and fittings
- B. Cast iron soil pipe

1.2 RELATED SECTIONS

- A. Section 33 02 01 – “Piping General Requirements”

1.3 REFERENCES

- A. AWWA C104: American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
- B. AWWA C110: American National Standard for Ductile-Iron and Gray Iron Fittings, 3 In. Through 48 In. for Water and Other Liquids.
- C. AWWA C111: American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- D. AWWA C115: American National Standard for Flanged Ductile-Iron and Gray Iron Pipe with Threaded Flanges.
- E. AWWA C151: American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metals Molds or Sand-Lined Molds, for Water and Other Liquids.
- F. AWWA C600: AWWA Standard for Installation for Ductile-Iron Water Mains and Their Appurtenances.
- G. AWWA C606: AWWA Standard for Grooved and Shoulder Joints.
- H. AWWA C153: Ductile Iron Compact Fittings 3 inch thru 16 inch, for Water and Other Liquids.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

SECTION 33 05 05
DUCTILE IRON PIPE

- A. All ductile iron pipe and specials shall be marked with the manufacturer's name or trademark, size, weight, thickness class, the date of manufacture, and the word "Ductile".
- B. Pipe and fittings shall be the class that equals or exceeds the pipe class in the Piping Schedule on the Contract Drawings. Requirements for various types of joints are described in following paragraphs.
- C. Pipe Material
 - 1. Ductile iron pipe (DIP) of the sizes shown or specified shall conform to ANSI A21.51 (AWWA C151), Grade 60-42 for ductile iron pipe centrifugally cast in metal molds or sand-lined molds. All ductile iron pipes shall conform to ANSI A21.50 (AWWA C150) for thickness design and shall be supplied in 18 or 20 foot nominal lengths or as required to meet the requirements of the Drawings. Fittings and specials shall be cast iron or ductile iron, conforming to the requirements of AWWA C153 and shall have minimum rated working pressure of 250 psi.
- D. Coatings
 - 1. Lining: The interior of all pipe and fittings shall be as described below.
 - a. Cement Mortar: Unless noted otherwise, the interior of pipes and fittings shall be lined with cement mortar conforming to American Standard Specifications for Cement Mortar Lining for Cast Iron Pipe and Fittings, ANSI A21.4 (AWWA C104) and shall be standard thickness. The mortar lining shall be protected with the bituminous seal coat.
 - 2. Exterior for Buried Service: The exterior of all pipe and fittings for buried service shall have a bituminous coating conforming to AWWA C151.
 - 3. Exterior for Exposed Service: The exterior of all pipe and fittings for exposed service shall have a shop-applied epoxy prime coat.
- E. Joints and Fittings
 - 1. Flanged joints and fittings shall have a minimum pressure rating of 250 psi with 125 lb. American Standard flanges. All flanges and fittings shall conform to the requirements of ANSI B16.1. Flanges shall be ductile iron and shall be of the threaded or screw on type. The face of the flanges shall be machined after installation of the flange to the pipe. No raised surface shall be allowed on flanges. Flanged pipe shall conform to the requirements of ANSI Specification A21.15, (AWWA C115). Pipe lengths shall be fabricated to meet the requirements of the Drawings.
 - 2. Gaskets shall be the "Ring Gasket" type, 1/8-inch minimum thickness, cloth inserted rubber, red rubber or neoprene and shall be suitable for the service intended. Gaskets for glass lined pipe shall be TORUSEAL flange gasket or equal. Bolts shall be of the size and length called for and in accordance with the "American Standard" and complies with the requirements of the ANSI/AWWA Standards. The bolts for flanged joints shall be a minimum ASTM A307; Grade B carbon steel and be in accordance with ANSI A21.10, (AWWA C110). The bolts shall have hexagonal heads and nuts, no washers shall be used.
 - 3. Bell and spigot pipe shall be provided with push on, O-ring rubber gasket, compression type joints shall conform to the requirements of ANSI A21.11 (AWWA C111). Fittings and specials shall be supplied with mechanical joints as specified for mechanical joint pipe. If required by installation conditions, pipe shall have cast-on lugs for adequately tying it together.
 - 4. Mechanical joints and fittings shall conform to the requirements of ANSI A21.11, (AWWA C111). Joints shall be made employing a tapered rubber gasket forced into a groove with a ductile iron follower ring. If required by installation conditions, pipe and fittings shall have cast-on lugs for adequately tying the pipe and fittings together. These shall be in conformance with standard practice and as outlined under the appropriate AWWA specifications.

5. Bolts for mechanical joints shall be high strength corrosion resistant low-alloy steel tee-head bolts with hexagonal nuts.
6. Grooved mechanical couplings for joint pipe and fittings shall be ductile iron. Couplings shall have a minimum pressure rating and service equal to that of the connected piping. Gaskets shall be of rubber. Bolts and nuts shall be heat treated carbon steel track bolts and shall be plated. Couplings shall be Style 31 as manufactured by Victaulic Company of America, or equal.
7. Restrained joint pipe and fittings shall be one of the following types. Refer to the Drawings for the type required in each location.
 - a. Locking Segment: Pipe joints and fittings shall be Lok-Fast or Lok-Ring type as manufactured by American Cast Iron Pipe; TR Flex as manufactured by US Pipe, Bolt-Lok by Griffin Pipe Products, or equal.
 - b. Restrained Gland: Fitting restraints shall be Series 1100 Megalug Restraints by EBAA Iron with mechanical joint fittings. All straight pipe joints shall be restrained with Series 1700 Megalug Restraints by EBAA Iron. Contractor may provide equivalent Roma-Grip models by Romac.
 - c. Restrained Gasket: Pipe joints and fittings shall use Field Lok 350 gaskets by US Pipe, or equal.
8. The above systems for thrust restraint shall be used where restrained joint ductile iron pipe is specified. Thrust restraint and harnessing systems such as thrust blocks, tie-rods, friction clamps, retainer glands, and other proprietary systems such as the Star Harnessing System, may be used in isolated applications such as connections to existing piping, or walls, etc. Where tie-rods are allowed, the rods and tabs shall be designed for the specified design pressure, shall have lengths less than 10 feet between fittings, and shall be painted with two heavy coats of coal tar epoxy after installation.

2.2 CAST IRON SOIL PIPE

- A. Cast Iron Soil Pipe shall conform to the standards of the Cast Iron Soil Pipe Institute (CISPI) Specification HS-67, and also ANSI Specification A-112.5.2 for Hub & Spigot pipe or A.112.5.1 for Hub & Spigot pipe or A.112.5.1 for No-Hub Pipe. Pipe class shall be "Extra Heavy: (XH)."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Reference Section 33 02 01 – "Piping General Requirements."

- END OF SECTION -

PVC / CPVC PIPE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Polyvinyl chloride (PVC) schedule 40/80 piping and fittings
- B. Chlorinated polyvinyl chloride (CPVC) schedule 40/80 pipe and fittings
- C. Water service (AWWA) PVC pipe
- D. Gravity sewer service PVC pipe and fittings
- E. Pressure sewer service PVC pipe and fittings
- F. PVC drain pipe

1.2 RELATED SECTIONS

- A. Section 33 02 01 – “Piping General Requirements”
- B. Section 33 13 00 – “Piping - Flushing, Leakage Testing, and Disinfection”

1.3 REFERENCES

- A. ASTM D 1784: Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds
- B. ASTM D 2241: Standard Specification for Polyvinyl Chloride (PVC) Pressure Rated Pipe (SDR-Series)
- C. ASTM D 2321: Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
- D. ASTM D 2412: Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- E. ASTM D 2564: Standard Specification for Solvent Cement for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
- F. ASTM D 2729: Standard Specification for Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
- G. ASTM D 2774: Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
- H. ASTM D 2855: Standard Practice for Making Solvent Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings
- I. ASTM D 3034: Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
- J. ASTM D 3139: Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- K. ASTM D 3112: Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- L. ASTM F 656: Standard Specification for Primers for Use in Solvent Cement Joints of Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
- M. ASTM F 679: Standard Specification for Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

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PCV PIPE

- N. AWWA C900: AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. for Water
- O. AWWA C905: AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe 14 In. Through 24 In. for Water
- P. NSF #14 (National Sanitation Foundation): Standard for Thermoplastic Materials, Pipe, Fittings, Valves, Traps, and Joining Materials

1.4 DEFINITIONS

- A. Standard Dimension Ratio (SDR): Outside diameter of pipe divided by wall thickness.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) SCHEDULE 40/80 PIPE AND FITTINGS

- A. PVC pipe and fittings shall be manufactured in accordance with ASTM D1785, D1784 and F 441, "normal impact" pipe, Schedule 40 or 80 as specified.
- B. Fittings used with this pipe shall be socket type or flanged type as specified herein, in Section 33 02 01 – "Piping General Requirements," or indicated on the Drawings. Plastic piping shall be installed in full accordance with the manufacturer's recommendations for the specific installation. No field bending or distortion of the pipe will be permitted.
- C. PVC pipe shall be Type 1, Grade 1 conforming to ASTM D 1784 and D 1785. Fittings shall conform to the following standard specifications:
- D. Socket Type (Schedule 40); ASTM D 2466
- E. Socket Type (Schedule 80); ASTM D 2467
- F. Fillers and additives, including but not limited to stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed 10 parts by weight per 100 parts of PVC resin in the compound.
- G. Provide flanged fittings of the same material as the specified pipe and material conforming to ANSI B16.5 at all valves and equipment with Teflon filled or natural rubber gaskets. Bolts shall be type 316 stainless steel for flanged joints. Flanges are not required at true (double) union valves.
- H. Solvent cement for socket type joints shall conform to ASTM D 2564 for PVC pipe and fittings.

2.2 CHLORINATED POLYVINYL CHLORIDE (CPVC) SCHEDULE 40/80 PIPE AND FITTINGS

- A. CPVC shall be manufactured in accordance with ASTM D 1785, D 1784 and F 441, "normal impact" pipe, Schedule 40 or 80 as specified.
- B. Fittings used with this pipe shall be socket type or flanged type as specified herein or indicated on the Drawings. Plastic piping shall be installed in full accordance with the manufacturer's recommendations for the specific installation. No field bending or distortion of the pipe will be permitted.
- C. CPVC pipe shall be Type 4, Grade 1, Schedule 80, conforming to ASTM D 1784 and ASTM F 441. CPVC fittings shall be socket type conforming to ASTM F 439.
- D. Solvent cement for socket type joints shall conform to ASTM F 493 for CPVC pipe and fittings.

2.3 WATER SERVICE (AWWA) PVC PIPE

A. C900 PVC shall be in sizes between 4 inches and 12 inches and shall meet the requirements of AWWA C900 "Poly Vinyl Chloride (PVC) Pressure Pipe" and shall conform to all requirements of ASTM D1784 and ASTM D2241. The pipe shall be capable of withstand the overburden pressure determined by the depth of the burial in the field.

1. Pipe material shall be made from clean, virgin, NSF approved Class 12454-A PVC compound conforming to resin specification ASTM D1784. Standard laying lengths shall be 20-feet (± 1 inch). Random lengths of not more than 15% of the total footage of each size may be shipped in lieu of the standard lengths. Reruns of reclaimed material shall not be accepted.
2. The pipe shall have bell and spigot ends with push-on, O-ring rubber gasket compression type joints conforming to the requirements of ASTM D 3139. Elastomeric gaskets shall conform to the requirements of ASTM D1869 and ASTM F477.
3. Minimum pipe stiffness using (F/dy) for PVC rated water pipe is contained in the table below for all sizes when tested in accordance with D2241:

DR	Rating (psi)	F/ Δy
25	100	129
18	150	364
14	200	815

4. The pipe shall be designed to pass a quick burst test pressure, given below in the table, applied in 60 to 70 seconds when tested in accordance with UL 1285, as referenced in ASTM D2241.

DR	Rating (psi)	Minimum burst pressure at 73°F (psi)
25	100	535
18	150	755
14	200	985

5. Fittings for C900 PVC pipe shall be ductile iron, bolted mechanical joint.
6. Thickness and class (DR) of C900 PVC pipe shall be determined in the drawings.

B. C905 PVC pipe shall be in sizes between 14 inches and 48 inches and shall meet the requirements of AWWA C905 "Poly Vinyl Chloride (PVC) Pressure Pipe" and shall conform to all the requirements of ASTM D1784 and ASTM D2241. The pipe shall be capable of withstanding the overburden pressure determined by the depth of the burial in the field.

1. Pipe material shall be made from clean, virgin, NSF approved Class 12454-A PVC compound conforming to resin specification ASTM D1784. Standard laying lengths shall be 20-feet (± 1 inch). Random lengths of not more than 15% of the total footage of each size may be shipped in lieu of the standard lengths. Reruns of reclaimed materials shall not be accepted.
2. The pipe shall have bell and spigot ends with push-on, O-ring rubber gasket, compression type joints conforming to the requirements of ASTM D 3139. Elastomeric gaskets shall conform to the requirements of ASTM D1869 and ASTM F477.
3. Minimum pipe stiffness using (F/dy) for PVC rated water pipe is contained in the table below for all sizes when tested in accordance with D2241:

DR	Rating (psi)	F/ Δy
18	235	364

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25	165	129
32.5	125	57
41	100	28
51	80	14

4. The pipe shall be designed to pass a quick burst test pressure, given below in the table, applied in 60 to 70 seconds when tested in accordance with UL 1285, as referenced in ASTM D2241.

DR	Rating (psi)	Minimum burst pressure at 73°F (psi)
18	235	755
25	165	535
32.5	125	400
41	100	315
51	80	255

5. Fittings for C905 PVC pipe shall be ductile iron, bolted mechanical joint.
6. Thickness and class (DR) of C905 PVC pipe shall be determined in the drawings.

2.4 GRAVITY SEWER SERVICE PVC PIPE AND FITTINGS

A. All pipe and fittings shall meet the requirements of ASTM D3034 for 4" through 15" SDR 35/26 and F679 for 18" 46PS/115PS sewer pipe. The pipe shall be made from quality PVC resin, compound to provide physical and mechanical properties that equal or exceed cell class 12454 as defined in ASTM 1784. Pipe and fittings shall have bell and spigot ends with O-ring rubber gasketed, compression type joints. Joints shall conform to the requirements of ASTM Specification D 3212.

B. Pipe and joints shall be J-M Manufacturing Ring-Tite or approved equal.

2.5 PRESSURE SEWER SERVICE PVC PIPE AND FITTINGS

A. PVC pressure rated IPS pipe shall be in size between 1 ½ inches and 12 inches and shall conform to all the requirements of ASTM D1784 and ASTM D2241. The pipe shall be of the pressure class indicated on the Drawings, and shall be capable of withstanding the overburden pressures determined by the depth of the burial in the field.

1. Pipe material shall be made from clean, virgin, NSF approved Class 12454-A PVC compound conforming to resin specification ASTM D1784. Standard laying lengths shall be 20-feet (±1 inch). Random lengths of not more than 15% of the total footage of each size may be shipped in lieu of the standard lengths. Reruns of reclaimed materials shall not be accepted.
2. The pipe shall have bell and spigot ends with push-on, O-ring rubber gasket, compression type joints conforming to the requirements of ASTM 2677. Elastomeric gaskets shall conform to the requirements of ASTM D1869 and ASTM F477.
3. Minimum pipe stiffness (F/dy) at 5% deflection shall be 435 psi for all sizes when tested in accordance with D2241.
4. The pipe shall be designed to pass a quick burst test pressure of 755 psi applied in 60 to 70 seconds when tested in accordance with ASTM D1599, as referenced in ASTM D2241.
5. Fittings for C900-Class 150, DR 18 shall be ductile iron, bolted mechanical joint.

B. Fittings shall be PVC and designed for the pipe being supplied.

2.6 PVC DRAIN PIPE

A. Perforated and closed drainage pipe and fittings shall be rigid PVC pipe, Schedule 40, unless otherwise shown or specified with solvent welded type joints, or approved equal. Pipe shall be slotted or have two rows of 1/4-inch diameter holes spaced 4-inches apart along the circumference of the pipe. Longitudinal spacing of holes shall be 5-inches maximum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Reference Section 33 02 01 – “Piping General Requirements.”

-END OF SECTION-

MANHOLES AND CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 REFERENCES

- A. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
- B. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
- C. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
- D. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures
- E. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
- F. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate manhole and concrete structure locations, elevations, piping and sizes and elevations of penetrations.
- C. Product Data: Submit cover and frame construction, features, configuration and dimensions.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with City of Midvale Public Work's standard.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and structures.
- C. Store precast concrete manholes and structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.
- D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

SECTION 33 05 13
MANHOLES AND CONCRETE STRUCTURES

PART 2 - PRODUCTS

2.1 MANHOLES AND STRUCTURES

- A. Reinforced precast concrete in accordance with ASTM C857 with HS-20 loading with gaskets in accordance with ASTM C923, unless otherwise indicated.
- B. Mortar and Grout: Shall conform to ASTM C 270, Type M with Type II, IIA or V cement.

2.2 FRAMES AND COVERS

- A. Manufacturers:
 - 1. Oldcastle or approved equal. Model Number as shown on the Drawings.
- B. Product Description: ASTM A536 Cast iron construction, machined flat bearing surface, removable lid; HS-20 load rating; "Water" cast into cover.

2.3 COMPONENTS

- A. Manhole and Structure Steps shall be polypropylene coated steel steps with 1'-0" maximum spacing.

2.4 CONFIGURATION

- A. Shaft Construction: Square or rectangular with flat lid top section; lipped male/female joints; shaped to receive pipe sections.
- B. Clear Inside Dimensions: As indicated on Drawings.
- C. Design Depth: As indicated on Drawings.
- D. Clear Cover Opening: As indicated on Drawings.
- E. Pipe Entry: Core openings for pipes as required.

2.5 BEDDING AND COVER MATERIALS

- A. Bedding: 3/4" Washed Rock as specified in Section 31 23 23.
- B. Soil Backfill to Finish Grade: Trench Backfill Material as specified in Section 31 23 15.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify built-in items are in proper location, and ready for roughing into Work.
- C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

- A. Do not install structures where site conditions induce loads exceeding structural capacity of structures.
- B. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

- A. Lift precast components at lifting points designated by manufacturer.
- B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.
- C. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 23 23.
- D. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.
- E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.
- F. Joint sealing materials may be installed on site or at manufacturer's plant.
- G. Verify manholes and structures installed satisfy required alignment and grade.
- H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe.

3.4 FRAME AND COVER INSTALLATION

- A. Set frame and cover 2 inches above finished grade for manholes and structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.

3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Vertical Adjustment of Existing Manholes and Structures
 - 1. Where required, adjust top elevation of manholes and structures to finished grades shown on Drawings.
 - 2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.

- END OF SECTION -

MECHANICAL APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. CONTRACTOR shall furnish and install all piping and equipment.

1.2 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 WATER WORKS ASSOCIATION (AWWA)
1. C-500 Metal-Seated Gate Valves for Water Supply Services
 2. C-504 Standard for Rubber-Seated Butterfly Valves
 3. C-509 Resilient-Seated Gate Valves for Water Supply Service
 4. C-512 Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
 5. C-515 Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Services
 6. C-540 Standard for Power-Actuating Devices for Valves and Sluice Gates

1.3 SUBMITTALS

- A. Submit catalog cut sheets on all mechanical appurtenances including: fittings, valves, or other items shown on the Drawings referencing each item by mark number. Information shall indicate manufacture specification compliance and dimensional data.

PART 2 - PRODUCTS

2.1 NSF 61 CERTIFICATION

- A. All products that may come into contact with drinking water must have the NSF 61 certification and must be constructed with less than 0.25% lead by weight.

2.2 GATE VALVES

- A. Gate valves shall conform to the "Standard for Resilient-Seated Gate Valves for Ordinary Water Works Service" (AWWA C-500 and C-509). Valves shall be of the resilient-seat type with non-rising stem, opening to the left, and provided with a 2-inch square operating nut for buried valves or handwheel for valves located in structures. Buried valves shall be of flange or mechanical joint design to match pipe joint system.

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- 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 an FDA, EPA, AWWA C550 and ASTM D1763 approved two-part thermosetting epoxy protective coating (10 mil minimum inside and out) system that is non-toxic and imparts no taste to water.
- 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.
- 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 Mueller Resilient Seat, or approved equal.

2.3 PIPE TAPPING SLEEVES

- A. Pipe Tapping Sleeves for hot-tapping the existing waterlines shall be rated for 150 psi test pressure and shall be manufactured by JCM (Model 432), or approved equal.

2.4 COMBINATION AIR VACUUM VALVES

- A. The air valves shall be as manufactured by Valmatic Valve and Manufacturing Corporation and shall be a fully automatic float operated valve designed to exhaust air from the pipe while filling and then shut-off drip tight. The valve shall open upon negative pressure to allow air into the pipeline. The valve shall separately allow air that occurs under pressure to be periodically released. The valve shall function as both an air release valve and air and vacuum valve in a single body.
- B. Materials: The body, baffle and cover shall be ductile or cast iron. The float, guide bushing and float arm shall be stainless steel.
- C. The valves shall conform to AWWA C512.
- D. The seat material shall be compatible with the design pressure.

2.5 WELL SERVICE VALVE

- A. The well service valve shall be as manufactured by Valmatic Valve and Manufacturing Corporation and shall be a fully automatic float operated valve designed to exhaust air from the well column pipe during pump start-up, and designed to allow air to enter the pipe column on shut-down. The valve shall provide drip free shutoff. The valve shall be intended for use with municipal drinking water systems.

- B. Materials: The body, cover and baffle shall be ductile or cast iron, and the float, baffle screen and guide bushing shall be stainless steel.
- C. The valve shall have an adjustable throttling device which controls the rate of air exhaust, but allows free airflow into the valve once a negative pressure occurs in the valve.
- D. The inlet and outlet connections shall be NPT pipe threads.
- E. The valve shall be Valmatic Model 100ST, or approved equal.

2.6 PUMP CONTROL VALVE

- A. The pump control valve shall be a pilot operated valve designed to eliminate pipe surges caused by the starting and stopping of well pumps. The main valve is hydraulically operated, diaphragm-type modified globe valve. A solenoid pilot valve controls the valve operation. It shall contain a resilient, synthetic rubber disc. The pump control valves shall be manufacture by Cla-Val Co., Model 61-02, for installation at the location shown on the drawings. The valve shall have an epoxy coating and shall include the required pilot, two position control switches, and solenoid system assemblies. The pressure class shall be 150 lb, and the valve shall include opening and closing speed adjustments and "Y" strainers.

2.7 PRESSURE RELIEF VALVE

- A. The pressure relief valve shall be a pilot controlled hydraulically operated, diaphragm-type globe valve. The valve shall be manufacture by Cla-Val Co., Model 50-01, for installation at the location shown on the drawings. The valve shall have an epoxy coating. The pressure relief valve for the Booster Station Well shall be set to open at 110 psi.

2.8 BALL VALVES

- A. Ball Valves shall be full port opening bronze/stainless steel body, hard chrome plated brass ball and have adjustable stem packing gland. They shall be Nibco T-585-66-LF or approved equal.

2.9 BUTTERFLY VALVES

- A. Butterfly Valves shall be manufactured in accordance with AWWA C504. Valve bodies shall be constructed of cast iron with a stainless steel body seat. The seat shall be rubber. Valve shafts shall be Type 304 stainless steel.
- B. Actuators shall be of the manual hand wheel style.

2.10 CHECK VALVES

- A. Check valves shall be globe style silent check valves. Valves shall include a center guided, spring loaded disc and when open shall have an open area equal to the nominal valve size.

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B. Materials: The body shall be ductile or cast iron. The seat and disc shall be silicon bronze (lead free). The spring and retaining screws shall be stainless steel.

C. Check valves shall be Valmatic Model Series 1800, or approved equal. 2.11.

2.11 HOSE BIBB AND SAMPLING TAPS

A. Hose bibbs shall be brass or stainless steel and shall include anti-siphon devices.

B. Sampling taps shall be brass or stainless steel and smooth nosed (no threads at the discharge point).

2.12 PRESSURE GAUGES

A. Pressure gauges shall be provided where shown. Gauges shall be industrial type with stainless steel movement, liquid filled, and stainless steel or Phenolic case. Unless otherwise shown, pressure gauges shall have a 4-1/2 inch dial, 1/2 inch threaded connection and a shut-off valve unless otherwise requested by the OWNER. Gauges shall be calibrated to read in applicable units, with an accuracy of ± 1 percent, to 150 percent of the working pressure. Gauges shall be manufactured by U.S. Gauge, Foxboro, Marsh, or approved equal.

2.13 SERVICE SADDLES

A. Shall consist of a brass body and two flattened silicone bronze straps, meeting applicable sections of ANSI/AWWA C800 - Underground Service Line Valves and Fittings.

B. Outlet shall be tapped with AWWA I.P. thread (F.I.P.T.). Outlet shall be o-ring sealed.

C. Shall be rated for a maximum working pressure of 150 psi **2.14**

2.14 COPPER PIPE CONNECTIONS AND FITTINGS

A. Copper pipe shall be Type K copper for buried service lines. Copper piping and fittings shall be 3/4-inch, 1-inch or 1 1/2-inch minimum as required to replace existing piping with the same diameter.

B. Type K copper pipe shall have smooth surfaces free from bumps and shall be flexible enough to be coiled.

C. Connections shall be flared type for service lines.

D. Connections for dissimilar piping shall include dielectric insulation unions.

E. Fittings shall conform to AWWA C-800 standards.

2.15 BRASS PIPING

A. Brass piping shall be iron pipe size standards and meet ASTM B-43 standards for Seamless Red Brass Pipe.

2.16 DISMANTLING JOINTS

- A. The dismantling joints shall be flanged joints designed to ease the assembly/dis-assembly of the piped system. Joints shall have an adjustable length of 2-inches, minimum. The dismantling joints shall be constructed of steel or ductile iron and shall be covered with an NSF 61 compliant epoxy coating. Joints shall provide thrust restraint for pressures of 200 psi minimum.

2.17 VALVE BOXES AND LIDS

- A. All buried valves shall be installed complete with 6-inch diameter slide type, two-piece cast iron soil pipe as manufactured by Tyler, and shall be Tyler 562 Series (or approved equal). The valve box lid shall be designated "water."
- B. Concrete Collars shall be 10" thick x 2'6" in diameter centered over 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.

2.18 PIPE SUPPORTS

- A. Pipe supports shall be manufactured by Grinnell, and shall be Grinnell Adjustable Pipe Support Model No. 265 (or approved equal). All pipe supports shall have a 1-inch high grouted pad to be used as a leveling base.

2.19 STATIC MIXER

- A. The static mixer shall be a Westfall 2800 series mixer or approved equal. The mixer shall be of the orifice plate type and shall fit between flanges of other fittings. The mixer shall be type 316 stainless steel and shall have a Beta value of 0.8. The mixer shall be oriented so that the primary (larger) open orifice areas are located in a north south alignment.

PART 3 - PRODUCTS – 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 plans and in accordance with the manufacturer's written instructions.

- END OF SECTION -

FLUSHING, LEAKAGE TESTING, AND DISINFECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing materials
- B. Disinfectant
- C. Alkali
- D. Acid

1.2 GENERAL REQUIREMENTS

- A. CONTRACTOR shall flush, test and disinfect piping as described herein.

1.3 REFERENCES

- A. AWWA A100: AWWA Standard for Water Wells
- B. AWWA B300: AWWA Standard for Hypochlorites
- C. AWWA B301: AWWA Standard for Liquid Chlorine
- D. AWWA C651: AWWA Standard for Disinfecting Water Mains
- E. AWWA C652: AWWA Standard for Water-Storage Facilities

1.4 DEFINITIONS

- A. Leakage: The quantity of water required to maintain the specified hydrostatic test pressure after the pipeline has been filled with water and the air expelled.
- B. Non-rigid Pipe: Any pipe which requires bedding and backfill material for structural support.
- C. Disinfect Residual: The quantity of disinfectant in treated water.
- D. ppm: Parts per million

1.5 SUBMITTALS

- A. Leakage Testing:
 - 1. Testing Plan: Submit prior to testing and include at least the information that follows.
 - a. Testing dates
 - b. Piping systems and section(s) to be tested
 - c. Test type
 - d. Method of isolation
 - e. Calculation of maximum allowable leakage for piping section(s) to be tested
 - 2. Certifications of Calibration: Testing equipment.
 - 3. Certified Test Report.

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- B. Disinfection
 - 1. CONTRACTOR's evidence of experience in disinfection.
 - 2. Bacteriological laboratory's evidence of certification if laboratory is not OWNER's laboratory.
 - 3. Disinfection Report: three copies including:
 - a. Date issued
 - b. Project name and location
 - c. Treatment Contractor's name, address and phone number
 - d. Type and form of disinfectant used
 - e. Time and date of disinfectant injection started
 - f. Time and date of disinfectant injection completed
 - g. Test locations
 - h. Initial and 24-hour disinfectant residuals in ppm for each outlet tested
 - i. Time and date of flushing start
 - j. Time and date of flushing completion
 - k. Disinfectant residual after flushing in ppm for each outlet tested
 - 4. Bacteriological Report: three copies including:
 - a. Date issued
 - b. Project name and location
 - c. Laboratory's name, certification number, address, and phone number
 - d. Time and date of water sample collection
 - e. Name of person collecting samples
 - f. Test locations
 - g. Time and date of laboratory test start
 - h. Coliform bacteria test results of each outlet tested
 - i. Certification that water conforms or fails to conform to bacterial standards of State of Utah and Project public drinking water regulations
 - j. Bacteriologist's signature

PART 2 - PRODUCTS

2.1 TESTING MATERIALS

- A. Medium: Potable Water
- B. Recording Equipment:
 - 1. Supply all equipment and power to perform pressure testing.
 - 2. Secure approval of pressure gauges.
 - 3. Locate all gauges and recording equipment away from affect of sunshine or unsuitable weather conditions.
 - 4. Place vents, pressure taps, and drains for the test. Repair pipeline at completion of test at no additional cost to OWNER.

2.2 DISINFECTANT

- A. Liquid Chlorine: AWWA B301 with chlorine 99.5 percent pure by volume.
- B. Sodium Hypochlorite: AWWA B300 with not less than 100 grams per liter available chlorine.

- C. Calcium Hypochlorite: AWWA B300 with 65 to 70 percent available chlorine by weight in granular form.
- D. Powder, tablet, or gas according to manufacturer's specification.

2.3 ALKALI

- A. Caustic Soda or Soda Ash

2.4 ACID

- A. Hydrochloric (Muriatic) type

PART 3 - EXECUTION

3.1 PREPARATION

- A. Notify ENGINEER in writing five (5) days in advance of testing. Perform testing in presence of ENGINEER.
- B. Pressure Piping:
 - 1. Install temporary thrust blocking or other restraint as necessary to protect adjacent piping or equipment and make taps in piping prior to testing.
 - 2. Wait five (5) days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to two (2) days.
 - 3. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.
 - 4. New Piping Connected to Existing Piping: Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to ENGINEER.
 - 5. Items that do not require testing include: Piping between wetwells and wetwell isolation valves, equipment seal drains, tank overflows to atmospheric vented drains, and tank atmospheric vents.
- C. Test section may be filled with water and allowed to stand under low pressure prior to testing.
- D. Gravity Piping:
 - 1. Perform testing after service connections, manholes, and backfilling have been completed between stations to be tested.
 - 2. Determine groundwater level at time of testing by exploratory holes or other method acceptable to ENGINEER.
 - 3. Pipe 42-inch Diameter and Larger Piping: Joint testing device may be used to isolate and test individual joints.

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3.2 HYDROSTATIC TEST FOR PRESSURE PIPING

- A. Fluid: Clean water of such quality to prevent corrosion of materials in piping system.
- B. Buried Piping:
 - 1. Test after backfilling has been completed.
 - 2. Expel air from piping system during filling.
 - 3. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
 - 4. Maintain hydrostatic test pressure continuously for two (2) hours minimum, reopening isolation valve only as necessary to restore test pressure.
 - 5. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
 - 6. Maximum Allowable Leakage:
 $L = ND \text{ times the square root of } P \text{ divided by } 7400$

Where

L = Allowable leakage, gallons per hour

N = Number of joints in tested line including fittings

D = Nominal diameter of pipe in inches

P = Average test pressure, pounds per square inch (gauge)

*Pressure systems will be tested at working pressure plus surge allowance. Gravity systems will be tested with a minimum of 4 feet of head at each manhole or cleanout, or the equivalent head of the down gradient manhole, whichever is greater.

- C. Exposed Piping:
 - 1. Exposed piping shall be hydrostatically tested at the specified test pressure in accordance with the procedures of AWWA C600. Each pipeline shall be filled with water for a period of no less than 24 hours and then subjected to the test pressure for two (2) hours. During this test, exposed piping shall show no leakage.

3.3 PNEUMATIC TEST FOR PRESSURE PIPING

- A. Do not perform on:
 - 1. PVC pipe
 - 2. Any piping listed in the Pipe Schedule for hydrostatic testing
 - 3. Buried and other non-exposed piping
- B. Fluid: Oil-free, dry air
- C. Procedure:
 - 1. Apply preliminary pneumatic test pressure of 25 psig maximum to piping system prior to final leak testing to locate visible leaks. Apply soap bubble mixture to joints and connections; examine for leakage.
 - 2. Correct visible leaks and repeat preliminary test until visible leaks are corrected.
 - 3. Gradually increase pressure in steps of approximately one-tenth of specified test pressure until required test pressure is reached.
 - 4. Maintain pneumatic test pressure continuously for minimum of 10 minutes and for such additional time as necessary to conduct soap bubble examination for leakage.
 - 5. Correct visible leakage and retest as specified.

- D. Allowable Leakage: Piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leakage.
- E. After testing and final cleaning, purge with nitrogen those lines that will carry flammable gases to assure no explosive mixtures will be present in system during filling process.

3.4 HYDROSTATIC TEST FOR GRAVITY PIPING

- A. Testing Equipment Accuracy: Plus or minus 1/2-gallon of water leakage under specified conditions.
- B. Maximum Allowable Leakage: 0.16 gallons per hour per inch diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.
- C. Gravity Sanitary and Roof Drain Piping: Test with 15 feet of water to include highest horizontal vent in filled piping. Where vertical drain and vent systems exceed 15 feet in height, test systems in 15-foot vertical sections as piping is installed.
- D. *Defective* Piping Sections: Replace or test and seal individual joints, and retest as specified.

3.5 FIELD QUALITY CONTROL

- A. Test Report Documentation:
 - 1. Test date
 - 2. Description and identification of piping tested
 - 3. Test fluid
 - 4. Test pressure
 - 5. Remarks, including:
 - a. Leaks (type, location)
 - b. Repair/replacement performed to remedy excessive leakage
 - 6. Signed by CONTRACTOR to represent that test has been satisfactorily complete

3.6 ALIGNMENT AND GRADE TEST

- A. No variance will be allowed from line and grade in excess of 1/32 inch per inch of pipe diameter or 1/2 inch maximum provided that such variation shall not be in a level or reverse sloping invert.
- B. The variation in the invert elevation between adjoining ends of pipe due to eccentricity of joining surface and pipe interior surfaces shall not exceed 1/64 inch per inch of pipe diameter, or 1/2 inch maximum.

3.7 OBSTRUCTION TEST

- A. Visually examine pipe internally for obstructions.
- B. When visual test is not feasible, pass through pipeline around incompressible mandrel which is one inch less in diameter than the internal diameter of the pipeline and 2 times the diameter in length.

SECTION 33 13 00
FLUSHING, LEAKAGE TESTING, AND DISINFECTION

3.8 NON-RIGID PIPE DEFLECTION TEST

- A. Test installed sections of non-rigid pipeline to ensure that circumferential deflection of non-rigid pipe does not exceed 5 percent. Use mandrel of proper size.

3.9 INFILTRATION TEST

- A. No pipe will be accepted if the infiltration rate exceeds 100 gallons per inch diameter per mile per 24 hours.

3.10 PIPE TESTING SCHEDULE

- A. Irrigation:
 - 1. Grade Test: All circuits drain
 - 2. Hydrostatic Test
 - 3. Operational Testing:
 - a. Perform operational testing after hydrostatic test is complete; backfill is in place and sprinkler heads adjusted to final coverage.
 - b. Demonstrate system meets coverage requirements and automatic controls function properly.
 - c. Coverage requirements are based on operation of one circuit at a time.
- B. Sanitary Sewers and all Gravity Systems:
 - 1. Alignment and grade test
 - 2. Obstruction test
 - 3. Non-rigid pipe deflection test (if applicable)
 - 4. Infiltration test for gravity pipeline systems
 - 5. Hydrostatic test
- C. Subdrains:
 - 1. Grade test: All pipelines drain
 - 2. Obstruction Test
 - 3. Non-rigid pipe deflection test (if applicable)
- D. Storm Drains:
 - 1. Alignment and grade test
 - 2. Obstruction test
 - 3. Non-rigid pipe deflection test (if applicable)
 - 4. Hydrostatic test
- E. Potable Water System and all Pressure Systems:
 - 1. Obstruction test
 - 2. Hydrostatic test

3.11 FLUSHING

- A. Flush all lines after pressure testing.

- B. Provide for a 2.5 foot per second flushing velocity according to the following:
Flow (GPM) = $4.37 D^2$
Where D = Inside Diameter in Inches
- C. Gravity lines and large diameter pressure pipelines may be cleaned in lieu of flushing by means of high-pressure water jetting prior to final testing.

3.12 DISINFECTION

- A. Preparation
 - 1. Prior to starting the disinfection procedure, ensure the potable water system is completed, cleaned, tested in accordance with the provisions of this Section and ready for disinfection.
 - 2. Ensure that the pipeline to be disinfected is not connected to the existing system.
 - 3. Provide necessary signs, barricades, and notices to prevent accidental exposure to disinfecting materials, consuming disinfecting water, or disturbing the system being disinfected.
- B. Disinfection of Water Lines
 - 1. Use one method defined under AWWA C651, as approved by ENGINEER.
 - 2. Disperse disinfectant throughout system to obtain a minimum of 25 milligrams per liter of free chlorine residual.
 - 3. Starting at outlet closest to water source, bleed water from each outlet until water produces odor of disinfectant. Repeat process at each outlet throughout system.
- C. Quality Control - Bacteriological Test
 - 1. No samples for testing shall be taken sooner than 24 hours after system flushing.
 - 2. Sample water at each of the following locations, as applicable:
 - a. Where water enters system
 - b. Ends of piping runs
 - c. Remote outlets
 - 3. Analyze water samples in accordance with state Project requirements.
 - 4. If bacteriological test proves water quality to be unacceptable, repeat system treatment.
 - 5. Water systems shall not be accepted or placed into service until a negative bacteriological test is made on water taken. Repeat dosing as necessary until a negative test is obtained. Provide a copy of the negative bacteriological test to ENGINEER.
- D. Flushing and Disposal of Disinfectant
 - 1. After the 24-hour retention period, flush the chlorinated water from the main until chlorine concentration measurements in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.
 - 2. Legally and properly dispose of disinfecting water and ensure no chlorine buildup or damage to the environment.

- END OF SECTION -

Part 5
DRAWINGS
