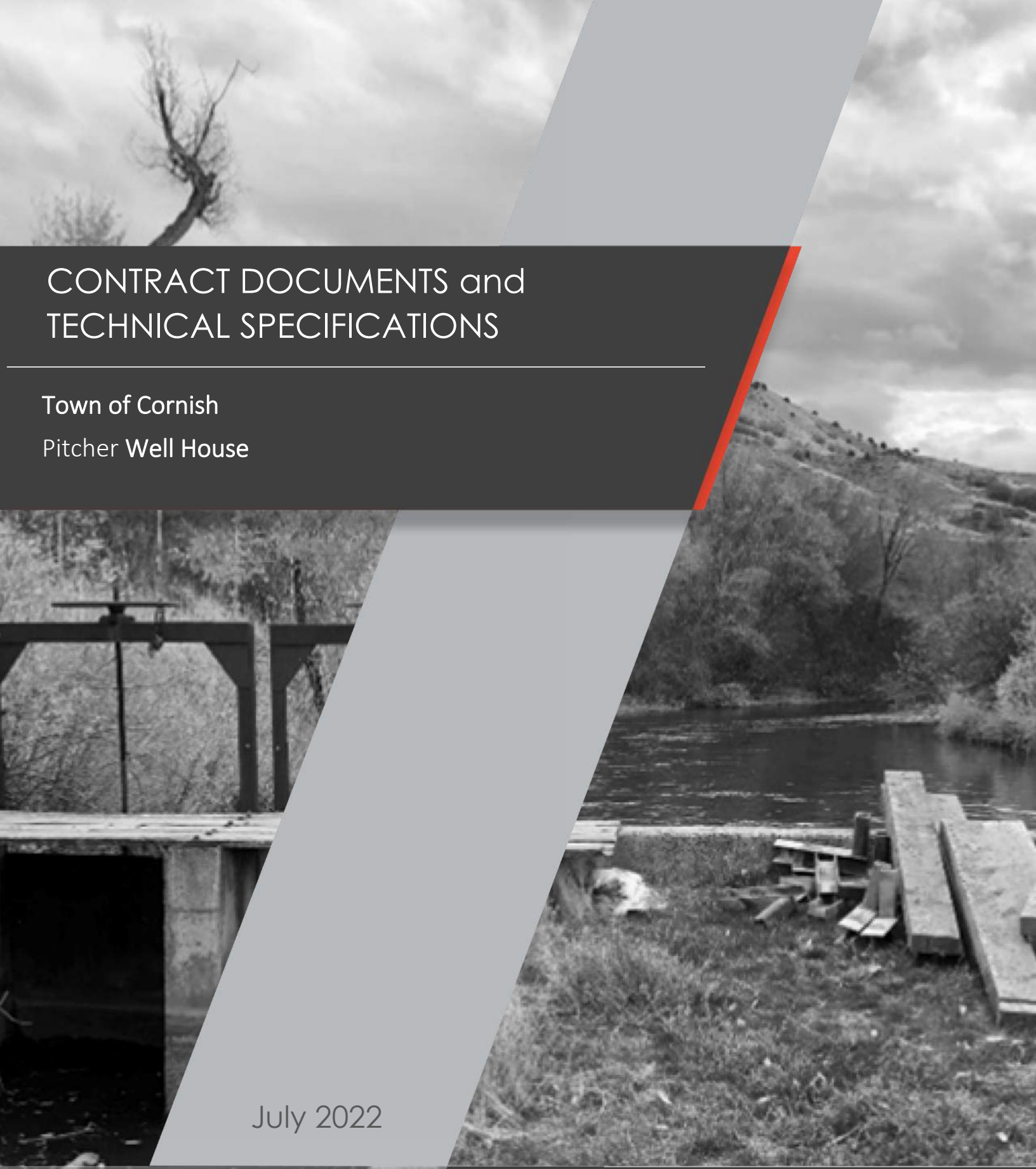

CONTRACT DOCUMENTS and TECHNICAL SPECIFICATIONS

Town of Cornish

Pitcher **Well House**

July 2022

Prepared by CRS Engineers
4246 S. Riverboat Rd, Ste 200| Salt Lake City, UT 84123
O. (801) 359-5565 | F. 801.359.4272

CRS Engineers PN 2019-0406
4246 S. Riverboat Rd, Ste 200, Salt Lake City, UT 84123

Town of Cornish

Pitcher Well House

Project Location:
12197 N 5800 W, Cornish City, Utah

July 2022

CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

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DOCUMENT 00 10 00
ADVERTISEMENT FOR BIDS

GENERAL NOTICE

Town of Cornish is requesting Bids for the construction of the following Project:

Pitcher Well House

Bids for the construction of the Project will be received at CRS Engineers located at 4246 S. Riverboat Rd, Ste 200, Salt Lake City, UT 84123 until August 12th, 2022 at 2:00 p.m. local time. Alternatively, bids may be emailed to Mark Chandler at mark.chandler@crsengineers.com. At that time the Bids received will be publicly opened and read.

The Work generally consists of constructing and furnishing a wellhouse and appurtenant piping for the town of Cornish.

OBTAINING THE BIDDING DOCUMENTS

The Issuing Office for the Bidding Documents is:

CRS Engineers
4246 S. Riverboat Rd, Ste 200
Salt Lake City, UT 84123

Prospective Bidders may obtain the Bidding Documents in .PDF format from the Issuing Office upon contacting Mark Chandler at mark.chandler@crsengineers.com or by phone at (801) 359-5565. Partial sets of Bidding Documents will not be available from the Issuing Office. Neither Owner nor Engineer will be responsible for full or partial sets of Bidding Documents, including addenda, if any, obtained from sources other than the Issuing Office.

INSTRUCTIONS TO BIDDERS

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

THIS ADVERTISEMENT IS ISSUED BY:

Owner: Town of Cornish
By: Matt Leak
Title: Mayor
Date: July 18, 2022

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DOCUMENT 00 20 00
INSTRUCTIONS TO BIDDERS

Table of Contents

ARTICLE 1—DEFINED TERMS

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

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

ARTICLE 2—BIDDING DOCUMENTS

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

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

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

2.04 Electronic Documents

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

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

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

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

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

a. **[List documents that will be made available to Bidder]**

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

3. In all cases, the Bidder shall take appropriate measures to verify that any electronic/digital information provided in Electronic Documents is appropriate and adequate for the Bidder's specific purposes.

4. Bidders may obtain the Electronic Documents listed above from the Engineer. The Engineer will transmit said documents to the Bidder upon receipt of the CRS Copyright and Indemnity Agreement, signed by Bidder.

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

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

a. **[List documents that will be made available to Contractor]**

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

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

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

5. Contractor may obtain the Electronic Documents listed above from the Engineer. The Engineer will transmit said documents to the Contractor upon receipt of the CRS Copyright and Indemnity Agreement, signed by Contractor.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

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

ARTICLE 4—PRE-BID CONFERENCE

4.01 A pre-Bid conference will not be conducted for this Project.

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

5.01 Site and Other Areas

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

5.02 Existing Site Conditions

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

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

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

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

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

   d. Technical Data contained in such reports and drawings.

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

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

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

5.03 Other Site-related Documents

A. No other Site-related documents are available.

5.04 Site Visit and Testing by Bidders

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

B. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner or Engineer contact for visiting the Site: **Mark Chandler with CRS Engineers**. Bidder must conduct the required Site visit during normal working hours.

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

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

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

5.05 Owner's Safety Program

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

5.06 Other Work at the Site

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

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 Express Representations and Certifications in Bid Form, Agreement

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

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

ARTICLE 7—INTERPRETATIONS AND ADDENDA

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

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:

A. Submit questions in writing to Mark Chandler, P.E., CRS Engineers at mark.chandler@crsengineers.com.

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

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

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

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

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

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

ARTICLE 9—CONTRACT TIMES

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

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

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

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

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

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

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

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

A. Piping

B. Electrical

C. Material suppliers

D. Materials testing

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

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

ARTICLE 12—PREPARATION OF BID

12.01 The Bid Form is included with the Bidding Documents.

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

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

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

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

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

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

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

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

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

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

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

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

12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in

writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 Unit Price

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

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

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

ARTICLE 14—SUBMITTAL OF BID

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

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

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

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

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

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

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

ARTICLE 16—OPENING OF BIDS

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

16.02 Bids will be opened privately.

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

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

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

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

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

18.05 Evaluation of Bids

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

B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form. To determine the Bid prices for purposes of comparison, Owner will announce to all bidders a "Base Bid plus alternates" budget after receiving all Bids, but prior to opening them. For comparison purposes alternates will be accepted, following the order of priority established in the Bid Form, until doing so would cause the budget to be exceeded. After determination of the Successful Bidder based on this comparative process and on the responsiveness, responsibility, and other factors set forth in these Instructions, the award may be made to said Successful Bidder on its base Bid and any combination of its additive alternate Bids for which Owner determines funds will be available at the time of award.

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

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

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

ARTICLE 19—BONDS AND INSURANCE

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

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

ARTICLE 20—SIGNING OF AGREEMENT

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

END OF DOCUMENT

DOCUMENT 00 41 00
BID FORM

Town of Cornish

Pitcher Well House

Bids due and publicly read:

August 12th, 2022 at 2:00 p.m.
A virtual meeting link will be sent out to bidders.

CRS Engineers

4246 S. Riverboat Rd, Ste 200, Salt Lake City, UT 84123

emailed to:

CRS Engineers

Mark Chandler - mark.chandler@crsengineers.com

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to: CRS Engineers.

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

ARTICLE 2—ATTACHMENTS TO THIS BID

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

A. Required Bid security;

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

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

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

F. Required Bidder Qualification Statement with supporting data

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

3.01 Unit Price Bids

A. Bidder will perform the following Work at the indicated unit prices:

Base Bid

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
1	Mobilization	LS	1	$	$
2	Furnish and Install Well House Structural/Mechanical Building	LS	1	$	$
3	Furnish and Install Well House Pump, Piping, and Appurtenances.	LS	1	$	$
4	Furnish and Install Wellhouse Electrical & Generator	LS	1	$	$
5	Furnish and Install Storm Drain Line and Components	LS	1	$	$
6	Complete Site Grading	LS	1	$	$
7	Power Relocation	LS	1	$	$
Total of All Unit Price Base Bid Items					$
Total Unit Price Base Bid (in words): _____					

B. Bidder acknowledges that:

1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item,
2. the Contractor or Owner shall be entitled to an adjustment in Unit Price as indicated in Section 00 80 00 - Supplementary Conditions, SC-13.03E, and
3. estimated quantities are not guaranteed and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 4—TIME OF COMPLETION

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

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

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

5.01 Bid Acceptance Period

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

5.02 Instructions to Bidders

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

5.03 Receipt of Addenda

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 Bidder's Representations

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

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

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

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

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

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

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

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

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

6.02 Bidder's Certifications

A. The Bidder certifies the following:

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

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

3. Bidder has not solicited or induced any individual or entity to refrain from bidding.

4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:

a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.

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

c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.

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

BIDDER hereby submits this Bid as set forth above:

Bidder:

_____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(typed or printed)

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

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(typed or printed)

Address for giving notices: _____

_____

Bidder's Contact:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Phone: _____

Email: _____

Address: _____

_____

_____

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

END OF DOCUMENT

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DOCUMENT 00 43 00
BID BOND (PENAL SUM FORM)

Bidder	**Surety**
Name: Address *(principal place of business)*:	Name: Address *(principal place of business)*:
Owner	**Bid**
Name: Town of Cornish Address *(principal place of business)*: 13322 North 4400 West Cornish, Utah 84308	Project *(name and location)*: Pitcher Well House 12197 N 5800 W Cornish City, Utah Bid Due Date: August 12th, 2022
Bond	
Penal Sum Amount: Date of Bond:	

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

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

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

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

END OF DOCUMENT

DOCUMENT 00 45 10
BIDDER QUALIFICATIONS STATEMENT

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

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

1.02 Provide information on the Business's organizational structure:

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

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

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

Name of business:		Affiliation:	
Address:			

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

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

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business:

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

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

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

Certification	Certifying Agency	Certification Date
☐ Disadvantaged Business Enterprise		
☐ Minority Business Enterprise		
☐ Woman-Owned Business Enterprise		
☐ Small Business Enterprise		
☐ Disabled Business Enterprise		
☐ Veteran-Owned Business Enterprise		
☐ Service-Disabled Veteran-Owned Business		
☐ HUBZone Business (Historically Underutilized) Business		
☐ Other		
☐ None		

ARTICLE 4—SAFETY

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

Name of Business's Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

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

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—FINANCIAL

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

Financial Institution:		
Business address:		
Date of Business's most recent financial statement:		☐ Attached
Date of Business's most recent audited financial statement:		☐ Attached
Financial indicators from the most recent financial statement		
Contractor's Current Ratio (Current Assets ÷ Current Liabilities)		
Contractor's Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)		

ARTICLE 6—SURETY INFORMATION

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

Surety Name:	
Surety is a corporation organized and existing under the laws of the state of:	

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

ARTICLE 7—INSURANCE

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

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

ARTICLE 8—CONSTRUCTION EXPERIENCE

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

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

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

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

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

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

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

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

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

B. Diverse Business Certifications if required by Paragraph 3.01.

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

D. Financial statements as required by Paragraph 5.01.

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

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

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

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

I. Additional items as pertinent.

This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

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

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

Schedule A—Current Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

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

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

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

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

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

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

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

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

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule C—Key Individuals

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

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

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

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

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DOCUMENT 00 51 00
NOTICE OF AWARD

Date of Issuance:		Effective Date:	
Owner:	Town of Cornish	Owner's Contract No.:	
Engineer:	CRS Engineers	Engineer's Project No.:	2019-0406
Project:	Pitcher Well House		
Bidder:			
Bidder's Address:			

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

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

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

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

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

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

1. Deliver to Owner three counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any): ***[Describe other conditions that require Successful Bidder's compliance]***

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

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

Owner: Town of Cornish

By (signature): _____

Name (printed): _____

Title: _____

Copy: Engineer

END OF DOCUMENT

This page is left blank intentionally.

DOCUMENT 00 52 00
AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT

This Agreement is by and between Town of Cornish ("Owner") and [contractor] ("Contractor").

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

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 *Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally consists of constructing and furnishing a wellhouse and appurtenant piping for the town of Cornish.*

ARTICLE 2—THE PROJECT

2.01 *The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Pitcher Well House.*

ARTICLE 3—ENGINEER

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

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

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

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

4.02 *Contract Times: Dates*

A. The Work will be substantially complete on or before Wednesday, May 31, 2023**,** and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before Friday, June 30, 2023.

4.05 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner **$15.00** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted

pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner **$15.00** for each day that expires after such time until the Work is completed and ready for final payment.

3. *Milestones:* Contractor shall pay Owner **$15.00** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved, or until the time specified for Substantial Completion is reached, at which time the rate indicated in Paragraph 4.05.A.1 will apply, rather than the Milestone rate.

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

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

ARTICLE 5—CONTRACT PRICE

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

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

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

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

UNIT PRICE WORK					
Item No.	**Description**	**Unit**	**Estimated Quantity**	**Unit Price**	**Extended Price**
				$	$
				$	$
				$	$
				$	$
				$	$
Total of all Extended Prices for Unit Price Work (subject to final adjustment based on actual quantities)					$

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

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

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

ARTICLE 6—PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

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

6.02 Progress Payments; Retainage

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the **[ordinal number, such as 5th]** day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

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

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

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

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

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

6.03 Final Payment

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

6.04 Consent of Surety

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

6.05 Interest

A. All amounts not paid when due will bear interest at the rate at 2% per annum above the rate paid by the Internal Revenue Service on refund claims.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 Contents

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

1. This Agreement.
2. Bonds:
   a. Performance bond (together with power of attorney).
   b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual.
6. Drawings (not attached but incorporated by reference) consisting of _____ sheets with each sheet bearing the following general title: [project name].
7. The following Addenda:
   a. [list addenda here with number and date]
9. Exhibits to this Agreement (enumerated as follows):
   a. **[list exhibits]**
10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.
    d. Field Orders.
    e. Warranty Bond, if any.

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

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

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

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 Contractor's Representations

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

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Contractor has carefully studied the reports of explorations and tests of subsurface

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

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

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

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

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

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

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

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

8.02 Contractor's Certifications

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

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

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

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

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

8.03 Standard General Conditions

A. Owner stipulates that if the General Conditions that are made a part of this Contract are

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

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

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

Owner:

_____
(typed or printed name of organization)

By: _____
(individual's signature)

Date: _____
(date signed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Attest: _____
(individual's signature)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

*(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*

Contractor:

_____
(typed or printed name of organization)

By: _____
(individual's signature)

Date: _____
(date signed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

*(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority*

Attest: _____
(individual's signature)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

License No.: _____
(where applicable)

State: _____

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DOCUMENT 00 55 00
NOTICE TO PROCEED

Owner:	**Town of Cornish**	Owner's Contract No.:	
Contractor:		Contractor's Project No:	
Engineer:	CRS Engineers	Engineer's Project No.:	**2019-0406**
Project:	**Pitcher Well House**		
Effective Date of Contract:			

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **[date Contract Times are to start]** pursuant to Paragraph 4.01 of the General Conditions.

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

In accordance with the Agreement:

The date by which Substantial Completion must be achieved is **Wednesday, May 31, 2023**, and the date by which readiness for final payment must be achieved is **Friday, June** 30, 2023.

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

[Note any access limitations, security procedures, or other restrictions]

Owner: **Town of Cornish**

By (signature): _____

Name (printed): _____

Title: _____

Date Issued: _____

Copy: Engineer

END OF DOCUMENT

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DOCUMENT 00 61 00
PERFORMANCE BOND

Contractor Name: Address *(principal place of business)*:	**Surety** Name: Address *(principal place of business)*:
Owner Name: **Town of Cornish** : Mailing address *(principal place of business):* **13322 North 4400 West** **Cornish, Utah 84308**	**Contract** Description *(name and location)*: **Pitcher Well House** **12197 N 5800 W** **Cornish City, Utah** Contract Price: Effective Date of Contract:

Bond

Bond Amount:

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

Modifications to this Bond form:
☐ None ☐ See Paragraph 16

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

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

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

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:
   3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;
   3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
   3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
   5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
   5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
   5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or
   5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:
      5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
      5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.
7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:
   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and
7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.
9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.
10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.
12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.
13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.
14. Definitions
    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.
    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.
    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.
    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
16. Modifications to this Bond are as follows: None.

END OF DOCUMENT

DOCUMENT 00 61 50
PAYMENT BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **Town of Cornish** Mailing address *(principal place of business)*: **13322 North 4400 West** **Cornish, Utah 84308**	Description *(name and location)*: **Pitcher Well House** **12197 N 5800 W** **Cornish City, Utah** Contract Price: Effective Date of Contract:

Bond

Bond Amount:

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

Modifications to this Bond form:
☐ None ☐ See Paragraph 18

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

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

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

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
    5.1. Claimants who do not have a direct contract with the Contractor
        5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
        5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).
    5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
    7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
    7.2. Pay or arrange for payment of any undisputed amounts.
    7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.
8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.
16. Definitions
    16.1. *Claim*—A written statement by the Claimant including at a minimum:
        16.1.1. The name of the Claimant;
        16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;
        16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
        16.1.4. A brief description of the labor, materials, or equipment furnished;
        16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
        16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
        16.1.7. The total amount of previous payments received by the Claimant; and
        16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.
    16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
    16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
    16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
    16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
18. Modifications to this Bond are as follows: None.

END OF DOCUMENT

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

APPLICATION FOR PAYMENT

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

NSPE®
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed By

CSI®
Building Knowledge
Improving Project Delivery

NUCA
We Dig America

National Society of Professional Engineers
1420 King Street, Alexandria, VA 22314-2794
(703) 684-2882
www.nspe.org

American Council of Engineering Companies
1015 15th Street N.W., Washington, DC 20005
(202) 347-7474
www.acec.org

American Society of Civil Engineers
1801 Alexander Bell Drive, Reston, VA 20191-4400
(800) 548-2723
www.asce.org

NOTE: EJCDC publications may be purchased at www.ejcdc.org, or from any of the sponsoring organizations above.

GUIDELINES FOR THE INTENDED USE OF EJCDC C-620, APPLICATION FOR PAYMENT

1.0 PURPOSE AND INTENDED USE OF THE DOCUMENT

The Application for Payment is used to facilitate periodic progress payments to the Contractor for Work completed and for stored materials and equipment (referred to in this document as "Stored Materials").
For additional information regarding the Application for Payment, see EJCDC® C–700, Standard General Conditions of the Construction Contract (2018), Paragraph 15.01, and EJCDC® C–001, Commentary on the 2018 EJCDC Construction Documents (2018).

2.0 APPLICATION FOR PAYMENT OVERVIEW

This document was prepared in Microsoft Excel due to the number of calculations involved in the preparation of the Application for Payment. The application consists of a Summary worksheet, and 3 supporting worksheets: Lump Sum worksheet, Unit Price worksheet, and Stored Materials worksheet.

2.1 *Summary Worksheet* — calculates the amount to be paid to the Contractor at the end of each Application for Payment period. This calculation imports numbers from the supporting worksheets to determine the value of the Work completed and Stored Materials, calculate retainage, and deduct amounts previously paid to determine the amount the Contractor should be paid for the current application period. Application periods are typically one month; however these periods may be extended when Contractor's efforts do not result in the billable completion of Work or storage of materials and equipment during the payment period.

2.2 *Lump Sum Worksheet* — calculates the total value for completed Work for which compensation is paid on a Lump Sum basis. The schedule of values included in this worksheet reflects a breakdown of lump sum Work items to which Contractor and Engineer have agreed, pursuant to Article 2 of the General Conditions. Costs for Stored Materials associated with lump sum items are included on this worksheet to calculate the total value for completed lump sum Work and associated Stored Materials. This total is exported to the Summary worksheet. Separate totals for Work Completed and for materials currently stored are also exported to the Summary worksheet for use in calculating the amount of retainage to be held for each.

2.3 *Unit Price Worksheet* — calculates the total value for completed Work for which compensation is paid on a Unit Price basis. The schedule of values included in this spreadsheet is typically a tabulation of Unit Price items from the Agreement. Costs for Stored Materials associated with unit price items are included in this worksheet to calculate the total value for completed Unit Price Work and associated Stored Materials. This total is exported to the Summary worksheet. Separate totals for Work Completed and for Materials Currently Stored are also exported to the Summary worksheet for use in calculating the amount of retainage to be held for each.

2.4 *Stored Materials Worksheet* — calculates the total value for materials and equipment that have been purchased and are being stored until they are incorporated into the Work. This worksheet adds materials and equipment to the worksheet as they are brought to the site and stored; such Stored Materials are then deducted from the Stored Materials worksheet total as they are incorporated into the Work, providing a running net value for the materials and equipment remaining in storage. The values of Stored Materials must be manually added to the Lump Sum or Unit Price line items. These do not automatically update when changes are made. The amount of materials remaining in storage is eligible for payment but must be tracked separately from Work completed since different retainage rates may apply to Work completed and Stored Materials.

3.0 Instructions for filling out the Payment Application form

3.1 Project-specific information is to be entered in the top portion (header) of the Summary worksheet. This same information will automatically be copied to the other worksheets to complete the headers on all other worksheets.

3.2 Outside of the header, data can be entered in non-shaded cells when the sheet is protected. Cells shaded light blue contain equations that will automatically transfer data from other cells or make calculations to complete the worksheet. Altering any of these cells can result in errors in the Application for Payment. It is recommended that the worksheets be protected at all times unless alterations are deliberately being made to the Application for Payment form other than to enter data. See Paragraph 4.0 below for information on Protection of Worksheets.

3.3 Enter information regarding each item in the Lump Sum and/or Unit Price worksheets. For Lump Sum projects, each item should represent an item in the schedule of values prepared by the Contractor and approved by the Engineer/Owner, breaking down the Lump Sum amount into measurable components. For Unit Price contracts, use numbers from the Agreement as the schedule of values. Specific information on the data to be entered into each column may be seen by clicking on the header description for that column. Similar comments may be seen for cells in the "Totals" row that indicates how the number is calculated and where this number is exported to another part of the spreadsheet. See the Commentary for additional

3.4 The equations in the Summary worksheet use numbers imported from both the Lump Sum and Unit Price worksheets. Projects will typically either use the Lump Sum or the Unit Price worksheet, but some projects may use both. If one of the worksheets is not used, it should be hidden and not deleted. If it is deleted, Users will need to correct the equations in the Summary worksheet by unprotecting the worksheet and editing the equations. To hide a worksheet, right click on the worksheet tab at the bottom of the worksheet and select "Hide." To unhide a worksheet, right click on any worksheet tab and select "Unhide," and then select the worksheet to unhide and click "Okay." This same process may be used to hide these Guidelines for Use.

4.0 Protection of Worksheets

4.1 The cells in this Workbook that create the forms or contain equations have been coded to "lock" the cells that should not be altered. It is recommended that the Workbook be Protected (cells locked) at all times unless it is necessary to add or delete rows. Directions for adding and deleting rows are provided in the next section. Passwords can be used to lock the Protect / Unprotect settings on spreadsheets, however the worksheets in this workbook do not require a password.

4.2 To unprotect a worksheet, click on the "Review" menu tab at the top of Excel, then click "Unprotect Sheet." To protect a worksheet, click on the "Review" menu tab at the top of Excel, then click "Protect Sheet." This will open a dialog box in which the User is allowed to select protection options. It is recommended that only the top two checkboxes for "Select Locked Cells" and "Select Unlocked Cells" be checked. This will reset the protection for the Worksheet.

5.0 Adding and Deleting Rows

5.1 A limited number of blank rows are provided in the Lump Sum, Unit Price, and Stored Material worksheets. Additional rows may be added to these worksheets by the User. The first step in this process is to unprotect the worksheet as previously discussed. After the sheet is unprotected, move with caution to prevent inadvertently deleting any cells that contain equations. To insert a row, right click in the row heading at the left of the spreadsheet and select "Insert." A new row will be inserted at the location where the cursor was placed in the row heading. If more than one new row is desired, left click and drag the cursor to include the desired number of rows, right click in the selected row headings and then select "Insert." It is important that the line immediately above the "Totals" row not be included in the rows selected. Doing so will require that equations in the "Totals" row be adjusted. When rows are inserted, Excel automatically adjusts the equations to include the new rows, unless the row directly above the "Totals" row is also selected.

5.2 After new rows are inserted, it is important to copy a line from one of the original rows so correct formatting and equations are copied into each new row. To do this, select the row to be copied by clicking the cell in Column A and dragging the cursor to the last column in the table. Then select "Copy" from the menu or type CTRL+C to copy the cells. Excel will show that this row has been copied by showing a moving dashed line around the cells that are to be copied. Then select the new rows into which the information is to be copied as before and select Paste from the menu or

5.3 To delete an unused row, right click in the row heading on the left of the spreadsheet for the row to be deleted and select "Delete." The selected row will be deleted. If more than one row is to be deleted, left click and drag the cursor to the desired number of rows to be deleted and then right click to open the menu and select "Delete." Unlike the admonition on adding new rows, it is okay to delete the row just

5.4 After rows have been added or deleted, it is important reset the worksheet

6.0 Saving Files

This file is provided as a Microsoft ® Excel Open XML workbook template (.xltx) to prevent this file from being inadvertently changed. When an application for payment is created for a specific project it should be saved as an Excel workbook (.xlxs) file. To do this, select Save As (F12), type in a new file name and select Excel Workbook (.xlxs) from the drop down Save As Type menu.

7.0 License Agreement

CONTRACTOR'S APPLICATION FOR PAYMENT

Payment Application #1

Application Date: _____

Application Period: from _____ **to** _____

Owner: _____ Owner's Project No.: _____

Engineer: _____ Engineer's Project No.: _____

Contractor: _____ Contractor's Project _____

Project: _____

1. Original Contract Price	$ -
2. Net change by Change Orders	$ -
3. Current Contract Price (Line 1 + Line 2)	$ -
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)	$ -
5. Retainage	
a. 5% X $ - Work Completed	$ -
b. 0% X $ - Stored Materials	$ -
c. Total Retainage (Line 5.a + Line 5.b)	$ -
6. Amount eligible to date (Line 4 - Line 5.c)	$ -
7. Less previous payments (Line 6 from prior application)	
8. Amount due this application	$ -
9. Balance to finish, including retainage (Line 3 - Line 4)	$ -

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;

(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and

(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ Date: _____

Recommended by Engineer

By: _____

Title: _____

Date: _____

Approved by Owner

By: _____

Title: _____

Date: _____

Approved by Funding Agency

By: _____

Title: _____

Date: _____

Approved by Funding Agency

By: _____

Title: _____

Date: _____

This page is left blank intentionally.

Progress Estimate - Lump Sum Work **Contractor's Application for Payment**

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

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

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

Progress Estimate - Lump Sum Work **Contractor's Application for Payment**

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

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

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

Progress Estimate - Unit Price Work **Contractor's Application for Payment**

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

Application No.: ______ Application Period: From ______ to ______ Application Date: ______

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

Progress Estimate - Unit Price Work **Contractor's Application for Payment**

Owner: ______________________ Owner's Project No.: __________

Engineer: ______________________ Engineer's Project No.: __________

Contractor: ______________________ Contractor's Project No.: __________

Project: ______________________

Contract: ______________________

Application No.: __________ Application Period: From __________ to __________ Application Date: __________

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

Stored Materials Summary **Contractor's Application for Payment**

Owner: ______________________________ Owner's Project No.: __________

Engineer: ______________________________ Engineer's Project No.: __________

Contractor: ______________________________ Contractor's Project No.: __________

Project: ______________________________

Contract: ______________________________

Application No.: __________ Application Period: From __________ to __________ Application Date: __________

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

DOCUMENT 00 62 50
CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	**Town of Cornish**	Owner's Contract No.:	
Contractor:		Contractor's Project No:	
Engineer:	CRS Engineers	Engineer's Project No.:	**2019-0406**
Project:	**Pitcher Well House**		

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

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

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: **[Enter date, as determined by Engineer]**

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

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

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

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

[List amendments to Owner's Responsibilities]

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

[List amendments to Contractor's Responsibilities]

The following documents are attached to and made a part of this Certificate:

[List attachments such as punch list; other documents]

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

_____

ENGINEER

By (signature): _____

Name (printed): _____

Title: _____

END OF DOCUMENT

DOCUMENT 00 62 60
NOTICE OF ACCEPTABILITY OF WORK

Owner:	**Town of Cornish**	Owner's Contract No.:	
Contractor:		Contractor's Project No:	
Engineer:	CRS Engineers	Engineer's Project No.:	**2019-0406**
Project:	**Pitcher Well House**		
Effective Date of Contract:			

The Engineer hereby gives notice to the Owner and Contractor that Engineer recommends final payment to Contractor, and that the Work furnished and performed by Contractor under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract's Contract Documents ("Contract Documents") and of the Agreement between Owner and Engineer for Professional Services dated [date of professional services agreement] ("Owner-Engineer Agreement"). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer's professional opinion.
3. This Notice has been prepared to the best of Engineer's knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor's Work) under the Owner-Engineer Agreement, and applies only to facts that are within Engineer's knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of Contractor's performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner's reservations of rights with respect to completion and final payment.

ENGINEER

By (signature): _____

Name (printed): _____

Title: _____

Date Issued: _____

END OF DOCUMENT

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DOCUMENT 00 70 00
STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

Prepared By:

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Endorsed By:

NSPE® NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

CSI®
Building Knowledge
Improving Project Delivery

NUCA
We Dig America

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

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

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

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

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

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

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

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

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

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

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

10. Claim

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

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

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4,

concerning disputes arising after Engineer has issued a recommendation of final payment.

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

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

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

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

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

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

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

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

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

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

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

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections;

warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

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

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

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

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

46. Technical Data

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

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

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

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

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

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

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

1.02 *Terminology*

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

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

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

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

1. does not conform to the Contract Documents;

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

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

E. Furnish, Install, Perform, Provide

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

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

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

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

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

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

ARTICLE 2—PRELIMINARY MATTERS

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

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

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

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

2.02 *Copies of Documents*

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

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

2.03 *Before Starting Construction*

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

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

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

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

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

2.05 *Acceptance of Schedules*

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

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.
4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

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

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

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

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

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

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

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

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

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

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

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or
2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. Standards Specifications, Codes, Laws and Regulations

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

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

3.03 *Reporting and Resolving Discrepancies*

A. Reporting Discrepancies

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

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

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

B. Resolving Discrepancies

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

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

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

3.04 *Requirements of the Contract Documents*

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

arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

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

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

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

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

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

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

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

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

4.02 *Starting the Work*

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

4.03 *Reference Points*

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

4.04 *Progress Schedule*

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

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

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

4.05 *Delays in Contractor's Progress*

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

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

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

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
2. Abnormal weather conditions;
3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and
4. Acts of war or terrorism.

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

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

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

1. The circumstances that form the basis for the requested adjustment;
2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
4. The number of days' increase in Contract Times claimed as a consequence of each such

cause of delay, disruption, or interference; and

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

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

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

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

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

5.01 *Availability of Lands*

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

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

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

5.02 *Use of Site and Other Areas*

A. Limitation on Use of Site and Other Areas

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

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

action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

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

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

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

5.03 *Subsurface and Physical Conditions*

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

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

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

3. Technical Data contained in such reports and drawings.

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

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

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

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

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

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

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

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is

uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
2. is of such a nature as to require a change in the Drawings or Specifications;
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

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

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

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

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

E. Possible Price and Times Adjustments

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
    a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
    c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
    a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

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

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

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

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

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

5.05 *Underground Facilities*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

F. Possible Price and Times Adjustments

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

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

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

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

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

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

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

5.06 *Hazardous Environmental Conditions at Site*

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

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

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

3. Technical Data contained in such reports and drawings.

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

defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

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

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

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

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

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

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners,

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

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

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

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

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

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

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

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

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

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

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

provide a copy of the payment bond to such person or entity.

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

6.02 *Insurance—General Provisions*

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

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

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

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

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

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

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

H. Contractor shall require:

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

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

Project.

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

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

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

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

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

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

6.03 *Contractor's Insurance*

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

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

1. include at least the specific coverages required;

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

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

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

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

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

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

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

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

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

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

6.04 *Builder's Risk and Other Property Insurance*

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

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

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

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

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

6.05 *Property Losses; Subrogation*

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

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have

to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

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

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

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

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

6.06 *Receipt and Application of Property Insurance Proceeds*

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

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

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

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

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

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense.

Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

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

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

7.03 *Labor; Working Hours*

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

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

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

7.04 *Services, Materials, and Equipment*

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

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

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

7.05 *"Or Equals"*

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

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:
    a. in the exercise of reasonable judgment Engineer determines that the proposed item:
        1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
        2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
        3) has a proven record of performance and availability of responsive service; and
        4) is not objectionable to Owner.
    b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:
        1) there will be no increase in cost to the Owner or increase in Contract Times; and
        2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

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

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

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

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

7.06 *Substitutes*

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

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

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

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

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

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

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

b. will state:

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

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

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

c. will identify:

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

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

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

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

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

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

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

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

7.07 *Concerning Subcontractors and Suppliers*

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

Documents.

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

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

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

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

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

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

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

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

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

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

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

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

7.08 *Patent Fees and Royalties*

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

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

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

7.09 *Permits*

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

7.10 *Taxes*

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

7.11 *Laws and Regulations*

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

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

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

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings,

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

7.13 *Safety and Protection*

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

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

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

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

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

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

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

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

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

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

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

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

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to

conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

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

7.16 *Submittals*

A. Shop Drawing and Sample Requirements

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

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

b. determine and verify:

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

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

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

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

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

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

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

1. Shop Drawings

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

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

2. Samples

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

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

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

C. Engineer's Review of Shop Drawings and Samples

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

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

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

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

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

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

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

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

D. Resubmittal Procedures for Shop Drawings and Samples

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

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

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

the need for such change is beyond the control of Contractor.

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

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

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

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

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

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

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

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

7.17 *Contractor's General Warranty and Guarantee*

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

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

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

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

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

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

2. normal wear and tear under normal usage.

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

1. Observations by Engineer;

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

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

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

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

6. The issuance of a notice of acceptability by Engineer;
7. The end of the correction period established in Paragraph 15.08;
8. Any inspection, test, or approval by others; or
9. Any correction of defective Work by Owner.

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

7.18 *Indemnification*

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

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

7.19 *Delegation of Professional Design Services*

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

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

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

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

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

1. Checking for conformance with the requirements of this Paragraph 7.19;
2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

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

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

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

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

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

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

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

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

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

8.02 *Coordination*

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

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
2. An itemization of the specific matters to be covered by such authority and responsibility; and
3. The extent of such authority and responsibilities.

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

8.03 *Legal Relationships*

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

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

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

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

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

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

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

9.03 *Furnish Data*

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

9.04 *Pay When Due*

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

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

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

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

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

9.06 *Insurance*

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

9.07 *Change Orders*

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

9.08 *Inspections, Tests, and Approvals*

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

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

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

9.11 *Evidence of Financial Arrangements*

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

9.12 *Safety Programs*

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

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

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

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

10.02 *Visits to Site*

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

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

10.03 *Resident Project Representative*

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

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

10.04 *Engineer's Authority*

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

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

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

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

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

10.05 *Determinations for Unit Price Work*

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

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

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

Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

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

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

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

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

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

10.08 *Compliance with Safety Program*

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

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

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

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

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

11.02 *Change Orders*

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

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

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

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties,

subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

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

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

11.03 *Work Change Directives*

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

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

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

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

11.04 *Field Orders*

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

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

11.05 *Owner-Authorized Changes in the Work*

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

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

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

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract

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

11.07 *Change of Contract Price*

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

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

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

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

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

11.09 *Change Proposals*

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

B. Change Proposal Procedures

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

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

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

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

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

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

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

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

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change

Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

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

11.10 *Notification to Surety*

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

ARTICLE 12—CLAIMS

12.01 *Claims*

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

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

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

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

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

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

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

D. Mediation

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

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

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

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

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

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

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

13.01 *Cost of the Work*

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

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

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

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

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

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

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

Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

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

5. Other costs consisting of the following:

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

   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

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

   c. Construction Equipment Rental

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

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

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

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

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

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

will be included in the Cost of the Work for the purpose of determining Contractor's fee.

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

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

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

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

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. Contractor's Fee

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent

Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. Adjustments in Unit Price

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

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

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
3. by manufacturers of equipment furnished under the Contract Documents;
4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

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

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. Applications for Payments

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of

which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. Review of Applications

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work;

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

   d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

   e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in

Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. Payment Becomes Due

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. Reductions in Payment by Owner

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

    b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

    c. Contractor has failed to provide and maintain required bonds or insurance;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

    e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

    f. The Work is defective, requiring correction or replacement;

    g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    h. The Contract Price has been reduced by Change Orders;

    i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

    j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

    k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

    l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the

written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

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

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. Application for Payment

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

   d. a list of all duly pending Change Proposals and Claims; and

   e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness

connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed

for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

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

18.03 *Cumulative Remedies*

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

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other

matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

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

END OF DOCUMENT

DOCUMENT 00 80 00
SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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

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

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

ARTICLE 2—PRELIMINARY MATTERS

2.02 *Copies of Documents*

SC-2.02 Delete Paragraph 2.02.A in its entirety and insert the following new paragraph in its place:

A. Owner shall furnish to Contractor **one** printed copy of conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction.

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

5.03 *Subsurface and Physical Conditions*

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

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

Report Title	Date of Report	Technical Data
N/A	N/A	N/A

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

Drawings Title	Date of Drawings	Technical Data
N/A	N/A	N/A

5.06 *Hazardous Environmental Conditions*

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

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

Report Title	Date of Report	Technical Data
N/A	N/A	N/A

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

Drawings Title	Date of Drawings	Technical Data
N/A	N/A	N/A

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

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

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

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

6.03 Contractor's *Insurance*

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

E. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Jones Act (if applicable)	
Bodily injury by accident—each accident	$
Bodily injury by disease—aggregate	$
Employer's Liability	
Each accident	$1,000,000
Each employee	$1,000,000
Policy limit	$1,000,000
Stop-gap Liability Coverage	
For work performed in monopolistic states, stop-gap liability coverage must be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	$1,000,000

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

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,

2. damages insured by reasonably available personal injury liability coverage, and

3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

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

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

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

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

I. *Commercial General Liability—Minimum Policy Limits*

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

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

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

K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	**Policy limits of not less than:**
Each Occurrence	$5,000,000
General Aggregate	$5,000,000

L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit as stated above, such umbrella or excess policy may retain a minimum limit of $10,000 prior to attribution of umbrella or excess limits due to underlying policies not paying and the umbrella or excess will pay.

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

Contractor's Pollution Liability	**Policy limits of not less than:**
Each Occurrence/Claim	$1,000,000
General Aggregate	$2,000,000

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

Contractor's Professional Liability	**Policy limits of not less than:**

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	$1,000,000
Annual Aggregate	$2,000,000

P. *Unmanned Aerial Vehicle Liability Insurance:* If Contractor uses unmanned aerial vehicles (UAV—commonly *referred* to as drones) at the Site or in support of any aspect of the Work, Contractor shall obtain UAV liability insurance in the amounts stated; name Owner, Engineer, and all individuals and entities identified in the Supplementary Conditions as additional insureds; and provide a certificate to Owner confirming Contractor's compliance with this requirement. Such insurance will provide coverage for property damage, bodily injury or death, and invasion of privacy.

Unmanned Aerial Vehicle Liability Insurance	Policy limits of not less than:
Each Claim	$1,000,000
General Aggregate	$1,000,000

Q. *Other Required Insurance:* **N/A**

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Delete Paragraph 6.04.A of the General Conditions and substitute the following in its place:

A. *Installation Floater*

1. Contractor shall provide and maintain installation floater insurance on a broad form or "all risk" policy providing coverage for materials, supplies, machinery, fixtures, and equipment that will be incorporated into the Work ("Covered Property"). Coverage under the Contractor's installation floater will include loss from covered "all risk" causes (perils) to Covered Property:

   a. of the Contractor, and Covered Property of others that is in Contractor's care, custody, and control;

   b. while in transit to the Site, including while at temporary storage sites;

   c. while at the Site awaiting and during installation, erection, and testing;

   d. continuing at least until the installation or erection of the Covered Property is completed, and the Work into which it is incorporated is accepted by Owner.

2. The installation floater coverage cannot be contingent on an external cause or risk, or limited to property for which the Contractor is legally liable.

3. The installation floater coverage will be in an amount sufficient to protect Contractor's interest in the Covered Property. The Contractor will be solely responsible for any deductible carried under this coverage.

4. This policy will include a waiver of subrogation applicable to Owner, Contractor, Engineer, all Subcontractors, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them.

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

H. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.

1. The builder's risk policy (or if applicable the installation floater) will be subject to a deductible amount not to exceed $10,000 or 0.1% of the Contract value, whichever is less, or as agreed upon by Owner.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.03 *Labor; Working Hours*

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

1. Regular working hours will be **7AM-10PM**
2. Owner's legal holidays – please contact owner for list.

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state "…all Work at the Site must be performed during regular working hours, **Monday** through **Friday**. Contractor will not perform Work on a **Saturday**, **Sunday**, or any legal holiday."

SC-7.03 Delete Paragraph 7.03.C in its entirety, and insert the following:

C. In the absence of any Laws or Regulations to the contrary, Contractor may perform the Work on holidays, during any or all hours of the day, and on any or all days of the week, at Contractor's sole discretion.

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

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

7.10 *Taxes*

SC-7.10 Add a new paragraph immediately after Paragraph 7.10.A:

A. Owner is exempt from payment of sales and compensating use taxes of the State of **Utah** and of cities and counties thereof on all materials to be incorporated into the Work.

1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

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

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

1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.
2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.
3. *Liaison*

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

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

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

4. *Review of Work; Defective Work*

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

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

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

5. *Inspections and Tests*

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

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

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

7. *Completion*

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

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

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

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

D. The RPR will not:

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

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

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

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

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

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

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

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

13.01 *Cost of the Work*

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

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

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

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

13.03 *Unit Price Work*

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

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

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

   b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

17.02 *Arbitration*

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

17.02 *Arbitration*

A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of $100,000 or less will be settled in accordance with the American Arbitration Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

C. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration

Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.

D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.

E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.

F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.

G. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;

2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;

3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and

4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.

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

I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

17.03 *Attorneys' Fees*

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02. [Note: If there is no Paragraph 17.02, because neither arbitration nor any other dispute resolution process has been specified here in the Supplementary Conditions, then revise this to state "Add the following new Paragraph immediately after Paragraph 17.01" and revise the numbering accordingly].

17.03 *Attorneys' Fees*

A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other

arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

4. Except as noted in the procurement contract, all rights, duties and obligations of Engineer to "buyer" and "seller" under the procurement contract will cease **[upon the assignment to Contractor]**.

END OF DOCUMENT

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SECTION 00 90 00
ADDENDA AND MODIFICATIONS

PART 1 - GENERAL

1.1 PROCEDURE

A. For filing purposes, add Addenda and Modifications to the Contract Documents following this page.

END OF DOCUMENT

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DOCUMENT 00 94 00
WORK CHANGE DIRECTIVE

Work Change Directive No. _____

Date of Issuance:			
Owner:	**Town of Cornish**	Owner's Contract No.:	
Contractor:		Contractor's Project No:	
Engineer:	CRS Engineers	Engineer's Project No.:	**2019-0406**
Project:	**Pitcher Well House**		

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

Description:

Attachments: *[List documents supporting change]*

Purpose for Work Change Directive:

Directive to proceed promptly with the Work described herein, prior to agreeing to change on Contract Price and Contract Time, is issued due to: *[check one or both of the following]*

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

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

Contract Price	$	[increase] [decrease] [not yet estimated]
Contract Time	[X} days	[increase] [decrease] [not yet estimated]

Basis of estimated change in Contract Price:

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

RECOMMENDED:		AUTHORIZED:	
By:	_____	By:	_____
	Engineer		Owner
Title:	_____	Title:	_____
Date:	_____	Date:	_____

END OF DOCUMENT

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DOCUMENT 00 94 10
CHANGE ORDER

Change Order No. _____

Date of Issuance:			
Owner:	**Town of Cornish**	Owner's Contract No.:	
Contractor:		Contractor's Project No:	
Engineer:	CRS Engineers	Engineer's Project No.:	**2019-0406**
Project:	**Pitcher Well House**		

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

Description:

Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE	**CHANGE IN CONTRACT TIMES**
Original Contract Price: $ _____	Original Contract Times, dates: Milestone 1: _____ Substantial Completion: _____ Ready for Final Payment: _____
[Increase][Decrease] from previously approved Change Orders No. X to No. X $ _____	[Increase][Decrease] from previously approved Change Orders No. X to No. X ,days: Milestone 1: _____ Substantial Completion: _____ Ready for Final Payment: _____
Contract Price prior to this Change Order: $ _____	Contract Times prior to this Change Order, dates Milestone 1: _____ Substantial Completion: _____ Ready for Final Payment: _____
[Increase][Decrease] of this Change Order: $ _____	[Increase][Decrease] of this Change Order, days: Milestone 1: _____ Substantial Completion: _____ Ready for Final Payment: _____
Contract Price incorporating this Change Order: $ _____	Contract Times with all approved Change Orders: Milestone 1: _____ Substantial Completion: _____ Ready for Final Payment: _____

RECOMMENDED:	ACCEPTED:	AUTHORIZED:
By: _____	By: _____	By: _____
Engineer	Contractor (Authorized Signature)	Owner (Authorized Signature)

Title: _____ Title: _____ Title: _____
Date: _____ Date: _____ Date: _____

Approved by Funding Agency (if applicable)

By: _____ Title: _____ Date: _____

END OF DOCUMENT

DOCUMENT 00 94 20
FIELD ORDER

Field Order No. _____

Date of Issuance:			
Owner:	**Town of Cornish**	Owner's Contract No.:	
Contractor:		Contractor's Project No:	
Engineer:	CRS Engineers	Engineer's Project No.:	**2019-0406**
Project:	**Pitcher Well House**		

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

Reference: _____ Specification(s) _____ Drawing(s) / Detail(s)

Description:

Attachments:

ISSUED:

By: _____
Engineer (Authorized Signature)

Title: _____

Date: _____

Copy to: Owner

END OF DOCUMENT

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SECTION 01 00 50
ADMINISTRATIVE PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes reference standards, preconstruction conference, Contractor Submittals, Work sequence, Contractor use of premises, Owner-furnished services/products and field engineering.

1.2 RELATED SPECIFICATIONS

A. Section 00 70 00 – General Conditions

1. Article 2, Paragraph 2.04 – Preconstruction Conference . . .
2. Article 3, Paragraph 3.02 – Reference Standards
3. Article 4, Paragraph 4.03 – Reference Points
4. Article 5, Paragraph 5.02 – Use of Site and Other Areas
5. Article 5, Paragraph 5.05 – Underground Facilities
6. Article 7, Paragraph 7.16 – Submittals
7. Article 8 – Other Work at Site
8. Article 9 – Owner's Responsibilities
9. Article 15, Paragraph 15.04 – Partial Use or Occupancy

B. Section 01 45 00 – Quality Control

C. Section 01 57 00 – Construction Facilities and Temporary Controls

D. Section 01 78 00 – Closeout Procedures

1.3 REFERENCE STANDARDS

A. Obtain copies of standards when required by individual Specifications. Maintain copy at jobsite during progress of the specific work.

B. Adhere to the following technical standards for construction. Where there is conflict between the different technical standards, follow in order of precedence as listed:

1. As presented in the Contract Documents herein and Project Drawings.
2. Utah 2017 APWA Standard Specifications (some of which are modified herein)

1.4 PRECONSTRUCTION CONFERENCE

A. Before commencement of the Work, a preconstruction conference will be held at a mutually agreed time and place. Attendees will include:

1. Contractor, its' superintendent and subcontractors as appropriate,
2. Engineer and Resident Project Representative,
3. Representatives of Owner,
4. Representatives of affected utility companies as appropriate,
5. Governmental representatives as appropriate, and

6. Others as requested by the Contractor, Engineer or Owner.

B. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The meeting agenda will be provided by the Engineer.

1.5 CONTRACTOR SUBMITTALS

A. Procedures

1. Transmit each Submittal to the Engineer with Contractor's standard Submittal form. Deliver Submittals electronically in .PDF format via email or hard copy to the Engineer as designated in the Preconstruction Conference.
2. If Contractor elects to submit a paper copy of a Submittal or Shop Drawing, an electronic copy shall accompany it.
3. Allow 14 days for the Engineer to review and return Submittals. All Submittals will be returned in .PDF format via email.

B. Identifying Information

1. Identify Project, Contractor, subcontractor or supplier; pertinent drawing sheet and detail number(s), and Specification section number, as appropriate.

C. Product Data

1. Mark product data to identify applicable products, models, options, and other data; supplement manufacturers' standard data to provide information unique to the Work. Submit only pages which are pertinent.

D. Manufacturer's Instructions and Certificates

1. Submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for product data.
2. Provide certificates of compliance as requested by the Owner or as indicated in individual Specifications sections.

E. Samples

1. Provide samples of materials as required by individual Specification sections and in the quantity indicated.

1.6 WORK SEQUENCE

A. Notify the Owner at least 48 hours prior to commencing any Work.

B. Provide and coordinate construction schedule and operations with Owner.

C. Coordinate Work of the various sections of specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.

D. Coordinate with the Owner regarding construction schedule and progress such that the Owner may record survey data for new construction such as waterlines, valves, sewer lines, manholes, and appurtenances prior to permanently backfilling or concealing work.

1.7 CONTRACTOR USE OF PREMISES

A. Coordinate use of premises with the Owner.

B. Owner, at their discretion, may occupy premises during entire period of construction for the conduct of their normal operations. Cooperate with Owner to minimize conflict and to facilitate the Owner's operations.

1.8 WORK BY OTHERS

A. If the Owner intends to contract with others for other Work at or adjacent to the Site, it will be described in Article SC-8.02 of Section 00 80 00 – Supplementary Conditions. Coordinate with any others at the site to minimize conflict and to facility the Owner's operations.

1.9 FIELD ENGINEERING

A. Provide field engineering services as required to establish grades, lines, and levels from construction stakes in order to complete the work in accordance with these drawings and specifications.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

This page is left blank intentionally.

SECTION 01 02 50
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.

1.2 RELATED SPECIFICATIONS

A. Section 00 41 00 – Bid Form

B. Section 00 52 00 – Agreement, Article 6 – Payment Procedures

C. Section 00 70 00 – General Conditions

1. Article 7, Paragraph 7.10 - Taxes
2. Article 13, Paragraph 13.03 – Unit Price Work
3. Article 15, Paragraph 15.01 – Progress Payments

1.3 MEASUREMENT OF QUANTITIES

A. Measurement Devices:

1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past year.
2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
3. Metering Devices: Inspected, tested and certified by the applicable State department within the past year.

1.4 PAYMENT

A. Payment for each Bid item includes full compensation for all required labor, materials, products, tools, equipment, manufacturing, transportation, services and incidentals; application or installation; permits, taxes, royalties, import costs, overhead and profit.

1.5 DESCRIPTION OF BID ITEMS

A. The work generally consists of the following, which are numbered according to the Bid schedule found in Article 5 of Section 00 41 00 – Bid Form:

1. **Mobilization** – Measurement is by lump sum. Payment includes mobilization, demobilization, installation of temporary facilities, construction fencing, all bonds, insurances, permits and fees, traffic control, public outreach, coordination, clearing and grubbing, SWPPP and implementation of erosion control, quality control and testing of materials, preparation of project schedule, project identification sign, construction survey and layout, final cleanup and project closeout, and all other items not specifically called for in any other Bid item or called for in the plans and specifications or is customary, incidental or appurtenant to performance of a complete project. Payments shall be made on according to the schedule established in Paragraph 1.6 herein.

2. **Furnish and Install Well House Structural/Mechanical Bldg** – This item includes all

materials, transportation, equipment, labor and other items required for the completion of the work including excavation, placing and compacting engineered fill, construction of footings and foundations, erection of the pump house building, HVAC and appurtenant plumbing, louvers, instrumentation, and other appurtenances as required.

This item is measured on a lump sum basis, which shall constitute the total cost to Owner. Progress payments for this item will based on the Contractor's schedule of values.

3. **Furnish and Install Well House Piping and Appurtenances** – This item includes all materials, transportation, equipment, labor and other items required for completion of the work including furnishing and installing all required pressure class 150 psi rated ductile iron mainline piping, valves, control valves, pipe supports, reducers, flow meters, gages, pump, motor, discharge head, and all other appurtenances required to complete the well house piping system. **This item also includes installation of the pump and motor by approved pump installer.**

   The item is measured on a lump sum basis, which shall constitute the total cost to the Owner. Progress payments for this item will be based on the Contractor's schedule of values.

4. **Furnish and Install Well House Electrical & Generator** – This item includes all materials, transportation, equipment, labor and other items required for the completion of the work including furnishing and installing all electrical, generator, SCADA, RVSS, controls, readouts and any other appurtenance required to complete well house electrical components as shown in the plans. **This item includes supply and installation of SCADA and supply and installation of RVSS.**

   This item is measured on a lump sum basis, which shall constitute the total cost to Owner. Progress payments for this item will based on the Contractor's schedule of values.

5. **Furnish and Install Storm Drain Line and Components** – Measurement is by lump sum. This item includes all labor, materials, transportation, and other items associated with the installation of the storm drain including but not limited to excavation and backfill, hauling, stockpiling, furnish and Install new RCP with proper bedding and backfill, storm drain system, discharge blow off box, and manholes. Payment includes all labor, materials, equipment, and transportation necessary to furnish and install the storm drain system including excavation, backfill and compaction, furnishing, installing, and compacting structural fill, hauling and disposing of waste materials, furnishing and installing all manhole sections, rings, concrete pedestals, and covers, and connecting and grouting all piping in accordance with the plans and specifications.

   Payments shall be based on a lump sum basis for the installation of the storm drain line and components, which shall constitute the total cost to Owner. Progress payments for this item will based on the Contractor's schedule of values.

6. **Complete Site Grading** – This item includes all materials, transportation, equipment, tools, labor and other items required to grade the site to match the designed finish grades including hauling cut material and furnishing and placing a 6-inch-thick layer of base course imported to the site. This item is measured on a lump sum basis, which shall constitute the total cost to the Owner.

7. **Power Relocation** - This item includes all materials, transportation, equipment, tools, labor and other items required to relocate the site power as shown in the contract drawings.

1.6 PAYMENT SCHEDULE FOR SELECTED LUMP SUM BID ITEMS

A. MOBILIZATION

1. This Bid item will be paid as follows:

Percent of Original Contract Amount Earned	Percent of Mobilization to be Paid
5%	40%
15%	20%
40%	30%
50%	10%

END OF SECTION

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SECTION 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes general quality control, workmanship, manufacturer's instructions and certificates, and testing services.

1.2 RELATED WORK

A. Section 01 00 50 Administrative Provisions

B. Section 01 70 00 – Contract Closeout

1.3 SUBMITTALS

A. Before construction, identify testing agency including name, address, telephone number, licensed professional for testing agency who is to review services, names and levels of certification and years of experience of testing agency's laboratory and field technicians.

B. During construction, submit all quality control test results to demonstrate that the work performed complies with the contract documents to Engineer within one week of each test.

1.4 QUALITY CONTROL - GENERAL

A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

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

C. Should manufacturers' instructions conflict with the Contract Documents, request clarification from Owner before proceeding.

1.5 TESTING LABORATORY SERVICES

A. Services will be performed in accordance with requirements of local jurisdiction having authority and with specified standards.

B. Reports will be submitted to Owner and Engineer giving observations and results of tests, indicating compliance or noncompliance with specified standards and with Contract Documents.

END OF SECTION

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SECTION 01 55 50
TRAFFIC CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Contractor's responsibilities to warn, guide and protect motorists and pedestrians affected by the construction zone.

1.2 RELATED WORK

1.3 REFERENCES

A. AASHTO Roadside Design Guide, Current Edition

B. American National Standards Institute (ANSI)

C. Americans with Disabilities Act

D. ATSSA: American Traffic Safety Services Association

E. Quality Standards for Work Zone Traffic Control Devices

F. International Safety Equipment Association (ISEA)

G. Manual on Uniform Traffic Control Devices (MUTCD), Current Edition

H. UDOT traffic control and safety requirements

I. NCHRP – Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features

1.4 SUBMITTALS

A. Contractor shall submit a Traffic Control Plan as necessary per the provisions of Section 01 33 00 – Submittals. The Traffic Control Plan must be signed and sealed by a professional engineer licensed in the state of Utah. The Traffic Control Plan must be accepted by the local authority / engineer prior to commencing work.

1. Show how to provide the least amount of disruption to vehicular movement as construction work progresses.
2. Show how to move pedestrians around or through the work site.
3. Show how to handle signalized intersections.
4. Show how to accommodate truck traffic that is high or extra wide (two lane width to pass truck) in a quick or immediate response time.
5. Show placement, spacing and taper rates of traffic control devices.

B. Submit copy of flagger or Traffic Control Technician certification when requested by Engineer.

1.5 SPECIAL TRAFFIC CONTROL REQUIREMENTS

A. None.

1.6 TRAFFIC CONTROL TECHNICIAN

A. Technician must be Engineer approved or ATSSA certified.

B. Make at least four inspections of traffic control devices each day as follows:

1. Before beginning work shift.
2. At mid-shift.
3. Half an hour after the end of the shift.
4. Once during the night.

C. Submit inspection forms to the engineer at least weekly.

D. Remain available to correct work zone signing within 5 minutes of need or notification.

E. Coordinate traffic control with emergency services, transportation services, and local law enforcement.

F. Update the traffic control plan when requested.

G. Clean devices at least weekly.

H. Replace devices missing any part of the message or background.

I. Remove devices if they are no longer required.

1.7 FLAGGER

A. Flagger must have a current Utah flagging certificate and must present proof of certification upon request by engineer.

B. Equipment:

1. 24" x 24" "Stop/Slow" sign.
2. 6" to 8" long red wand for night flagging.
3. Light plant for night flagging.

C. Clothing:

1. Clothed; full length pants and long or short sleeved shirt.
2. Hard toed shoes
3. Orange, red-orange hard hat and vest.
4. Night clothing to be reflectorized.

PART 2 - PRODUCTS

2.1 PAVEMENT MARKINGS

A. Refer to MUTCD requirements.

2.2 SIGNS, SIGNALING AND BARRICADES

A. Refer to MUTCD requirements.

B. Reflective Sheeting: ASTM D 4956.

C. Use devices and systems that meet NCHRP-350 Report crash test requirements with the exception of arrow boards and portable variable message signs.

PART 3 - EXECUTION

3.1 TRAFFIC CONTROL PLAN

A. Implement the Traffic Control Plan as approved.

B. If changes to the Traffic Control Plan are desired submit a revised Traffic Control Plan to the engineer at least 10 working days prior to the requested changes.

END OF SECTION

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SECTION 01 57 00
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for controlling surface and subsurface environmental conditions at a construction site and related areas under the Contractor's responsibility. This includes temporary utilities, sanitary facilities, barriers and enclosures, surface water, erosion & sediment control, dust control, noise control, construction cleaning, groundwater control, pollution control, and removal of temporary facilities.

1.2 RELATED WORK

A. Section 00 70 00 - General Conditions

1. Paragraph 5.02 – Use of Site and Other Areas
2. Paragraph 7.04 – Services, Materials and Equipment
3. Paragraph 7.13 – Safety and Protection

B. Section 01 00 50 - Administrative Provisions

C. Section 01 70 00 - Contract Closeout

1.3 REFERENCES

A. Utah DEQ Division of Air Quality rules.

B. Utah DEQ Division of Water Quality rules.

1.4 SUBMITTALS

A. Fugitive Dust Control Permit as required by Utah DEQ Division of Air Quality.

B. Storm Water Permit as required by Utah DEQ Division of Water Quality.

1.5 TEMPORARY UTILITIES

A. Set up and maintain in a neat and orderly manner temporary roads and paving, dewatering facilities, enclosures, identification signs and bulletin boards, waste disposal and temporary heat and lighting.

1.6 SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing restroom facilities shall not be used.

1.7 BARRIERS AND ENCLOSURES

A. Provide barriers and enclosures as required to prevent public entry to construction areas while allowing for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations.

B. Use local standards and codes for erection of adequate fences and barricades. Maintain all signing, barricades, fencing, drainage and other items as required to protect public and private property from damage caused by construction operations.

1.8 SURFACE WATER, EROSION AND SEDIMENT CONTROL

A. Before work begins, obtain a Storm Water Permit as required by DEQ.

B. Control surface water such that the construction area is not allowed to become wet from runoff from adjacent areas. Direct surface water away from these areas but not directed toward adjacent property, buildings, or any improvement that may be damaged by water. Do not allow surface water to enter sanitary sewers.

C. Prevent erosion and sedimentation.

D. Provide temporary measures such as berms, dikes, and drains.

E. Do not start grading work until installation of all temporary control measures is complete.

F. Complete installation and continue to maintain all erosion control in a timely manner.

G. Do not pollute streams, canals, lakes and other water courses.

H. Follow the more restrictive requirements when conflicts occur between erosion control specifications and federal, state, or local agencies laws, rules or regulations.

I. Noxious weed free certification will be required for all straw, hay bales, fiver, mats, mulches, etc. used for erosion control.

1.9 DUST CONTROL

A. Before work begins, obtain a Fugitive Dust Control Permit as required by DEQ.

B. Provide suitable equipment to control dust or air pollution caused by construction operations to all work areas, storage areas, haul and access roads, or other areas affected by construction.

C. All work shall be in compliance with the Federal, State, and local air pollution standards, and not cause a hazard or nuisance to personnel and the public in the vicinity of the work.

D. Execute work by methods to minimize raising dust from construction operations.

1.10 NOISE CONTROL

A. Use equipment that is equipped with noise attenuation devices. Comply with local laws and regulations.

1.11 CONSTRUCTION CLEANING

A. All public and private areas used as haul roads shall be continuously maintained and cleaned of all construction caused debris such as mud, sand, gravel, soils, pavement fragments, sod, etc. Care shall be taken to prevent spillage on haul routes. Any such spillage shall be removed immediately and the area cleaned.

B. Public roads shall be maintained in accordance with applicable ordinances and regulations.

C. Throughout all phases of construction, including suspension of work, and until final acceptance of the project, the Contractor shall keep the work site clean and shall remove daily all refuse, dirt, damaged materials, unusable materials, and all other trash or debris that he has created from his construction activities.

D. Materials and equipment shall be removed from the site as soon as they are no longer necessary; and upon completion of the work and before final inspection, the entire worksite shall be cleared of equipment, unused materials, and rubbish so as to present a satisfactory clean and neat appearance. All cleanup costs shall be included in the Contractor's Bid.

1.12 GROUND WATER CONTROL

A. Provide a dewatering system sufficient to maintain excavations and foundations free of water as required in the Contract Documents.

B. Remove all dewatering facilities when no longer required.

C. Dispose of water in a manner that will not cause damage to adjacent or downstream areas or facilities.

1.13 POLLUTION CONTROL

A. Soil: prevent contamination of soil from discharge of noxious substances (including engine oils, fuels, lubricants, etc.). Excavate and legally dispose of any such contaminated soil off-site, and replace with acceptable compacted fill and topsoil.

B. Water: prevent disposal of wastes, effluent, chemicals, or other such substances adjacent to or into streams, waterways, sanitary sewers, storm drains or public waterways. Perform any emergency measures required to contain any spillage.

1.14 REMOVAL OF TEMPORARY FACILITIES

A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to a depth of 2 feet; grade site as indicated. Restore existing facilities used during construction to specified, or to original, condition.

END OF SECTION

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SECTION 01 78 50
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes closeout procedures, final cleaning, and project record documents.

1.2 RELATED WORK

A. Section 00 70 00 – General Conditions
   1. Article 6, Paragraph 5.02 - Cleaning
   2. Article 7, Paragraph 7.12 – Record Documents
   3. Article 15, Paragraph 15.05 – Final Inspection
   4. Article 15, Paragraph 15.06 – Final Payment

B. Section 01 00 50 – Administrative Provisions

C. Section 01 33 00 – Submittals

D. Section 01 45 00 – Quality Control

E. Section 01 57 00 – Construction Facilities and Temporary Controls

1.3 SUBMITTALS

A. All items required in the Contract Documents, including:
   1. Test results.
   2. Record drawings (General Conditions Paragraph 7.12).
   3. Maintenance and operating instructions, schedules, guarantees, bonds, certificate or other evidence of insurance, certificates of inspection (General Conditions Paragraph 15.06A.1).
   4. Final submittals to governing authorities, if applicable (General Conditions Paragraph 15.06.A.2.a).
   5. Consent of surety to final payment (General Conditions Paragraph 15.06.A.2.b).
   6. Evidence that all title issues have been resolved (General Conditions Paragraph 15.06.A.2.c).
   7. A list of duly pending Change Proposals and Claims (General Conditions Paragraph 15.06.A.2.d).
   8. Releases or waivers of all Lien rights arising out of the Work (General Conditions Paragraph 15.06.A.2.e).

1.4 CLOSEOUT PROCEDURES

A. Follow procedures outlined in the General Conditions.

1.5 FINAL CLEANING

A. Execute prior to final inspection.

B. Clean site; sweep paved areas, rake clean other surfaces.

C. Remove waste and surplus materials, rubbish, and construction facilities from the Project and from the site after final acceptance.

1.6 PROJECT RECORD DOCUMENTS

A. Store record documents separate from those used for construction.

B. Keep documents current; do not permanently conceal any work until required information has been recorded.

C. At Contract closeout, submit documents including construction redlines for producing "Record Drawings" with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

D. Document the following items on the record drawings:

1. Northing and eastings for all valves, bends, drainage structures, Building Corners etc.

END OF SECTION

SECTION 02 41 00
SITE PREPARATION AND SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation, required video of existing features, protection, notification of jurisdictional utilities prior to commencement of work, clearing and grubbing, topsoil removal, asphaltic concrete pavement removal, Portland cement concrete removal, pipeline demolition and abandonment, removal of fences and miscellaneous obstructions, and disposal or salvage of waste materials.

1.2 RELATED WORK

A. Section 31 23 00 – Excavation, Backfilling and Compaction

1.3 REFERENCES

A. Tree Care Industry Association (TCIA) standards

B. ANSI A300 Pruning Standard Practices

1.4 SUBMITTALS

A. Prior to commencement of demolition, submit a video of all features to remain which might be affected by the work within 10 feet of limits of disturbance. Allow Owner to view video and approve prior to proceeding with the work.

1.5 QUALITY ASSURANCE

A. All tree trimming and removal shall be done in accordance with Tree Care Industry Association (TCIA) standards and ANSI A300 Pruning Standard Practices.

B. Locate and preserve all active utilities which are to remain in service.

PART 2 - PRODUCTS

A. Not Used.

PART 3 - EXECUTION

3.1 PREPARATION

A. No clearing, demolition, or removal of any kind shall proceed until all existing trees, improvements, etc. to be removed have been established and are inspected and documented by the Owner.

B. Mark all trees, shrubs, structures, fences, concrete, and other improvements to be removed.

C. Within 10 feet of limits of disturbance, inspect, photograph with video, and record condition of concrete slabs, structures, landscaping and other features to remain which might be affected by work. Allow Owner to view video and approve prior to proceeding with the work.

D. Trees, shrubs and lawn, areas to receive planting, rock outcroppings, fences, sprinklers and other improvements that are not to be removed shall be protected from damage or injury. If damaged or removed, they shall be restored or replaced in as nearly the original condition and location as is reasonably possible. Protect all trees, shrubs, and improvements that are not indicated to be removed on the Drawings or indicated to be protected by Owner.

E. Give reasonable notice to Owner to permit him to salvage plants, trees, fences, sprinklers and other improvements within the construction limits that may be destroyed because of the work.

F. Notify interested utility companies to be present if disturbing ground in the vicinity of utilities.

G. Protect active utility systems adjacent to or uncovered by any excavation during site preparation.

H. Maintain benchmarks, monuments and other reference points and construction stakes.

3.2 CLEARING AND GRUBBING

A. Prior to construction, unsuitable soils and vegetation should be removed from below pavements and bridge structure. Unsuitable soils consist of topsoil, organic soils, undocumented fill, loose or disturbed native soils, and other deleterious materials. All topsoil, uncontrolled fill, or other unsuitable soils should be removed completely. Remove all surface vegetation to a depth necessary for complete removal of all roots and other deleterious materials from within the areas to receive structural fill or base course.

3.3 TOPSOIL REMOVAL

A. Before any construction activity begins, remove topsoil. Topsoil shall be stockpiled if it is to be re-used.

B. Stockpiled topsoil shall be protected from contamination by weeds, debris, etc.

3.4 ASPHALTIC CONCRETE PAVEMENT REMOVAL

A. Use any method of cutting that produces a true, vertical, full-depth cut and ensures the breakage of pavement along straight lines.

B. Re-cut along any edge that is damaged during construction, and where cavities underneath pavement are caused by construction.

C. Remove asphalt pavement without damaging pavement that is to remain. Dispose of asphalt pavement to be removed at a suitable offsite location in accordance with applicable laws and ordinances.

3.5 PORTLAND CEMENT CONCRETE REMOVAL

A. Concrete shall be removed to neatly sawed edges with full depth saw cuts.

B. Re-cut along any edge that is damaged during construction, and where cavities underneath pavement are caused by construction.

C. Concrete sidewalk or driveway to be removed shall be neatly sawed in straight lines either parallel to the curb or at right angles to the alignment of the sidewalk. No section to be replaced shall be smaller than 30 inches in either length or width.

D. Unless otherwise shown on the Drawings, if the saw cut would fall within 30 inches of a construction joint, expansion joint, or edge, the concrete shall be removed to the joint or edge, except that where the saw cut would fall within 12 inches of a score mark, the saw cut shall be made in and along the score mark.

E. Curb and gutter to be removed shall be sawed full depth on a neat line at right angles to the curb face.

F. Foundations to be removed should be removed at least two feet below finished grade or two feet below natural ground surface.

3.6 PIPELINE DEMOLITION AND ABANDONMENT

A. General:

1. Abandoned pipelines not to be salvaged are considered as incidental excavation work.
2. Do not damage pipe or structures that remain in service or are to be salvaged for Owner.

B. Gravity Pipe Demolition:

1. Plug abandoned pipe with a permanent, water-tight concrete plug extending into the abandoned pipe at least two feet.
2. Seal openings in walls of remaining manholes, catch basins or structures with water-tight plugs.

C. Pressure Pipe Demolition:

1. Coordinate demolition with Engineer and agency owning the utility pipe.
2. Plug abandoned pipe with a permanent water-tight plug.
3. Cap and restrain the active pipe with a blind flange or equivalent type of plug.
4. For service line demolition or abandonment, disconnect the line from the mainline and shut off the corporation stop.

3.7 FENCES AND MISCELLANEOUS OBSTRUCTIONS

A. No demolition or removal of fences or miscellaneous obstructions shall proceed until clearance is obtained from the Owner.

3.8 DISPOSAL OF WASTE MATERIALS

A. Salvage designated equipment and materials for the Owner.

B. Where salvage is not required as otherwise specified herein or as shown on the drawings, dispose of all removed materials at a suitable off-site location in accordance with applicable laws and ordinances.

C. No burning shall be allowed.

END OF SECTION

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SECTION 03 10 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section covers cast-in-place concrete, including formwork, reinforcement, concrete mixtures and handling, placing and constructing for flatwork, manhole collars and bases, and thrust blocks.

1.2 RELATED WORK

A. Section 31 23 00 – Excavation, Backfilling and Compaction

B. Section 33 11 00 – Water Distribution and Transmission

1.3 REFERENCES

A. For concrete street improvements such as curb and gutter, sidewalk, drive approaches, etc. refer to the proper municipal or state standards.

B. ACI 301 – Structural Concrete (latest revision)

C. ACI 306 – Cold Weather Concreting (latest revision)

D. NSF 61 – Drinking Water System Components (latest revision)

E. ACI 305 – Hot Weather Concreting (latest revision)

F. ACI 201.2R-01 – Guide to Durable Concrete (latest revision)

1.4 SUBMITTALS

A. Concrete mixtures

1. Mixture proportions and characteristics.
2. Method and test data used to establish mixture proportions.
3. Information on types, classes, producers' names and plant locations for cementitious materials; types, pit or quarry locations, producers' names, grading and properties required by ASTM C 33 for aggregates; types, brand names, and producer's names for admixtures.

B. Reinforcement and reinforcement supports

1. Certified test reports on materials.
2. Placing drawings showing fabrication dimensions and locations for placement of reinforcement and supports.
3. Copy of plant certifications.
4. When Contractor finds it necessary to move reinforcement from locations specified to avoid interference with other reinforcement, submit the revised reinforcement arrangement.

C. Formwork and formwork accessories

1. Plan and procedures for installation and removal of reshoring and back shoring.
2. Data on formwork release agent or formwork liners.

3. Shop drawings for formwork.

D. Handling, placing and constructing

1. The Engineer must be notified 24 hours in advance of placement of concrete.
2. When applicable or requested by the Engineer, hot weather or cold weather precautions must be submitted.
3. Proposed location and treatment of construction joints not shown on the project drawings.
4. Proposed methods of curing.
5. Specification and data and methods of use for any proposed repair material.

E. Repair

1. Proposed repair methods, materials, and modifications to the Work.
2. Description of repair work performed to bring strength-deficient concrete into compliance with the Contract Documents.
3. Description of repair performed to being potentially nondurable concrete into compliance with the Contract Documents.

1.5 QUALITY STANDARD

A. Work shall conform to all requirements of ACI 301-05 published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by these Contract Documents.

1.6 TESTING

A. Testing of concrete materials shall be in accordance with ACI 301.

B. Payment for testing shall be in accordance with the General Conditions.

1.7 NOTICE TO PUBLIC

A. Follow laws and regulations concerning when and to whom notices are to be given at least two days before work starts.

B. Indicate when concrete work will take place and when driveway approach can be used.

C. Warn of potential vehicle tow away and other construction issues affecting neighborhood

D. Should work not occur on specified day, send a new notice.

PART 2 - PRODUCTS

2.1 FORMWORK AND FORMWORK ACCESSORIES

A. Form materials shall be faced with material which will produce smooth and uniform texture on concrete, unless indicated otherwise. Do not used material with raised grain, patches, or other defects which will impair the texture of the concrete surface.

B. Arrange facing material in a symmetrical manner, keeping number of seams to a minimum.

C. Form ties:

1. Use ties constructed so end fasteners can be removed without spalling concrete faces.
2. After end fasteners of ties have been removed, embedded portion of ties are to terminate not less than two times the diameter or thickness of the fasteners from formed faces of concrete, but in no case greater than ¾ inch.

3. When formed face on concrete is not exposed, form ties may be cut off flush with formed surfaces. Use ties with ¾ inch diameter cones on both ends or approved equal for water retaining structures.

D. Form release agents shall be a colorless material which will not stain concrete, absorb moisture, impair natural bonding or color characteristics of concrete.

2.2 REINFORCEMENT AND REINFORCEMENT SUPPORTS

A. Reinforcing steel shall conform to ASTM A 615/A 615M, 60 ksi yield grade.

B. Coated reinforcing bars shall be required as shown in the Project Drawings.

1. Epoxy-coated bars shall conform to ASTM A 775/A 775M.

C. Reinforcing steel shall be of the size specified in the Project Drawings.

D. Reinforcement supports shall be plastic.

E. Tie wire shall be minimum 16 gage annealed type or an acceptable patented system.

2.3 CONCRETE MIXTURES

A. All materials shall be in accordance with NSF Standard 61.

B. Concrete admixtures shall conform to ASTM C494 or C261.

C. Portland cement shall meet ASTM C150, Type II or V, ASTM C1157, MH or ASTM C595.

D. Fine aggregate shall conform to ASTM C33 with a fineness modulus greater or equal to 2.6.

E. Fly ash shall meet ASTM C618, Class F or N.

F. Silica fume shall conform to ASTM C1240.

G. Slag cement shall conform to C989.

H. The nominal maximum size of coarse aggregate shall be 1 inch and conform to ASTM C33.

I. Performance of concrete for various portions of the work shall be as shown in the following table:

Class	Use	Max. W/CM Ratio	Average 7-Day Comp. Strength (psi)	Minimum 28-Day Comp. Strength (psi)
2000	Thrust blocks	-	1,675	2,500
4000	Manhole bases Manhole collars Flatwork	0.45	2,680	4,000

J. Concrete shall meet the following performances requirements:

1. Mixture shall have total alkalis less than 0.40% or meet the equivalent requirements of ASTM C441.

2. Mixture shall conform to a value of less than 1500 coulombs when tested according to ASTM C1202 at or before 56 days.

3. The shrinkage of the concrete mixtures shall be less than 500 me after 28 days when tested according to ASTM C157.

K. Concrete shall be air entrained to withstand severe exposure as described in ACI 301-05.

L. The ready-mix concrete production facility shall demonstrate that it meets the requirements of National Ready Mixed Concrete Association (NRMCA) certification.

2.4 HANDLING, PLACING AND CONSTRUCTING

A. Concrete curing compound shall bestyrene-acrulic, styrene butadiene, or alpha-methylstyrene conforming to ASTM C 1315, Type II Class A or B (white pigmented) or Type ID Class A (clear with fugitive dye). Comply with local, state and federal requirements for volatile organic compounds (VOCs).

PART 3 - EXECUTION

3.1 FORMWORK AND FORMWORK ACCESSORIES

A. Keyway depths shall be as shown on the Project Drawings.

B. Chamfers and bevels on corners or edges of formed concrete shall be as shown on the Project Drawings.

C. Construction joints shall be as shown on the Project Drawings.

D. When removal of formwork or reshoring is based on concrete reaching a specified strength, it shall be assumed that concrete has reached this strength when either of the following conditions have been met:

1. When test cylinders, field-cured along with the concrete they represent, have reached the specified strength.
2. When concrete has been cured for the same maturity as the field-cured cylinders which reached specified strength as determined by the maturity method in ASTM C1074.

3.2 REINFORCEMENT AND REINFORCEMENT SUPPORTS

A. Maintain minimum concrete cover around reinforcing as described in the Project Drawings, or if it is not specified, maintain minimum cover as described in ACI 301-05.

B. Splicing:

1. Furnish all reinforcement in the full lengths indicated unless otherwise permitted. Splicing of bars, except where indicated, is not permitted without written approval.
2. Lap splice length shall be in accordance with ACI 318-05 and the International Building Code (IBC). Located reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on shop drawings. Stagger splices where possible.
3. Unless indicated otherwise, overlap reinforcing bars a minimum of 30 diameters to make the splice. In lapped splices, place the bars and wire to maintain the minimum distance for clear spacing to the surface of the concrete.
4. Do not use lap splices on bars greater in diameter than no. 11 unless otherwise approved.
5. Weld reinforcing steel only if indicated or if authorized in writing. Weld in conformance to AWS D1.4.
6. Do not bend reinforcement after embedding in hardened concrete.
7. Do not permit reinforcement or other embedded metal items bonded to the concrete, to extend continuously through any expansion joint, except dowels in floors bonded on only one side of joints.

C. All reinforcement to be free of loose mill scale, loose or thick rust, dirt, paint, oil or grease.

D. Place all reinforcement in the exact position indicated. With tie wire, tie bars together at all intersections except where spacing is less than 12 inches in each direction, in which case tie alternate intersections.

E. Maintain the distance from vertical forms and between layers of reinforcement by means of prefabricated chairs, ties, hangers or other approved devices. Placing and fastening of reinforcement in each section of the Work must be approved before concrete is placed.

F. Overlap sheets of metal mesh one square plus 6 inches to maintain a uniform strength. Securely fasten at the ends, edges, and supports to maintain clearances.

G. Flat slab work:

1. Support reinforcing steel of formed flat slabs with metal chairs, precast concrete blocks or other slab bolsters.
2. Size chairs or bolsters to position the steel in the exact location indicated.
3. Space chairs for supporting the top steel and bolsters for supporting the bottom steel not more than 5 feet on centers in each direction.
4. Plastic or epoxy coat the portion of the metal in contact with the forms to prevent rust.
5. Tie down deck steel to beams or forms at regular intervals of not more than 5 feet on centers along the beams or forms to prevent movement of the steel during concrete placement.

3.3 CONCRETE MIXTURES

A. Slump and air content shall be determined at the point of placement. Once slump and air loss during pumping can be determined, acceptance or rejection of concrete based on slump can then be determined at the delivery point.

B. Slump adjustment by addition of water at the site is not permitted without the consent of the Engineer.

3.4 HANDLING, PLACING AND CONSTRUCTING

A. The subgrade for slabs-on-ground shall be constructed of the material and compacted to the density shown on the Project Drawings or as specified in Section 31 23 00 – Excavation, Backfilling and Compaction.

B. In cold weather, as defined in ACI 301-05, concrete shall be placed in accordance with ACI 306. Similarly, in hot weather, as defined in ACI 301-5, concrete shall be placed in accordance with ACI 305.

C. Do not place concrete slabs or other flatwork if wind is greater than 5 mph unless a wind break is provided.

D. The finish of formed portions of concrete work shall have a uniform surface appearance in color and texture. All formed work shall have a smooth form finish as defined in ACI 301.

E. All flatwork shall have a float with broom finish as defined by ACI 301.

F. Where pipes, castings or conduits are to pass through structures, the Contractor shall place such pipes or castings in the forms before placing the concrete. Additional reinforcement shall be provided around large openings as shown in the Project Drawings.

END OF SECTION.

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SECTION 03 61 00
CEMENTITIOUS GROUTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pre mixed non metallic shrinkage resistant grout, pre mixed water stop hydraulic cement grout, epoxy grout, and portland cement grout.

1. Grout for leveling beds of structural steel plates.
2. Sealing of joints and gaps between piping and structures.
3. Sealing of joints between construction components.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. ASTM C 109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50 mm Cube Specimens).

B. ASTM C 144: Standard Specification for Aggregate for Masonry Mortar.

C. ASTM C 150: Standard Specification for Portland Cement.

D. ASTM C 190: Standard Test Method for Tensile Strength of Hydraulic Cement Mortars.

E. ASTM C 207: Standard Specification for Hydrated Lime for Masonry Purposes.

F. ASTM C 472: Standard Methods for Physical Testing of Gypsum Plasters and Gypsum Concrete.

G. ASTM C 595: Standard Specification for Blended Hydraulic Cements.

H. ASTM C 881: Standard Specification for Epoxy Resin Base Bonding Systems for Concrete.

I. ASTM C 1090: Standard Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic Cement Grout.

J. ASTM C 1107: Standard Specification for Packaged Dry Hydraulic Cement (Non Shrink).

K. ASTM C 1157: Standard Performance Specification for Blended Hydraulic Cement.

L. ASTM D 570: Standard Test Method for Water Absorption of Plastics.

M. ASTM D 638: Standard Test Method for Tensile Properties of Plastics.

N. ASTM D 695: Standard Test Method for Compressive Properties of Rigid Plastics.

1.4 SUBMITTALS

A. Grout mix components. Indicate proportions used, environmental conditions, and admixture limitations. Indicate material "Type", "Grade", and "Class" which suits Project requirements.

B. Manufacturer's data for latex bonding agent.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Cement:

1. ASTM C 150 natural color Type II (normal) or Type IIA (air entrained).
2. ASTM C 595, or C 1157: Blended.

B. Lime: ASTM C 207, Type S, hydrated.

C. Water: Clean, non staining and non detrimental.

D. Grout Aggregate: ASTM C 144, standard masonry type.

2.2 PORTLAND CEMENT GROUT

A. Proportions by Volume: 1 part Portland cement, and sand equal to 2 1/2 to 3 times sum of volumes of cement and lime.

B. Mix thoroughly with water to form a stiff workable plastic putty.

C. Compressive Strength: ASTM C 109, 2800 psi in 28 days.

2.3 GYPSUM PLASTER GROUT

A. Premixed, prepackaged, wood fiber gypsum plaster with an ASTM C 472 minimum average dry compressive strength of 2000 psi in 28 days.

B. Mix with water per manufacturer's instructions for intended use to form a stiff plastic mix required for workability.

2.4 CEMENT BASED SHRINKAGE RESISTANT GROUT

A. Grade B or grade C premixed, non metallic, non gaseous product; ASTM C 1107 at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty minute old grout shall flow through flow cone after slight agitation, in temperatures of 40 deg. F. to 90 deg. F.

B. Bleeding: None.

C. Compressive Strength: 6500 to 9000 psi, ASTM C 109 in 28 days.

D. Non shrink percentage: 0.5 percent, ASTM C 1090.

2.5 EPOXY ADHESIVE GROUT

A. Two component material suitable for use on dry or damp surfaces, 100 percent solids, high modulus, moisture insensitive, complying with ASTM C 881.

1. Tensile Strength: ASTM D 638, 5000 psi, minimum in 14 days.
2. Tensile Elongation: ASTM D 638, 2 percent minimum.
3. Compressive Strength: ASTM D 695, 6500 psi minimum in 24 hours and 70 deg. F., 12,500 psi in 28 days and 70 deg. F.
4. Water Absorption: ASTM D 570, 1 percent maximum.
5. Bond Strength:
    a. Direct Shear: 400 psi.
    b. Direct Tension: 250 psi.

c. Beam Break: 800 psi.

6. Pot Life: 5 minutes maximum at 70 deg. F.

2.6 BONDING GROUT

A. Of approximately 1 part cement to 1 part fine sand passing a No. 30 sieve with approved latex bonding agent when allowed.

2.7 PNEUMATICALLY PLACED PLASTER ("GUNITE" OR "SHOTCRETE")

A. Materials: Portland cement, lime, water and sand.

B. Compressive Strength: ASTM C 109, 2800 psi in 28 days.

C. Proportioning: 1 part cement to not more than 5 parts sand.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fill joints, voids, and pockets, completely.

B. Comply with manufacturer's instructions and UBC Chapter 47.

C. Finish surfaces exposed to view smooth.

D. Pneumatically Placed Plaster: Screened and reused rebound material in an amount not greater than 25 percent of the total sand in any batch.

END OF SECTION

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SECTION 04 05 16
MASONRY MORTAR AND GROUT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mortar and grout for masonry work.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. ASTM C 144: Standard Specification for Aggregate for Masonry Mortar.

B. ASTM C 150: Standard Specification for Portland Cement.

C. ASTM C 207: Standard Specification for Hydrated Lime for Masonry Purposes.

D. ASTM C 270: Standard Specification for Mortar for Unit Masonry.

E. ASTM C 404: Standard Specification for Aggregates for Masonry Grout.

F. ASTM C 476: Standard Specification for Mortar and Grout for Reinforced Masonry.

G. ASTM C 780: Standard Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

H. ASTM C 1019: Standard Method of Sampling and Testing Grout.

1.4 SUBMITTALS

A. Certification of Material: Submit manufacturer's mill test certificates covering materials shipped. Bags shall show the contents meet specifications herein.

B. Design Mix: Indicate proportions of Portland cement, hydrated lime and sand to be used, required environmental conditions, and admixture limitations.

1.5 DELIVERY, STORAGE AND HANDLING

A. Maintain packaged materials clean, dry and protected against dampness, freezing and foreign matter.

B. Maintain materials and surrounding air temperature to minimum 50 deg. F. prior to, during and 48 hours after completion off masonry work.

C. Use mortar or grout within 2 hours after mixing at temperatures of 80 deg. F. or 2 1/2 hours at temperatures under 50 deg. F.

D. Use fine grout for filling concrete masonry unit cores and when pumping is required.

E. Use fine or coarse grout for bond beams or where grout does not have to pass through openings less than 2 inches.

1.6 QUALITY ASSURANCE

A. Follow ASTM C 780 for testing mortar mix.

B. Follow ASTM C 1019 for testing grout mix.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: ASTM C 150, natural color, Type II (normal) or Type IIA (air entraining).

B. Hydrated Lime: ASTM C 207, Type S, no substitutes permitted.

C. Mortar Aggregate: ASTM C 144, standard masonry type except containing not more than 10 percent material passing through No. 100 sieve. Measure damp and loose throughout batches.

D. Water: Clean, non staining and non detrimental.

E. Grout Aggregate: ASTM C 404, fine aggregate size 2, No. 4 through No. 100 sieves. Coarse aggregate Size 8, 1/2 inch through No. 16 sieves.

2.2 MORTAR MIXES

A. Refer to ASTM C 270. Vary volumes of materials in mix design only slightly to assist workability.

1. Type S Mix (1,800 psi at 28 days): For reinforced masonry with high flexural bond strength. Use for all walls.
2. Type M Mix (2,500 psi at 28 days): For structural masonry, frost resistance, below grade masonry and masonry in contact with earth.
3. Mixing: Mix for a minimum of 3 minutes.

B. Admixtures: Not permitted.

C. Color: Natural gray.

2.3 GROUT MIXES

A. Refer to ASTM C 476. Vary volumes of materials in mix design only slightly to assist workability.

1. Reinforced masonry; 2,000 psi at 28 days.
2. Do not use antifreeze additives.

B. Mixing: Mix for a minimum of 5 minutes. Mix grout to have a slump of 10 inches 1 inch at time of placement.

C. Admixtures: Not permitted.

D. Color: Natural gray.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 05 05 10
METAL GALVANIZING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Application of a zinc coating on fabricated metal items.

B. Repair of damaged galvanized surfaces.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. ASTM A 123: Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A 153: Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

C. ASTM A 780: Standard Practice for Repair of Damaged Hot Dip Galvanized Coatings.

D. ASTM B 6: Standard Specification for Zinc (Slab Zinc).

E. ASTM E 376: Standard Practice for Measuring Coating Thickness by Magnetic Field or Eddy Current (Electromagnetic) Test Methods.

F. FS TT P 641: Primer Coating, Zinc Dust Zinc Oxide (for Galvanized Surfaces).

G. MIL P 21035: Paint, High Zinc Dust Content, Galvanizing Repair.

1.4 QUALITY ASSURANCE

A. When requested, verify weight of zinc coating in accordance with ASTM E 376.

PART 2 - PRODUCTS

2.1 ZINC METAL

A. Use zinc for coating that conforms to ASTM B 6 and is at least equal to the grade designated as "Prime Western".

PART 3 - EXECUTION

3.1 GALVANIZING

A. Provide a zinc coating for those items indicated or specified to be galvanized as follows:

1. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strips 1/8 inch thick and heavier.
2. ASTM A 153 for galvanizing iron and steel hardware.

3.2 WEIGHT OF COATING

A. Apply zinc on 1/8 inch to 3/16 inch thick steel at a rate of at least 2 ounces per square foot of

surface area.

B. Apply zinc on 1/4 inch and thicker steels at a rate of at least 2.3 ounces per square foot with no individual test measuring less than 2 ounces per square foot of surface area.

3.3 REPAIR OF DAMAGED COATING

A. Repair all shop damaged galvanized surfaces by the metallizing, hot stick or zinc rich paint, ASTM C 780 process.

B. Repair field damaged, cut, burned or uncoated surfaces in the field by coating with a dust zinc oxide paint conforming to FS TT P 641 or MIL P 21035.

END OF SECTION

SECTION 05 05 23
BOLTS, NUTS AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Steel bolts, nuts, washers, clamps, straps, rods and accessories.

B. Galvanize bolts, nuts and accessories unless specified otherwise.

1.2 RELATED WORK

A. Section 05 05 10 – Metal Galvanizing

1.3 REFERENCES

A. AISC M011: Manual of Steel Construction.

B. ASME B1.1: Unified inch Screw Threads (UN and UNR Thread Form), Supplement.

C. ASTM A 126: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

D. ASTM A 197: Standard Specification for Cupola Malleable Iron.

E. ASTM A 307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

F. ASTM A 325: Standard Specification for High Strength Bolts for Structural Steel Joints.

G. ASTM A 506: Standard Specification for Steel, Sheet and Strip, Alloy, Hot Rolled and Cold Rolled, Regular Quality and Structural Quality.

H. ASTM A 575: Standard Specification for Steel Bars, Carbon, Merchant Quality, M Grades.

I. ASTM F 593: Standard Specifications for Stainless Steel Bolts, Hex Cap Screws, and Studs.

1.4 SUBMITTALS

Not Used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bolts, Nuts, Accessories: Galvanized steel, Section 05 05 10 (except if stainless steel).

B. All sizes bolts and nuts, American Standard machined heavy hexagon heads with class 2 fit and threads, ASME B1.1.

C. Standard Bolts: Steel, ASTM A 307.

D. High Strength Bolts: Steel, ASTM A 325.

E. Anchor Bolts: Steel, ASTM A 307, or ASTM F 593 stainless steel when indicated.

F. Washers: Grey iron, ASTM A 126.

G. Clamps and Straps: Steel, ASTM A 506.

H. Rods: Steel, ASTM A 575.

I. Rod Coupling: Mallable iron, ASTM A 197.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Torque all nuts and bolts by procedures contained in AISC M011 to secure items requiring fastening.

B. Extend bolt through nut not less than 1/4 inch beyond nut.

END OF SECTION

SECTION 05 53 00
GRATINGS AND FLOOR PLATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grating, floor plates, and seats.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. ASTM A 36 - Standard Specification for Structural Steel.

B. ASTM B209 - Standard Specification for Aluminum and aluminum-Alloy Sheet and Plate

C. ASTM D 1187 - Standard Specification for Asphalt Base Emulsions for Use as Protective Coatings for Metal.

D. FS TT P 636 - Paint, Coating, Alkyd, Wood and Ferrous Metal.

1.4 SUBMITTALS

A. Prior to ordering or fabrication of grating, floor plates, or seats, submit Shop Drawings of all pieces with positioning diagram for approval, Section 01 33 00.

1.5 STRUCTURAL REQUIREMENTS

A. Unless otherwise noted, fabricate gratings and floor plates to support uniform live load of 100 pounds per square foot with deflection not to exceed L/240 of span, minimum or a concentrated load of 400 pounds.

B. Maximum weight of grating and floor plate units 100 pounds unless indicated otherwise.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grates: Aluminum, galvanized steel, or fiberglass grating as indicated. Furnish grating of the type, dimensions, and weights as required.

B. Floor Plates:

1. Floor plates fabricated from ASTM A 36 steel with checkered pattern of the dimensions and thickness indicated.
2. Aluminum diamond tread plate from ASTM B209 of dimensions and thickness indicated as supplied by MetalsDepot
    a. Dull mill finish (6061)
    b. Highly polished finish (3003)

C. Seats: Seats for all grating and floor plates as indicated. Fabricate seats for steel grating, fiberglass grating, or steel floor plates from steel sections as indicated. Fabricate seats for aluminum grating from aluminum sections as indicated.

2.2 FABRICATION

A. Band all grating.

B. Cut grating so that grating pattern matches adjacent sections.

C. Fabricate grating, floor plates, and seats so that adequate clearance is maintained.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Install gratings, floor plates, and seats as indicated.

B. Tops of grates and plates shall be flush with adjacent surfaces; tolerance -/+ 1/8 inch

C. Coat all aluminum surfaces in contact with concrete with ASTM D 1187 bituminous coating FS TT P 636 zinc chromate primer.

D. Block all seats during the placing of concrete so that clearances are maintained.

END OF SECTION

SECTION 05 56 00
METAL CASTINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Castings for grates, frames and covers for Manholes, catch basins, tree wells, monument boxes, water meters, etc.

1.2 RELATED WORK

A. Not Used

1.3 REFERENCES

A. ASTM A 27: Standard Specification for Steel Castings, Carbon, for General Application.

B. ASTM A 48: Standard Specification for Gray Iron Castings.

C. ASTM A 148: Standard Specification for Steel Castings, High Strength, for Structural Purposes.

D. ASTM B 22: Standard Specification for Bronze Castings For Bridges and Turntables.

E. ASTM B 584: Standard Specification for Copper Alloy Sand Castings For General Applications.

F. ASTM D 1187: Standard Specification for Asphalt Base Emulsion for Use as Protective Coatings for Metal.

G. ASTM E 10: Standard Test Method for Brinell Hardness of Metallic Materials.

1.4 SUBMITTALS

A. Submit shop drawings; Section 01 33 00.

B. Submit manufacturer's affidavit certifying materials comply with Part 2 requirements. (X ray certification mandatory).

1.5 QUALITY ASSURANCE

A. Make castings true to pattern in form and dimension and free from defects that would affect the service value of the casting.

B. Repair minor defects that do not impair the strength of a casting.

C. Reject castings that show injurious defects revealed by X ray or machining operations.

1.6 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Deliver and handle castings and gratings to prevent warping, rusting and damage.

B. Store all items on flexible surface and protect items from adverse environmental conditions.

PART 2 - PRODUCTS

2.1 STEEL CASTINGS

A. High Strength Steel Castings For Structural Purposes: ASTM A 148, Grade 80 50, except that the steel shall contain not less than 0.60 percent of manganese and not less than 0.20 percent silicon.

B. Mild to Medium Carbon Steel Castings For General Applications: ASTM A 27 Grade 65 35 with a minimum Brinell hardness number of 130 when tested in accordance with ASTM E 10.

2.2 GRAY IRON CASTINGS

A. All castings not specifically classified below shall conform to the requirements of ASTM A 48, Class 30.

1. Grate, frame and cover castings sets; ASTM A 48, Class 35.
2. Railings, railing posts and wheel guards; ASTM A 48, Class 40.
3. Rockers, rocker plate bearings and bearing plates for bridges; ASTM A 48, Class 50.

2.3 BRONZE CASTINGS

A. Expansion and Bearing Plates: ASTM B 22, Alloy C.

B. Ornamental Tablets, Railings, Miscellaneous Ornaments and Fixtures: ASTM B 584, Alloy 1B.

PART 3 - EXECUTION

3.1 PREPARATION

A. Fit bearing surfaces of flush fitting machined castings together firmly without rocking. Engineer reserves the right to reject rocking sets.

B. Ensure castings are boldly filleted at angles and the arises are sharp and true. Unless indicated otherwise all letters shall be heavily raised and spaced to secure a uniform and balanced effect over the entire area of the panel.

C. Before castings are removed from the foundry, ensure they are cleaned and the parting lines, gates, and risers are ground flush.

D. Ensure sets are coated in quality ASTM D 1187 asphalt paint unless galvanized or bronze sets are specified or required.

3.2 INSTALLATION

A. Furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation of castings.

B. Adjust Street Fixture elevation; Section 33 05 14.

C. Install countersunk flat head screw security bolts flush with top of grate.

3.3 CLEANING

A. Clean all castings free of grease, dirt, burrs, etc.

END OF SECTION

SECTION 06 61 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rough carpentry work not specified as part of other sections that is generally not exposed, except as otherwise indicated, and includes but is not limited to:

1. All wood framing and sheathing.
2. Furring.
3. Blocking for roofing system and related metal flashings.
4. Blocking for roof mounted items.
5. Wood posts and beams.
6. Wood grounds, nailers, blocking, and sleepers.
7. Subflooring and underlayment.
8. Preservative wood treatment where required.

1.2 RELATED WORK

A. Section 05 05 23 – Bolts, Nuts and Accessories

1.3 REFERENCES

A. ANSI A208.1: Mat Formed Wood Particleboard.

B. APA E 304: Design/Construction Guide Residential and Commercial.

C. ASTM D 226: Standard Specification for Asphalt Saturated Organic Felt Used in Roofing and Waterproofing.

D. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

E. AWPA M4: Care of Pressure Treated Wood Products.

F. AWPB LP 2: Quality Control and Observation Procedures for Soft Wood Lumber, Timber, Plywood, Pressure Treated With Waterborne Preservatives for Above Ground Use.

G. AWPB LP 22: Quality Control and Observation Procedures for Soft Wood Lumber, Timber, Plywood, Pressure Treated With Waterborne Preservatives for Ground Contact Use.

H. FS TT W 571: Wood Preservative, Treating Practices.

I. N.F.P.A. Publication: Manual for House Framing.

J. NPA: National Particleboard Association.

K. PS 1: Construction and Industrial Plywood.

L. PS 20: Softwood Lumber.

M. PS 51: Hardwood Lumber.

N. UL 790: Tests for Fire Resistance of Roof Covering Materials.

1.4 SUBMITTALS

A. Certificate of Pressure Treatment: Chemical solutions used, salt retention, and conformance. Include statement that moisture content of treated materials was reduced to maximum of 15 percent prior to shipment.

B. Certificate of Preservative and Fire retardant Treatment: Plant certification that material complies with this specification and will not bleed through finished surfaces.

1.5 QUALITY ASSURANCE

A. Lumber Grading Rules and Species: PS1.

B. Plywood Grading Rules and Recommendations: PS 20, PS 51.

C. Factory marking:

1. Type, grade, moisture content, observation service and producing mill.
2. Marking may be omitted if certificate of observation is provided for each shipment.

D. Underwriters' Laboratories, Inc.

E. Preservative and Pressure Treatment Standards: American Wood Preservers' Association.

1.6 PRODUCT DATA

A. Where dimensional lumber is required to comply with minimum allowable unit stresses, submit listing of species and grade selected for each use, and submit evidence of compliance with specified requirements. Compliance may be in form of a signed copy of applicable portion of lumber producer's grading rules showing design values for selected species and grade. Design values shall be as approved by the Board of Review of American Lumber Standards Committee.

B. For woods requiring preservative treatment, submit manufacturer's treatment literature and instructions for use and certification by treating plant stating chemicals and process used, net amounts of preservative retained, compliance with applicable standard, and expected Service Life.

C. For woods requiring fire retardant treatment, submit manufacturer's treatment literature and instructions for use and certification by treating plant that the treated woods comply with the applicable requirement and that the treating chemicals will not bleed out or affect finished surfaces.

1.7 PRODUCT HANDLING AND STORAGE

A. Keep wood covered, well ventilated, dry, and not in contact with earth when not being used.

B. Store wood to protect from warpage or delamination. Do not use woods damaged by improper protection.

C. Protect fire retardant treated materials against high humidity and moisture during storage and erection.

D. Time delivery and installation to avoid delaying progress of other work.

E. Handle treated lumber and plywood and treat penetration damage per AWPA M4.

PART 2 - PRODUCTS

2.1 LUMBER MATERIALS

A. Factory mark each piece of lumber with type, grade, mill and grading agency.

B. Provide dimensioned lumber; PS 20.

C. Provide dressed lumber, S4S, unless otherwise indicated.

D. Provide seasoned lumber with 19 percent maximum moisture at time of dressing and shipment for sizes 2 inches or less unless indicated otherwise.

E. For light bearing walls and framing use construction grade Hemlock fir North or better.

F. For interior nonbearing partition walls use stud grade Hemlock fir North or better unless indicated otherwise.

G. For structural framing use No. 2 grade Douglas fir or Larch or any species or grade meeting the following requirements:

1. Fb: 1,250 psi minimum.
2. E: 1,700,000 psi minimum.

2.2 PLYWOOD MATERIALS

A. Factory mark each sheet of plywood or particleboard with the appropriate trademark and grade.

B. Use plywood for subflooring, roofing, bracing, or other concealed areas that is APA performance rated, complying with the requirements indicated for grade designation, span rating, exposure durability classification, edge detail, and thickness.

C. Subflooring: Tongue and groove exterior rated sheathing thickness and span as indicated.

D. Wall sheathing: C D exterior rated; thickness as indicated.

1. 5 ply minimum, for use behind any veneer.
2. 4 ply minimum, for all other uses.

E. For roof sheathing use C D exterior rated plywood, thickness and span as indicated.

F. Provide mat formed particleboard, Grade 1 M 1, complying with ANSI A208.1, in thickness indicated.

2.3 ACCESSORIES

A. Nails, Spikes, and Staples: Galvanized for exterior, high humidity locations, and treated wood, cement coated for other interior locations, Size and type to suit application.

B. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; Section 05 05 23, Size and type to suit application; galvanized for exterior locations, high humidity locations, and treated wood; plain finish for other interior locations.

C. Fasteners:

1. Toggle bolt type for anchorage to hollow masonry.
2. Expansion shield and lag bolt type for anchorage to grouted masonry or concrete.
3. Bolts or power activated type for anchorage to steel.

D. Building Paper: 30 pound density asphalt saturated felt, non perforated, ASTM D 226.

E. Metal Framing Devices: Provide metal framing devices indicated.

F. Sound Board: Cellulose fiber board, specifically produced for sound deadening properties, thickness as indicated.

2.4 WOOD TREATMENT MATERIALS

A. Preservative Treatment: Where lumber or plywood is indicated as PT or "Treated", comply with applicable standard C2 (lumber) and C9 (plywood) of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.

B. Pressure treat above ground items with water borne preservatives complying with AWPB LP 2. After treatment, kiln dry to a maximum moisture content of 15 percent. Treat indicated items and the following:

1. Wood cants, nailers, curbs, blocking, stripping, and similar members in connection with roofing, flashing, vapor retarders, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches above grade.
4. Any wood framing members or elements exposed to weather.

C. Pressure treat wood in contact with ground or fresh water with water borne preservatives for gound contact use complying with AWPB LP 22.

D. If cut after treatment, coat cut surface with heavy brush coat of same chemical used for treatment and to comply with AWPA M4.

E. Complete fabrication of items that require treatment prior to the treatment step where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Observe each piece of lumber or plywood after drying and discard damaged or defective pieces.

F. Fire Retardant Treatment: Where "FR S" lumber or plywood is indicated, provide materials which comply with AWPA standards for pressure impregnation with fire retardant chemicals, and ASTM E 84, and show no increase in flame spread and significant progressive combustion upon continuation of test for additional 20 minutes.

1. Where treated items are exposed to exterior or to high humidity or are to have a transparent finish in the form of stain or sealer, provide materials which show no change in fire hazard classification when subjected to standard rain test (UL 790).
2. Use fire retardant treatment which will not bleed through or adversely affect type of finish indicated and which does not require brush treatment of field made end cuts to maintain fire hazard classification.
3. Kiln dry treated items to maximum moisture content of 19 percent.

G. Observe each piece of treated lumber or plywood after drying and discard all defective pieces.

2.5 SOURCE QUALITY CONTROL

A. Shop pressure treat wood materials requiring UL fire rating or pressure impregnated preservatives to FS TT W 571, Table 3.

B. Provide fire resistant treated materials with UL approved identification on each piece.

C. Deliver fire retardant treated materials cut to required sizes to minimize field cutting.

PART 3 - EXECUTION

3.1 SITE TREATMENT OF WOOD MATERIALS

A. Brush or spray 2 coats of preservative treatment for wood in contact with cementitious materials, roofing, metal flashings, and within 18 inches of the ground.

B. Apply preservative treatment per manufacturer's instructions.

C. Treat site sawn ends. Allow preservative to cure prior to placing members.

D. Preservative treat items indicated as "PT", and fire retardant treated items indicated as "FR S".

E. Prime paint surfaces in contact with cementitious materials with an exterior wood paint primer.

3.2 INSTALLATION GENERAL

A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Set carpentry work accurately to required levels and lines with members plumb and true and accurately cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads and fill holes in exposed carpentry work.

D. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

E. Refer to Uniform Building Code Table 25Q nailing requirements unless indicated otherwise.

3.3 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Do not countersink bolts and nuts unless otherwise shown. Where possible, anchor to form work before concrete placement.

C. Provide permanent ground of dressed, preservative treated, key bevelled lumber not less than 1 1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

3.4 STUD FRAMING

A. General: Provide stud framing, size and spacing indicated. Provide single bottom plate and double top plates 2 inches thick by width of studs; except single top plate may be used for non load bearing partitions. Nail or anchor plates to supporting construction.

B. Construct corners and intersection with not less than 3 studs. Provide miscellaneous blocking and framing indicated and as required for support of facing materials, fixtures, and specialty items and trim.

C. Provide continuous horizontal blocking row at mid height of single story partitions over 8 feet high and at midpoint of multi story partitions using 2 inches thick members of same width as wall or partitions.

D. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.

E. For nonbearing partitions provide double jamb studs and headers not less than 4 inches deep for openings 3 feet and less in width, and not less than 6 inches deep for wider openings.

F. For load bearings partitions provide double jamb studs for openings 6 feet and less in width, and triple jamb studs for wider openings. Provide headers of depth indicated, or if not, provide as recommended by N.F.P.A. "Manual for House Framing".

G. Plywood Sheathing: 4 feet wide panels vertical or horizontal. Fasten to framing as indicated. Block all edges with 2 x 4 minimum, flat.

3.5 FLOOR JOIST FRAMING

A. General: Provide framing of sizes and spacing indicated. Install with crown edge up and support ends of each member with not less than 1 1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach to wood bearing members by toe nailing or metal connectors; frame to wood supporting members with wood ledgers indicated, or if not with metal connectors. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 4 feet. Provide solid blocking (2 inches thick by depth of joist) at end of joists unless nailed to header or end member. Do not cut, bore, notch, or drill holes in any joists without Engineer's approval.

B. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking (2 inches thick by depth of joist) over supports.

C. Under jamb studs at openings provide solid blocking between joist.

D. Under non load bearing partitions provide double joists separated by solid blocking equal to depth of studs above.

E. Provide triple joists separated as above under partitions receiving ceramic tile and similar heavy finishes or fixtures unless otherwise shown.

F. Provide bridging between joists where nominal depth to thickness ratio exceeds 4, at intervals of 8 feet. Use bevel cuts 1" x 4" or 2" x 3" wood bracing, double crossed, and nailed both ends to joists, or use solid wood bridging 2 inches thick by depth of joist, end nailed to joist, or use steel cross bridging of equivalent strength.

G. Stair Framing: Provide stair framing members of size, space, and configuration indicated, or if not otherwise indicated, as required to support a minimum uniform live load of 100 psf and minimum concentrated load of 300 pounds applied to an area of 4 square inches at center of tread. Fabricate stair framing members to provide exact fit with treads and risers with no change in dimensions between landings.

3.6 PLYWOOD INSTALLATION

A. General: Comply with APA E 304 for types of plywood products and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Subflooring: Glue nail to framing.
2. Plywood Backing Panels: Nail to supports.

C. Particleboard Underlayment: Install in compliance with the recommendations of the NPA for the type of subfloor indicated. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush. Glue nail underlayment to subflooring.

D. Sound Board: Glue and nail per manufacturer's instructions.

END OF SECTION

SECTION 07 21 00
INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fiber fill, rigid, batt, spray, or granular insulation for:

1. Insulation under slabs on grade.
2. Foundation wall insulation (and supporting backfill).
3. Block/board cavity wall insulation.
4. Loose cavity wall insulation.
5. Concealed and exposed board type building insulation.
6. Blanket type building insulation.
7. Loose fill building insulation.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. ASTM C 209: Standard Method of Testing for Insulation Board (Cellulosic Fiber), Structural and Decorative.

B. ASTM C 516: Standard Specification for Vermiculite Loose Fill Insulation.

C. ASTM C 549: Standard Specification for Perlite Loose Fill Insulation.

D. ASTM C 665: Standard Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufacturer Housing.

E. ASTM C 764: Standard Specification for Mineral Fiber Loose Fill Insulation.

F. ASTM D 2842: Standard Test Method for Water Absorption of Rigid Cellular Plastics.

G. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

H. FS HH I 530: Insulation Board, Thermal, Unfaced Polyurethane or Polyisocyanurate.

I. FS HH I 558: Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering Thermal (Mineral Fiber, Industrial Type).

J. FS HH I 1030: Insulation, Thermal (Mineral Fiber, for Pneumatic or Poured Application).

1.4 SUBMITTALS

A. Manufacturer's product installation instructions.

B. Product data.

PART 2 - PRODUCTS

2.1 MOLDED BEAD POLYSTYRENE INSULATION

A. Thermal resistance "R" per inch of 3.7 aged in service value; minimum compressive strength of

10 psi; water absorption by volume, ASTM D 2842, 2.5 percent maximum, Square edges; board size of manufacturer's standard size by thickness indicated.

2.2 EXTRUDED CELLULAR POLYSTYRENE INSULATION

A. Thermal resistance "R" per inch of 5.56 aged in service value; minimum compressive strength of 30 psi; water absorption by volume, ASTM D 2842, 0.3 percent, Square edges; board size of manufacturer's standard dimensions by thickness indicated.

2.3 EXPANDED CELLULAR URETHANE INSULATION

A. Thermal resistance "R" per inch of 5.56 aged in service value; minimum compressive strength of 25 psi; water absorption by volume, ASTM D 2842, 3 percent; factory applied skin of aluminum foil both faces, Square edges board size of manufacturer's standard sizes by thickness indicated; FS HH I 530.

2.4 CLOSED CELL POLYISOCYANURATE INSULATION

A. Thermal resistance "R" per inch of 5.56 aged in service value; minimum compressive strength of 25 psi; water absorption by volume, ASTM C 209, less than 1 1/2 percent; factory applied skin of aluminum foil on both bases, Square edges; board size of manufacturer's standard dimensions by thickness indicate.

2.5 GLASS FIBER REINFORCED POLYISOCYANURATE FOAM INSULATION

A. Plastic core faced on exposed side with 0.019 inch aluminum sheet laminated over foil and faced on reverse side with reflective foil, thickness or R Value as indicated. Provide interlocking PVC strips of proper size for mounting boards and covering joints.

2.6 FIBER GLASS BATT INSULATION

A. Preformed glass fiber batt or roll friction fit type without membrane.

2.7 FIBER FILL INSULATION

A. Mineral wool modulated for pour or bulk for pneumatic placement; "R" value as indicated; FS HH I 1030.

2.8 MINERAL FIBER INSULATION

A. A maximum thermal conductivity "K" value of 0.26, and when tested, ASTM E 84 a flame spread of 25 or less, a fuel contribution of 15 or less, smoke developed rating of 20 or less, ASTM C 764. Where exposed, the color shall be white with a minimum light reflectance of 70 percent.

2.9 GRANULAR INSULATION

A. Water repellent; fire resistant; flame/fuel/smoke contribution of 0/0/0, ASTM E 84.

1. Vermiculite type, ASTM C 516.
2. Perlite type, ASTM C 549.

2.10 MINERAL FIRE PROOFING AND SAFING

A. Noncombustible, 4 pounds per cubic foot density, mineral fiber, ASTM C 665 or FS HH I 558.

2.11 ADHESIVE MATERIALS

A. Gun grade, mastic type, compatible with insulation and substrate, or type recommended by insulation manufacturer for application.

2.12 ACCESSORIES

A. Vapor and Air Retarder: Translucent polyethylene film for above grade application; 6 mil thick.

B. Nails or Staples: Steel wire; galvanized; type and size to suit application, at least 1/2 inch longer than thickness of insulation.

C. Tape: Bright aluminum self adhering; 2 inches wide.

D. Rigid Insulation Fasteners: Impale clip type of wood or galvanized steel; of type to be mechanically fastened to surface to receive insulation; length to suit insulation thickness; capable of securely and rigidly fastening insulation in place.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify substrate and adjacent materials and insulation board are dry and ready to receive insulation and adhesive.

B. Verify substrate surface is flat, free of honeycomb, fins, irregularities, or materials that will impair adhesive bond.

C. Verify insulation boards are unbroken, free of damage, with face membrane undamaged.

D. Verify mechanical and electrical services within walls have been installed and tested.

3.2 INSTALLATION - FIBER FILL INSULATION

A. Install by pneumatic or pouring placement methods through access holes as required.

B. Place fiber fill insulation per manufacturer's instructions.

C. Place insulation tightly in stud, joist, rafters, spaces and tight to and behind mechanical and electrical services within the plan of insulation.

D. Completely fill intended spaces. Leave no gaps and voids.

3.3 INSTALLATION - RIGID INSULATION

A. Foundation Perimeter:

1. Adhere a 6 inches wide strip of polyethylene sheet over joints with double beads of adhesive each side of joint. Tape seal joints between sheets. Extend sheet full height of joint.
2. Install boards on foundation wall perimeter, horizontally. Place boards in a method to maximize contact Bedding. Stagger end joints. Butt edges and ends tight to adjacent board and to protrusions.
3. Extend boards over expansion joints, unbonded to foundation 12 inches either side of joint.

B. Exterior Walls:

1. Apply adhesive in 3 continuous beads per board length. Daub adhesive tight to protrusions.
2. Install boards on wall surface perimeter, vertically. Place membrane surface of insulation against adhesive.
3. Place boards in a method to maximize contact Bedding. Stagger side joints. Butt edges and ends tight to adjacent board and to protrusions.
4. Place 24" wide polyethylene sheet at perimeter of wall openings from adhesive vapor and air retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor and air retarder.

C. Cavity Walls:

1. Secure impale fasteners to substrate at a frequency of 6 per insulated board.
2. Apply adhesive in 3 continuous beads per board length. Daub adhesive tight to protrusions to ensure continuity of vapor and air retarder.
3. Install boards horizontally between wall reinforcement.

D. Under Concrete Slabs:

1. Place insulation under slabs on grade after base for slab has been compacted.
2. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.4 INSTALLATION - BATT INSULATION

A. Install batt insulation and vapor retarder per manufacturer's instructions.

B. Install batt insulation without gaps or voids.

C. Trim insulation neatly to fit spaces. Use batts free of damage.

D. Fit insulation tight in spaces airtight to exterior side of mechanical and electrical services within the plane of insulation.

E. Protect all insulation materials during storage and insulation from moisture, tears or other damage. All damaged material shall be replaced at no additional cost to the OWNER.

3.5 INSTALLATION - SPRAY ON INSULATION

A. Surfaces to receive spray on insulation shall be free of dirt, grease, oil, loose paint, excessive rust scale, or other foreign material which would prevent adequate adhesion. Application shall not proceed until unsatisfactory conditions are corrected. Ambient temperature shall be between 40 and 155 deg. F.

B. Application: Mix, apply, and finish spray on insulation per manufacturer's specifications and instructions for a monolithic blanket of uniform texture. Thickness shall be as indicated.

C. Mineral fire proofing and safing: Following manufacturer's recommendations, install mineral fire proofing and safing in all openings in floors and walls to seal completely, without voids, around pipe, conduit, duct, and other penetrations.

D. Cleanup: Remove from site all containers, wrappings, and scrap insulation materials. Leave floors broom clean.

3.6 INSTALLATION - GRANULAR INSULATION

A. Place granular insulation in walls per manufacturer's instructions. Verify holes and openings have been sealed to prevent loss of insulation.

B. Place after masonry materials have sufficiently dried and attained optimum moisture content, and after vertical cores have been grouted.

C. Place as masonry is erected.

D. Ensure spaces are completely free of mortar and debris to allow free flow of insulation.

E. Completely fill spaces. Place in lifts and rod to eliminate air pockets. Do not exceed 4 feet pouring height. Place prior to covering cores and bond beams or lintels.

F. Place temporary signs in rooms that face insulated walls warning workers to use caution to prevent loss of insulation if cutting into walls.

END OF SECTION

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SECTION 07 26 16
UNDER SLAB VAPOR BARRIER/RETARDER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Products Supplied Under This Section

1. Vapor Barrier, seam tape, mastic, pipe boots, detail strip for installation under concrete slabs.

1.2 RELATED SECTIONS

A. Section 03 30 10 - Concrete Placement

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM); use most current versions

1. ASTM E 1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
2. ASTM E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
3. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials
4. ASTM E 1643 Standard Practice for Selection, Design, Installation and Observation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

B. American Concrete Institute (ACI)

1. ACI 302.2R 06 Guide for Concrete Slabs that Receive Moisture Sensitive Flooring Materials.

1.4 SUBMITTALS

A. Quality Control / Assurance

1. Full set of test results as per paragraph 8.3 of ASTM E 1745.
2. Manufacturer's samples, literature
3. Manufacturer's installation instructions for placement, seaming and pipe boot installation

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Barrier: When the specifications of different sections conflict, the contractor shall perform to the most restrictive provision.

1. Vapor Barrier membrane must have the following properties.

a. Permeance as tested after mandatory conditioning (ASTM E 1745 paragraphs 7.1.1 5): less than 0.01 perms (gr/ft2/hr/in Hg)

b. Strength: Class A (ASTM E 1745)

c. Thickness: 15 mil

2. Approved Products
   a. Stego Wrap 15 mil Vapor Barrier by Stego Industries LLC
   b. VaporGuard by Reef Industries, Inc
   c. Ecoshield E 15 by Epro Services, Inc.
   d. Approved equal

2.2 ACCESSORIES

A. Seam Tape: Use tape provided by vapor barrier manufacturer.
   1. Stego Tape by Stego Industries LLC, or approved equal

B. Vapor proofing Mastic
   1. Stego Mastic by Stego Industries LLC, or approved equal

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Engineer
   1. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION

A. Install Vapor Barrier/Retarder:
   1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643 (use most current version).
      a. Unroll vapor barrier/retarder with the longest dimension parallel with the direction of the pour.
      b. Lap vapor barrier/retarder over footings or seal to foundation walls.
      c. Overlap joints 6 inches and seal with manufacturer's tape.
      d. Seal all penetrations (including pipes) per manufacturer's instructions.
      e. No penetration of the vapor barrier/retarder is allowed except for reinforcing steel and permanent utilities.
      f. Repair damaged areas by cutting patches of vapor barrier/retarder, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION

SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

1.2 RELATED WORK

A. Section 07 71 00 – Roof Specialties

B. Section 07 51 00 – Built-Up Bituminous Roofing

C. Section 07 52 16 – Modified Bituminous Membrane Roofing

D. Division 07 – Roofing and Wall System Sections

E. Section 07 92 00 – Joint Sealants

F. Section 09 06 00 – Schedule for Finishes

G. Section 07 71 00 – Roof Specialties

H. Section 07 72 00 – Roof Accessories

I. Division 22 – Plumbing Sections

J. Division 23 – HVAC Sections

K. Section 09 91 00 – Painting

L. Section 13 34 19 – Metal Building Systems

M. Section 22 14 00 – Facility Storm Drainage

1.3 REFERENCES

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.

B. Aluminum Association (AA):

1. AA-C22A41 Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick
2. AA-C22A42 Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick
3. AA-C22A44 Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish

C. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):

1. ANSI/SPRI ES-1-03 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. American Architectural Manufacturers Association (AAMA):

1. AAMA 620 Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum
2. AAMA 621 Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

E. ASTM International (ASTM):

1. A240/A240M-14 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
2. A653/A653M-11 Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process
3. B32-08 Solder Metal
4. B209-10 Aluminum and Aluminum-Alloy Sheet and Plate
5. B370-12 Copper Sheet and Strip for Building Construction
6. D173-03(R2011) Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
7. D412-06(R2013) Vulcanized Rubber and Thermoplastic Elastomers-Tension
8. D1187-97(R2011) Asphalt Base Emulsions for Use as Protective Coatings for Metal
9. D1784-11 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
10. D3656-07 Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
11. D4586-07 Asphalt Roof Cement, Asbestos Free

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

G. National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 500-06 Metal Finishes Manual

H. Federal Specification (Fed. Spec):

1. A-A-1925A Shield, Expansion; (Nail Anchors)
2. UU-B-790A Building Paper, Vegetable Fiber

I. International Code Commission (ICC): International Building Code, Current Edition

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, Shop Drawings, Product Data, and Samples.

B. Shop Drawings: For all specified items, including:

1. Flashings
2. Copings
3. Gravel Stop-Fascia
4. Gutter and Conductors
5. Expansion joints
6. Fascia-cant

C. Manufacturer's Literature and Data: For all specified items, including:

1. Two-piece counterflashing
2. Thru wall flashing
3. Expansion joint cover, each type
4. Nonreinforced, elastomeric sheeting
5. Copper clad stainless steel
6. Polyethylene coated copper
7. Bituminous coated copper
8. Copper covered paper
9. Fascia-cant

D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

1.5 PERFORMANCE REQUIREMENTS

A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:

1. Wind Zone 1: 0.48 to 0.96 kPa (10 to 20 lbf/sq. ft.): 1.92-kPa (40-lbf/sq. ft.) perimeter uplift force, 2.87-kPa (60-lbf/sq. ft.) corner uplift force, and 0.96-kPa (20-lbf/sq. ft.) outward force.
2. Wind Zone 1: 1.00 to 1.44 kPa (21 to 30 lbf/sq. ft.): 2.87-kPa (60-lbf/sq. ft.) perimeter uplift force, 4.31-kPa (90-lbf/sq. ft.) corner uplift force, and 1.44-kPa (30-lbf/sq. ft.) outward force.
3. Wind Zone 2: 1.48 to 2.15 kPa (31 to 45 lbf/sq. ft.): 4.31-kPa (90-lbf/sq. ft.) perimeter uplift force, 5.74-kPa (120-lbf/sq. ft.) corner uplift force, and 2.15-kPa (45-lbf/sq. ft.) outward force.
4. Wind Zone 3: 2.20 to 4.98 kPa (46 to 104 lbf/sq. ft.): 9.96-kPa (208-lbf/sq. ft.) perimeter uplift force, 14.94-kPa (312-lbf/sq. ft.) corner uplift force, and 4.98-kPa (104-lbf/sq. ft.) outward force.

B. Wind Design Standard: Fabricate and install //copings// //roof-edge flashings// tested per ANSI/SPRI ES-1 to resist design pressure //insert design pressure// //indicated on Drawings//.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

A. Stainless Steel: ASTM A240, Type 302B, dead soft temper.

B. Copper ASTM B370, cold-rolled temper.

C. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m² (3 oz/sf). Bituminous coating shall weigh not less than 2 kg/m² (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Exposed fabric surface shall be crimped.

D. Copper Covered Paper: Fabricated of electro-deposit pure copper sheets ASTM B 370, bonded with special asphalt compound to both sides of creped, reinforced building paper, UU-B-790, Type I, style 5, or to a three ply sheet of asphalt impregnated creped paper. Grooves running along the width of sheet.

E. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m² (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.

F. Aluminum Sheet: ASTM B209, alloy 3003-H14 //except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14//.

G. Galvanized Sheet: ASTM, A653.

H. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30□C (-20 □F).

2.2 FLASHING ACCESSORIES

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.

B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m²(6 lbs/100 sf).

C. Bituminous Paint: ASTM D1187, Type I.

D. Fasteners:

1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
2. Nails:
    a. Minimum diameter for copper nails: 3 mm (0.109 inch).
    b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
    c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
    d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
3. Rivets: Not less than 3 mm (1/8 inch) diameter.
4. Expansion Shields: Fed Spec A-A-1925A.

E. Sealant: As specified in Section 07 92 00, Joint Sealants for exterior locations.

F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.

G. Roof Cement: ASTM D4586.

2.3 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:

B. Concealed Locations (Built into Construction):

1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick)
2. Stainless steel: 0.25 mm (0.010 inch) thick.
3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.
4. Galvanized steel: 0.5 mm (0.021 inch) thick.

C. Exposed Locations:

1. Copper: 0.4 Kg (16 oz).

2. Stainless steel: 0.4 mm (0.015 inch).
3. Copper clad stainless steel: 0.4 mm (0.015 inch).

D. Thickness of aluminum or galvanized steel is specified with each item.

2.4 FABRICATION, GENERAL

A. Jointing:

1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
3. Joints shall conform to following requirements:
    a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
    b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
    c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
4. Flat and lap joints shall be made in direction of flow.
5. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
    a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
    b. Wire brush to produce a bright surface before soldering lead coated copper.
    c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
    d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:

1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified

otherwise.

3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 0.6 Kg (24 ounce)copper, 0.6 mm (0.024 inch) thick stainless steel, 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using1 Kg (32 oz) copper, 0.8 mm (0.031 inch) thick stainless steel, 1.6 mm (0.0625 inch) thick aluminum.

E. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.
3. Where copper gravel stops, copings and flashings will carry water onto cast stone, stone, or architectural concrete, or stainless steel.

2.5 FINISHES

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.

B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.

C. Finish exposed metal surfaces as follows, unless specified otherwise:

1. Copper: Mill finish.
2. Stainless Steel: Finish No. 2B or 2D.
3. Aluminum:
    a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
    b. Colored Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 18 mm (0.7 mils) thick. Dyes will not be accepted.
    c. Fluorocarbon Finish: AAMA 620, high performance organic coating.
    d. Mill finish.
4. Steel and Galvanized Steel:
    a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.
    b. Manufacturer's finish:
        (i) Baked on prime coat over a phosphate coating.
        (ii) Baked-on prime and finish coat over a phosphate coating.
        (iii) Fluorocarbon Finish: AAMA 621, high performance organic coating.

2.6 THROUGH-WALL FLASHINGS

A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.

1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
2. Fabricate so keying nests at overlaps.

B. For Masonry Work When Concealed Except for Drip:

1. Either copper, stainless steel, or copper clad stainless steel.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.

C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:

1. Use same metal and thickness as counter flashing.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portion as snap lock receiver for counter flashing upper edge.

D. For Flashing at Architectural Precast Concrete Panels or Stone Panels.

1. Use plan flat sheet of stainless steel.
2. Form exposed portions with drip as specified or receiver.

E. Window Sill Flashing and Lintel Flashing:

1. Use either copper, stainless steel, copper clad stainless steel plane flat sheet, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
3. Turn up back edge as shown.
4. Form exposed portion with drip as specified or receiver.

F. Door Sill Flashing:

1. Where concealed, use either 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.
2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use either 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.7 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.

1. Use either copper, or stainless steel, thickness specified unless specified otherwise.
2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
4. Use either copper, or stainless steel at pipe flashings.

B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).

C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.

D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

E. Pipe Flashing: (Other than engine exhaust or flue stack)

1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
    a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
    b. Allow for loose fit around and into the pipe.
4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
    a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
    b. Allow for loose fit around pipe.

2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Either copper or stainless steel, unless specified otherwise.

B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:

1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
4. Manufactured assemblies may be used.
5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.

C. One-piece Counterflashing:

1. Back edge turned up and fabricate to lock into reglet in concrete.
2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).

D. Two-Piece Counterflashing:

1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:

1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Pipe Counterflashing:

1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
4. Use stainless steel bolt on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.9 GRAVEL STOPS

A. General:

1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
3. Fabricate roof flange not less than 100 mm (4 inches) wide.
4. Fabricate top edge to extend above roof not less than 25 mm (one inch) for embedded gravel aggregate and not less than 100 mm (4 inches) for loose laid ballast.
5. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:
    a. Fabricate of one-piece material of suitable width for fascia height of 250 mm (10 inch) maximum or counterflashing lap of not less than 100 mm (4 inch) over base flashing.
    b. Fabricate bottom edge of formed fascia to receive edge strip.
    c. When fascia bottom edge forms counter flashing over roofing lap roofing not less than 150 mm (6 inches).

B. Formed Flat Sheet Metal Gravel Stops and Fascia:

1. Fabricate as shown of //.05 mm (0.018 inch) thick stainless steel// //0.5 Kg (20 ounce) copper// //1.25 mm (0.050 inch) thick aluminum//.
2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.
3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch) at top and bottom. Clip shall be of the same thickness as the fascia.
5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.

C. Formed (Corrugated Sheet) Sheet Metal Gravel Stops and Fascia:

1. Fabricate as shown of //0.4 mm (0.015 inch) thick stainless steel// //0.5 Kg (16 ounce) copper// //0.8 mm (0.032 inch) thick aluminum//.
2. Sheets shall have 2 mm (1/16 inch) deep corrugations either transversely or diagonally rolled into the sheet. Crimped sheets are not acceptable.
3. Factory fabricate prepackaged system, complete with fastenings.
4. Provide concealed flashing splice plate at joints not less than 150 mm (6 inches) long and continuous edge strip at lower edge of fascia made from same metal.
5. Fabricate as two-piece fascia when fascia depth exceeds 175 mm (7 inches).

2.10 BITUMEN STOPS

A. Fabricate bitumen stops for bituminous roofing edges for use with formed sheet metal gravel

stops, pipe penetrations, and other penetrations through roof deck without a curb.

B. Fabricate with 19 mm (3/4 inch) vertical legs and 75 mm (3 inch) horizontal legs.

C. When used with gravel stop or metal base flashing use same metal for bitumen stop in thickness specified for concealed locations.

2.11 HANGING GUTTERS

A. Fabricate gutters of not less than the following:

1. 0.4, 0.5, 0.6Kg (16, 20, 24 oz) copper..
2. 0.5, 0.6, 0.8mm (0.018, 0.025, 0.031 inch) thick stainless steel..
3. 0.6, 0.8, 1.3mm (0.025, 0.032, 0.051 inch) thick aluminum.

B. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.

C. Building side of gutter shall be //not less than 38 mm (1 1/2 inches) higher than exterior side, same height as exterior side.

D. Gutter Bead: Stiffen outer edge of gutter by folding edge over approximately 19 mm (3/4 inch) toward roof and down approximately19 mm (3/4 inch) unless shown otherwise.

E. Gutter Spacers:

1. Fabricate of same material and thickness as gutter.
2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
4. Rivet and solder to gutter except rivet and seal to aluminum.

F. Outlet Tubes:

1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch). Flange upper end of outlet tube 13 mm (1/2 inch).
2. Lock and solder longitudinal seam, except use sealant in lieu of solder with aluminum.
3. Solder tube to gutter. Seal aluminum tube to gutter and rivet to gutter.
4. Fabricate basket strainers of same material as gutters.

G. Gutter Brackets:

2.12 CONDUCTORS (DOWNSPOUTS)

A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long [with 19 mm (3/4 inch) wide flat locked seams].

1. Fabricate open face channel shape with hemmed longitudinal edges.

B. Fabricate elbows by mitering, riveting, and soldering except seal aluminum in lieu of solder. Lap upper section to the inside of the lower piece.

C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual Plate 34, Design C for rectangular shapes and E for round shapes.

D. Conductor Heads:

1. Fabricate of same material as conductor.
2. Fabricate conductor heads to not less than 250 mm (10 inch) wide by 200 mm (8 inch) deep by 200 mm (8 inches) from front to back.
3. Form front and side edges channel shape not less than 13 mm (1/2 inch) wide flanges with edge hemmed.
4. Slope bottom to sleeve to conductor or downspout at not less than 60 degree angle.
5. Extend wall edge not less than 25 mm (one inch) above front edge.
6. Solder joints for water tight assembly.
7. Fabricate outlet tube or sleeve at bottom not less than 50 mm (2 inches) long to insert into conductor.

2.13 SPLASHPANS

A. Fabricate splashpans from the following:
   1. 0.4 Kg (16 oz) copper.
   2. 0.4 mm (0.015 inch) thick stainless steel.
   3. 1.25 mm (0.050 inch) thick aluminum.

B. Fabricate in accordance with Architectural Sheet Metal Manual Plate 35 with not less than two ribs as shown in alternate section.

2.14 REGLETS

A. Fabricate reglets of one of the following materials:
   1. 0.4 Kg (16 ounce) copper.
   2. Stainless steel, not less than 0.3 mm (0.012 inch) thick.
   3. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.
   4. Plastic, ASTM D1784, Type II, not less than 2 mm (0.075 inch) thick.

B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.

C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.

D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.

E. Fabricate mitered corners, fittings, and special shapes as may be required by details.

F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

2.15 INSULATED EXPANSION JOINT COVERS

A. Either type optional, use only one type throughout.

B. Types:
   1. Construct of two preformed, stainless steel strips, not less than 0.4 mm (0.015 inch) thick, mechanically and adhesively bonded to both sides of a 2 mm (1/16 inch) thick neoprene or butyl sheet, or to a 0.4 mm (32 mil) thick reinforced chlorinated polyethylene sheet. Adhesively attach a 10 mm (3/8 inch) thick sheet of closed cell,

neoprene foam insulation, to the underside of the neoprene, butyl, or chlorinated polyethylene sheet.

2. Constructed of a 2 mm (1/16 inch) thick vinyl sheet, flanged at both sides with stainless steel strips not less than 0.4 mm (0.015 inch) thick. Vinyl sheet locked and encased by the stainless steel strip and prepunched for nailing. A 10 mm (3/8 inch) thick closed cell polyvinyl chloride foam insulating strip shall be heat laminated to the underside of the vinyl sheet between the stainless steel strips.

C. Expansion joint covers shall have factory fabricated mitered corners, crossing tees, and other necessary accessories. Furnish in the longest available lengths.

D. Metal flange of sufficient width to extend over the top of the curb and down curb sides 50 mm (2 inches) with hemmed edge for lock to edge strip.

2.16 ENGINE EXHAUST PIPE OR FLUE OR STACK FLASHING

A. Flashing at penetrations through roofing shall consist of a metal collar, sheet metal flashing sleeve and hood.

B. Fabricate collar with roof flange of 1.2 mm (0.047 inch) minimum thick black iron or galvanized steel sheet.

1. Fabricate inside diameter of collar 100 mm (4 inches) larger than the outside diameter of the item penetration the roofing.
2. Extend collar height from structural roof deck to not less than 350 mm (14 inches) above roof surface.
3. Fabricate collar roof flange not less than 100 mm (4 inches) wide.
4. Option: Collar may be of steel tubing 3 mm (0.125 inch) minimum wall thickness, with not less than four, 50 mm x 100 mm x 3 mm (2 inch by 4 inch by 0.125 inch) thick tabs bottom edge evenly spaced around tube in lieu of continuous roof flange. Full butt weld joints of collar.

C. Fabricate sleeve base flashing with roof flange of either copper, stainless steel, or copper clad stainless steel.

1. Fabricate sleeve roof flange not less than 100 mm (4 inches) wide.
2. Extend sleeve around collar up to top of collar.
3. Flange bottom of sleeve out not less than 13 mm (1/24 inch) and soldered to 100 mm (4 inch) wide flange to make watertight.
4. Fabricate interior diameter 50 mm (2 inch) greater than collar.

D. Fabricate hood counter flashing from same material and thickness as sleeve.

1. Fabricate the same as pipe counter flashing except allow not less than 100 mm (4 inch) lap below top of sleeve and to form vent space minimum of 100 mm (4 inch) wide.
2. Hem bottom edge of hood 13 mm (1/2 inch).
3. Provide a 50 mm (2 inch) deep drawband.

E. Fabricate insect screen closure between sleeve and hood. Secure screen to sleeve with sheet metal screws.

2.17 SCUPPERS

A. Fabricate scuppers with minimum of 100 mm (4 inch) wide flange.

B. Provide flange at top on through wall scupper to extend to top of base flashing.

C. Fabricate exterior wall side to project not less than 13 mm (1/2 inch) beyond face of wall with drip at bottom outlet edge.

D. Fabricate not less than 100 mm (4 inch) wide flange to lap behind gravel stop fascia.

E. Fabricate exterior wall flange for through wall scupper not less than 25 mm (one inch) wide on top and sides with edges hemmed.

F. Fabricate gravel stop bar of 25 mm x 25 mm (one by one inch) angle strip soldered to bottom of scupper.

G. Fabricate scupper not less than 200 mm (8 inch) wide and not less than 125 mm (5 inch) high for through wall scupper.

H. Solder joints watertight.

2.18 GOOSENECK ROOF VENTILATORS

A. Form of 1.3 mm (0.0508 inch) thick sheet aluminum, reinforce as necessary for rigidity, stiffness, and connection to curb, and to be watertight.

1. Form lower-edge to sleeve to curb.
2. Curb:
    a. Form for 100 mm (4 inch) high sleeve to ventilator.
    b. Form for concealed anchorage to structural curb and to bear on structural curb.
    c. Form bottom edge of curb as counterflashing to lap base flashing.

B. Provide open end with 1.6 mm (16 gage), stainless steel wire guard of 13 mm (1/2 inch) square mesh.

1. Construct suitable aluminum angle frame to retain wire guard.
2. Rivet angle frame to end of gooseneck.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, Architectural Sheet Metal Manual, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, Joint Sealants.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope

and nail with large headed copper nails.

7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:
    a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
    b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches)and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.

5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, Joint Sealants.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).

B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.

C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).

D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.

E. Flashing at Veneer Walls:
    1. Install near line of finish floors over shelf angles or where shown.
    2. Turn up against sheathing.
    3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
    4. At concrete backing, extend flashing into reglet as specified.
    5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.

F. Lintel Flashing when not part of shelf angle flashing:
    1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
    2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face

of wall.

3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.

G. Window Sill Flashing:

1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
2. Turn back edge up to terminate under window frame.
3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.

H. Door Sill Flashing:

1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

I. Flashing at Masonry, Stone, or Precast Concrete Copings:

1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

3.3 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.

1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.

B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings,

except as otherwise specified or shown.

2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:

1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.
    a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
        (i) Locate fasteners in masonry mortar joints.
        (ii) Use screws to sheet metal or wood.
    b. Fill joint at top with sealant.
4. Where flashing or hood is mounted on pipe.
    a. Secure with draw band tight against pipe.
    b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
    c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:

1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:
    a. Secure to face construction in accordance, with manufacturers instructions.
    b. Completely fill space at the top edge of receiver with sealant.
3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

E. When counter flashing is a component of other flashing install as shown.

3.5 REGLETS

A. Install reglets in a manner to provide a watertight installation.

B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.

C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:

1. Coordinate reglets for anchorage into concrete with formwork construction.
2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.6 GRAVEL STOPS

A. General:

1. Install gravel stops and fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).
2. Extend roof flange of gravel stop and splice plates not less than four inches out over roofing and nail or screw to wood nailers. Space fasteners on 75 mm (3 inch) centers in staggered pattern.
3. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.
4. Where ends of gravel stops and fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
5. Set flange in roof cement when installed over built-up roofing.
6. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2003.

B. Sheet metal gravel stops and fascia:

1. Install with end joints of splice plates sheets lapped three inches.
2. Hook the lower edge of fascia into a continuous edge strip.
3. Lock top section to bottom section for two piece fascia.

C. Corrugated sheet gravel stops and fascia:

1. Install 300 mm (12 inch) wide sheet flashing centered under joint. A combination bottom and cover plate, extending above and beneath the joint, may be used.
2. Hook lower edge of fascia into a continuous edge strip.

D. Scuppers:

1. Install scupper with flange behind gravel stops; leave 6 mm (1/4 inch) joint to gravel stop.
2. Set scupper at roof water line and fasten to wood blocking.
3. Use sealant to seal joint with fascia gravel stops at ends.
4. Coordinate to lap over conductor head and to discharge water into conductor head.

3.7 COPINGS

A. General:

1. On walls topped with a wood plank, install a continuous edge strip on the front // and rear // edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
3. Install ends adjoining existing construction so as to form space for installation of

sealants. Sealant is specified in Section 07 92 00, Joint Sealants.

B. Aluminum Coping:

1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
2. Install joint covers, centered at each joint, and securely lock in place.

C. Stainless steel, Copper Copings:

1. Join ends of sheets by a 19 mm (3/4 inch) locked and soldered seam, except at intervals of 9600 mm (32 feet), provide a 38 mm (1 1/2 inch) loose locked expansion joint filled with sealant or mastic.
2. At straight runs between 7200 mm (24 feet) and 19200 mm (64 feet) locate expansion joint at center.
3. At straight runs that exceed 9600 mm (32 feet) and form the leg of a corner locate the expansion joint not more than 4800 mm (16 feet) from the corner.

3.8 EXPANSION JOINT COVERS, INSULATED

A. Install insulated expansion joint covers at locations shown on curbs not less than 200 mm (8 inch) high above roof surface.

B. Install continuous edge strips of same metal as expansion joint flange, nailed at not less than 75 mm (3 inch) centers.

C. Install insulated expansion joint covers in accordance with manufacturer's directions locking edges to edge strips.

3.9 ENGINE EXHAUST PIPE OR STACK FLASHING

A. Set collar where shown and secure roof tabs or flange of collar to structural deck with 13 mm (1/2 inch) diameter bolts.

B. Set flange of sleeve base flashing not less than 100 mm (4 inch) beyond collar on all sides as specified for base flashing.

C. Install hood to above the top of the sleeve 50 mm (2 inch) and to extend from sleeve same distance as space between collar and sleeve beyond edge not sleeve:

1. Install insect screen to fit between bottom edge of hood and side of sleeve.
2. Set collar of hood in high temperature sealant and secure with one by 3 mm (1/8 inch) bolt on stainless steel draw band type, or stainless steel worm gear type clamp. Install sealant at top of head.

3.10 HANGING GUTTERS

A. Hang gutters with high points equidistant from downspouts. Slope at not less than 1:200 (1/16 inch per foot).

B. Lap joints, except for expansion joints, at least 25 mm (one inch) in the direction of flow. Rivet and seal or solder lapped joints.

C. Support gutters in brackets spaced not more than 600 mm (24 inch) on centers, brackets attached to facial or wood nailer by at least two screws or nails.

1. For copper or copper clad stainless steel gutters use brass or bronze brackets.
2. For stainless steel gutters use stainless steel brackets.
3. For aluminum gutters use aluminum brackets or stainless steel brackets.
4. Use brass or stainless steel screws.

D. Secure brackets to gutters in such a manner as to allow free movement of gutter due to expansion and contraction.

E. Gutter Expansion Joint:

1. Locate expansion joints midway between outlet tubes.
2. Provide at least a 25 mm (one inch) expansion joint space between end baffles of gutters.
3. Install a cover plate over the space at expansion joint.
4. Fasten cover plates to gutter section on one side of expansion joint only.
5. Secure loose end of cover plate to gutter section on other side of expansion joint by a loose-locked slip joint.

F. Outlet Tubes: Set bracket strainers loosely into gutter outlet tubes.

3.11 CONDUCTORS (DOWNSPOUTS)

A. Where scuppers discharge into downspouts install conductor head to receive discharge with back edge up behind drip edge of scupper. Fasten and seal joint. Sleeve conductors to gutter outlet tubes and fasten joint and joints between sections.

B. Set conductors plumb and clear of wall, and anchor to wall with two anchor straps, located near top and bottom of each section of conductor. Strap at top shall be fixed to downspout, intermediate straps and strap at bottom shall be slotted to allow not less than 13 mm (1/2 inch) movement for each 3000 mm (10 feet) of downspout.

C. Install elbows, offsets and shoes where shown and required. Slope not less than 45 degrees.

3.12 SPLASH PANS

A. Install where downspouts discharge on low slope roofs unless shown otherwise.

B. Set in roof cement prior to pour coat installation or sealant compatible with single ply roofing membrane.

3.13 GOOSENECK ROOF VENTILATORS

A. Install on structural curb not less than 200 mm (8 inch) high above roof surface.

B. Securely anchor ventilator curb to structural curb with fasteners spaced not over 300 mm (12 inch) on center.

C. Anchor gooseneck to curb with screws having nonprene washers at 150 mm (6 inch) on center.

END OF SECTION

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SECTION 07 71 23
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Includes But Not Limited To: Furnish and install gutters and downspouts as described in Contract Documents.

1.2 RELATED WORK:

A. Section 07 92 13 – Quality of Sealants for Joints

1.3 REFERENCES

A. Sheet Metal & Air Conditioning Contractors National Association Inc:

1. SMACNA Architectural Sheet Metal Manual.

1.4 SUBMITTALS

A. Shop Drawings: Show gutter cross section, mounting method, gauge of metal, expansion joint design and locations, and downspout locations minimum.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:

1. Type Two Acceptable Manufacturers of Metal:

a. CMG Coated Metals Group, Denver, CO www.cmgmetals.com.

b. Englert Inc, Perth Amboy, NJ www.englertinc.com.

c. Fabral, Jackson, GA www.fabral.com.

d. Firestone Metal Products, Anoka, MN www.unaclad.com.

e. MBCI, Houston, TX www.mbci.com.

f. Metal Sales Manufacturing Corp, Sellersburg, IN www.mtlsales.com.

g. Petersen Aluminum Corp, Elk Grove, IL www.pac-clad.com.

h. Reynolds Metals Company, Richmond, VA www.rmc.com.

i. Ryerson, Chicago, IL www.ryerson.com.

j. Equal as approved by Architect before installation. See Section 01 62 00.

B. Materials

1. Steel:

a. Downspouts: Rectangular, 26 ga 0.478 mm galvanized steel including necessary elbows.

b. Gutters: 24 ga 0.635 mm galvanized steel.

c. Brackets: 22 ga 0.792 mm galvanized steel or 26 ga 0.478 mm double hemmed minimum.

2. Aluminum:
    a. Downspouts: Rectangular 0.032 inch 0.813 mm minimum aluminum including necessary elbows.
    b. Gutters: 0.050 inch 0.127 mm minimum aluminum.
    c. Brackets: 0.060 inch 0.152 mm minimum aluminum.
    d. Screws, Bolts, Nails, And Accessory Fasteners: Non corrosive and of strength and type consistent with function.
    e. Downspouts, gutters, brackets, fasteners, and accessories shall be compatible material.

C. Fabrication:
1. Fabricate in accordance with SMACNA Manual recommendations, where applicable.
2. Cross sectional configuration of gutter shall be Style A, Page 1.11 of SMACNA Manual, 5th edition, 1993.
3. Form accurately to details.
4. Profiles, bends, and intersections shall be even and true to line.

D. Finishes:
1. Metal exposed to view shall have face coating of polyvinyledene Fluoride (PVF2) Resin base finish (Kynar 500 or Hylar 5000) containing 70 percent minimum PVF2 in resin portion of formula. Thermo cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre treated metal. Reverse side coating shall be thermo cured system consisting of corrosion inhibiting epoxy primer applied over properly pre treated metal.
2. Color as selected by Architect from Manufacturer's standard colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before starting work, verify governing dimensions at building. Observe conditions that would prevent installation of specified system. Do not install over improper conditions.

3.2 INSTALLATION

A. Insulate work from fascia as necessary to prevent electrolytic action.

B. Allow no more than 40 feet between downspouts. Lap joints in downspouts 1 1/2 inches 38 mm minimum in direction of water flow.

C. Furnish and install outlet tubes and gutter ends where required. Furnish and install expansion joints in runs exceeding 50 feet 15 meters and in runs that are restrained at both ends. Lap other joints in gutter one inch minimum, apply sealant in lap, and rivet 2 inches 50 mm on center maximum.

3.3 FIELD QUALITY CONTROL

A. Field Tests: At completion of this work, block downspouts and flood gutters. Notify Architect two working days before testing. Repair leaks and adjust for proper drainage.

3.4 CLEANING

A. Leave metals clean and free of defects, stains, and damaged finish.

END OF SECTION

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SECTION 07 92 13
ELASTOMERIC JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Includes But Not Limited To:

1. Furnish and install sealants not specified to be furnished and installed under other Sections.
2. Quality of sealants to be used on Project not specified elsewhere, including submittal, material, and installation requirements.

1.2 RELATED WORK

A. Furnishing and installing of sealants is specified in Sections specifying work to receive new sealants.

1.3 REFERENCES

Not Used.

1.4 SUBMITTALS

A. Action Submittals:

1. Product Data:
   a. Manufacturer's literature and installation recommendations for each Product.
   b. Schedule showing joints requiring sealants. Show also backing and primer to be used.

B. Informational Submittals:

1. Manufacturer Report: Certificate from Manufacturer indicating date of manufacture.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle to prevent inclusion of foreign matter, damage by water, or breakage.

B. Deliver and keep in original containers until ready for use.

C. Store in a cool place, but never under 40 deg F 4 deg C.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:

1. Manufacturer Contact List:
   a. Dow Corning Corp, Midland, MI www.dowcorning.com.
   b. GE Sealants & Adhesives, Huntersville, NC www.gesealants.com.
   c. Laticrete International Inc, Bethany, CT www.laticrete.com.
   d. Sherwin Williams, Cleveland, OH www.sherwin-williams.com.

e. Sika Corporation, Lyndhurst, NJ www.sikaconstruction.com.

f. Tremco, Cleveland, OH www.tremcosealants.com.

B. Materials:

1. Sealants provided shall meet Manufacturer's shelf life requirements.
2. Sealants At Exterior Building Elements:
    a. Joints and cracks around windows.
    b. Aluminum entrance perimeters and thresholds.
    c. Door frames.
    d. Columns.
    e. Louvers.
    f. Wall penetrations.
    g. Connections.
    h. Parapet caps.
    i. Other joints necessary to seal off building from outside air and moisture.
3. Sealants At Exterior Sheet Metal And Miscellaneous:
    a. Penetrations in soffits and fascias.
    b. Roof vents and flues.
    c. Flashings.
    d. Gutters.
4. General Interior Sealants:
    a. Inside jambs and heads of exterior door frames.
    b. Both sides of interior door frames.
    c. Inside perimeters of windows.
    d. Miscellaneous gaps between substrates.
5. Sealants For Interior Joints Formed By:
    a. Countertops and backsplash to wall.
    b. Sinks and lavatories to countertops.
    c. Joints between plumbing fixtures and other substrates.
6. Color: As selected by Architect from Manufacturer's standard colors.

2.2 ACCESSORY PRODUCTS

A. Backing: Flexible closed cell, non gassing polyurethane or polyolefin rod or bond breaker tape as recommended by Sealant Manufacturer for joints being sealed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surfaces shall be clean, dry, and free of dust, oil, grease, dew, or frost.

B. Apply primer, if required.

C. Joint Backing:

1. Rod for open joints shall be at least 1 1/2 times width of open joint and of thickness to give solid backing. Backing shall fill up joint so depth of sealant bite is no more than 3/8 inch 10 mm deep.
2. Apply bond breaker tape in shallow joints as recommended by Sealant Manufacturer.

3.2 APPLICATION

A. Do not use damaged or deteriorated materials.

B. Apply sealant with hand calking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint. Apply sealants in vertical joints from bottom to top.

C. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface. Tool joints in opposite direction from application direction, i.e., in vertical joints, from the top down. Do not 'wet tool' sealants.

D. Depth of sealant bite shall be 1/4 inch 6 mm minimum and 1/2 inch 13 mm maximum, but never more than one half or less than one fourth joint width.

E. Do not apply calking at temperatures below 40 deg F 4 deg C.

F. Calk gaps between painted or coated substrates and unfinished or pre finished substrates. Calk gaps larger than 3/16 inch 9 mm between painted or coated substrates.

3.3 CLEANING

A. Clean adjacent materials, which have been soiled, immediately (before setting) as recommended by Manufacturer.

END OF SECTION

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SECTION 08 12 13
HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Products Furnished But Not Installed Under This Section:

1. Hollow metal frames.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. Reference Standards:

1. Steel Door Institute / American National Standards Institute:
2. SDI / ANSI A250.11 Recommended Erection Instructions for Steel Frames.

1.4 SUBMITTALS

A. Informational Submittals: Copy of SDI / ANSI A250.11.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:

1. Any current member of Steel Door Institute.

B. Frames:

1. Cold rolled furniture steel.
   a. Interior Frames: 16 ga. 1.6 mm.
   b. Exterior Frames: 14 ga. 2 mm.
2. Provide labeled frame to match fire rating of door.
3. Finish:
   a. Use one of following systems:
      (i) Prime surfaces with rust inhibiting primer.
      (ii) Galvanize.
4. Anchors: 16 US ga 1.6 mm minimum meeting UL or other code acceptable requirements for door rating involved.

C. Fabrication:

1. General Requirements:
   a. Frames shall be welded units. Provide temporary spreader on each welded frame.
   b. Provide Manufacturer's gauge label for each item.

c. Make breaks, arrises, and angles uniform, straight, and true. Accurately fit corners.

2. Provide mortar guards at strikes and hinges.
3. Anchors:
   a. Provide three jamb anchors minimum for each jamb. On hinge side, install one anchor at each hinge location. On strike side, install one anchor at strike level and anchors at same level as top and bottom hinges. Tack weld anchors on frames intended for installation in framed walls.
   b. Frames installed before walls are constructed shall be provided with extended base anchors in addition to other specified anchors.
   c. Anchor types and configurations shall meet wall conditions.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 08 13 13
HOLLOW METAL DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Products Furnished But Not Installed Under This Section:

1. Hollow metal doors.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. Reference Standards:

1. Steel Door Institute:

a. SDI-100 - Recommended Specifications, Standard Steel Doors And Frames.

1.4 SUBMITTALS

Not Used.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:

1. Any current member of Steel Door Institute.

B. Doors:

1. Meet requirements of Steel Door Institute Bulletin SDI 100.

a. Classification:

(i) Interior - Level 2 (18 Ga.)
(ii) Exterior - Level 3 (16 Ga.)

b. Model: 1 Full Flush or Model 2 Seamless designs at Manufacturer's option.

c. Core:

(i) Interior - Honeycomb or Polyurethane
(ii) Exterior – Polyurethane

d. Finish:

(i) Interior doors primed or galvanized.
(ii) Exterior doors galvanized and primed.

C. Fabrication:

1. General:

a. Mortise and reinforce doors for hinges and locks.

b. Reinforce doors for closers and other surface applied hardware.

c. Drill and tap on job.

d. Seams along vertical edges of door need not be filled.

e. Do not extend hinge cut out full width of door unless fill strip is inserted, weld filled, and ground smooth so no seam appears on back face plate.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Label each door as conforming to above required standards.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 08 70 00
GENERAL HARDWARE REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Includes But Not Limited To

1. General requirements for finish hardware related to architectural wood and hollow metal doors.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. Builders Hardware Manufacturer's Association (BHMA) Hardware Functions

1.4 SUBMITTALS

A. Hardware Templates

1. Provide hardware templates to Sections 08 12 13 and 08 13 13 within 14 days after hardware schedule is approved.
2. Supply necessary hardware installation templates to Division 06 prior to pre-installation meeting.

1.5 DEFINITIONS

A. Builders Hardware Manufacturer's Association (BHMA) Hardware Functions

1. F 75 Passage Latch - Latch bolt operated by knob / lever from either side at all times.
2. F 76 Privacy Lock - Latch bolt operated by knob / lever from either side. Outside knob / lever locked by push button inside and unlocked by emergency key from outside or rotating knob / lever from inside.
3. F 81 Office Door Lock - Dead locking latch bolt operated by knob / lever from either side, except when outside knob / lever is locked by turn button in inside knob/lever. When outside knob / lever is locked, latch bolt is operated by key in outside knob/lever or by rotating inside knob / lever. Turn button must be manually rotated to unlock outside knob / lever.
4. F 84 Classroom Deadlock - Dead locking latch bolt operated by knob / lever from either side, except when outside knob / lever is locked, latch bolt is operated by key in outside knob / lever or by rotating inside knob / lever.
5. F 86 Utility Space Door Lock - Dead locking latch bolt operated by key in outside knob / lever or by rotating inside knob / lever. Outside knob / lever is always fixed.
6. F 91 Latch And Deadlocks - Dead locking latch bolt operated by key from both sides.
7. E 2142 Deadbolt - Dead bolt operated by key from either side. Bolt automatically dead locks when fully thrown.
8. E 2152 Deadbolt - Dead bolt operated by key from outside and turn button from inside. Bolt automatically dead locks when fully thrown.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Neatly and securely package hardware items by hardware group and identify for individual door with specified group number and set number used on Supplier's hardware schedule. Include fasteners and accessories necessary for installation and operation of finish hardware in same package.

PART 2 - PRODUCTS

2.1 FINISHES

A. Finishes for steel, brass, or bronze hardware items shall be US26D, Chromium plated, satin, except flat goods which may be US32D, stainless steel, satin. Materials other than steel, brass, or bronze shall be finished to match the appearance of US26D / 32D.

2.2 FASTENERS

A. Fasteners shall be of suitable types, sizes and quantities to properly secure hardware. Fasteners shall be of same material and finish as hardware unless otherwise specified. Fasteners exposed to weather shall be non-ferrous or corrosion resisting steel.

PART 3 - EXECUTION

3.1 APPROVED SUPPLIERS

A. Architectural Building Supply, Salt Lake City, UT Russ Farley

Phone (800) 574-4369 FAX 801-484-6817

B. Beacon Metals Inc, Salt Lake City, UT Chad Riches

Phone (888) 823-2206 FAX 801-485-7647

C. Girtman & Associates, Nashville, TN Ken Rummage

Phone (615) 350-6000 FAX 615-350-6686

D. Approved Equal

3.2 PREPARATION

A. Before ordering materials, examine documents to be assured that material to be ordered is appropriate for substrate to which it is to be secured and will function as intended.

3.3 HARDWARE GROUP SCHEDULE

A. Single Interior Doors

1. Group 20 -

3 each - Hinges
1 each - Latchset Function F-75
1 each - Closer
1 each - Stop
1 set - Smoke Gaskets

2. Group 20A -

3 each - Hinges
1 each - Latchset Function F-75

1 each - Stop
1 set - Smoke Gaskets

3. Group 20B -
   3 each - Hinges
   1 each - Lockset Function F-84
   1 each - Closer
   1 each - Stop
   1 set - Smoke Gaskets
4. Group 21 -
   3 each - Hinges
   1 each - Lockset Function F-86
   1 each - Closer
   1 each - Stop
   1 set - Smoke Gaskets
5. Group 21A -
   3 each - Hinges
   1 each - Lockset Function F-86
   1 each - Stop
   1 set - Smoke Gaskets
6. Group 22 -
   3 each - Hinges
   1 each - Lockset Function F-81
   1 each - Closer
   1 each - Stop
   1 set - Smoke Gaskets
7. Group 22A -
   3 each - Hinges
   1 each - Lockset Function F-81
   1 each - Stop
   1 set - Smoke Gaskets
8. Group 22B -
   3 each - Hinges
   1 each - Lockset Function F-81
   1 each - Closer
   1 each - One-way Viewer
   1 each - Stop
   1 set - Smoke Gaskets
9. Group 23 -

3 each - Hinges
1 each - Lockset Function F-81
1 each - Closer
1 each - Stop
1 each - Threshold
1 each - Acoustic Seal
1 set - Smoke Gaskets

10. Group 23A -
    3 each - Hinges
    1 each - Latchset Function F-75
    1 each - Closer
    1 each - Stop
    1 each - Threshold
    1 each - Acoustic Seal
    1 set - Smoke Gaskets
11. Group 23B -
    3 each - Hinges
    1 each - Lockset Function F-76
    1 each - Closer
    1 each - Stop
    1 each - Threshold
    1 each - Acoustic Seal
    1 set - Smoke Gaskets
12. Group 23C -
    3 each - Hinges
    1 each - Lockset Function F-81
    1 each - Stop
    1 each - Threshold
    1 each - Acoustical Seal
    1 set - Smoke Gaskets
13. Group 25
    3 each - Hinges
    1 each - Exit Device
    1 each - Cylinder
    1 each - Closer
    1 each - Kick Plate
    1 each - Stop
    1 set - Smoke Gaskets

14. Group 25A
    - 3 each - Hinges
    - 1 each - Exit Device
    - 1 each - Closer
    - 1 each - Kick Plate
    - 1 each - Stop
    - 1 set - Smoke Gaskets
15. Group 25B
    - 3 each - Hinges
    - 1 each - Exit Device, exit only
    - 1 each - Closer
    - 1 each - Kick Plate
    - 1 each - Stop
    - 1 set - Smoke Gaskets
16. Group 26
    - 3 each - Hinges
    - 1 each - Latchset Function F-75
    - 1 each - Closer
    - 1 each - Kick Plate
    - 1 each - Stop
    - 1 set - Smoke Gaskets
17. Group 26A
    - 3 each - Hinges
    - 1 each - Closer
    - 1 each - Push
    - 1 each - Pull
    - 1 each - Kick Plate
    - 1 each - Stop
    - 1 set - Smoke Gaskets
18. Group 26B
    - 3 each - Hinges
    - 1 each - Lockset Function F-76
    - 1 each - Stop
    - 1 set - Smoke Gaskets
19. Group 27
    - 3 each - Hinges
    - 1 each - Lockset Function F-76
    - 1 each - Closer

1 each - Stop
1 set - Smoke Gaskets

20. Group 28
    3 each - Hinges
    1 each - Nightlatch Function E-2152
    1 each - Closer
    1 each - Push
    1 each - Pull
    1 each - Stop
    1 set - Smoke Gaskets
21. Group 29
    3 each - Hinges
    1 each - Lockset Function F-76
    1 each - Deadbolt Function E-2142
    1 each - Closer
    1 each - Stop
    1 each - Threshold
    1 each - Acoustic Seal
    1 set - Smoke Gaskets
22. Group 30
    a. 2 each- Cylinders
23. Group 30A
    1 each - Padlock
    1 each - Chain
24. Group 31
    3 each - Hinges
    1 each - Latchset Function F-75
    1 each - Stop
    1 each - Threshold
    1 each - Acoustic Seal
    1 set - Smoke Gaskets
25. Group 31A
    3 each - Hinges
    1 each - Lockset Function F-91
    1 each - Stop
    1 each - Threshold
    1 each - Acoustic Seal
    1 set - Smoke Gaskets

26. Group 33
    2 each - Hinges
    1 each - Gatelatch
    1 each - Stop
    2 each - Silencers
27. Group 48 - Existing Doors: No hardware required.
28. Group 49 - Existing Doors: Re-use existing hardware.

END OF SECTION

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SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Finishing prepared surfaces which are to be coated in accordance with paint manufacturer's recommendations.

B. Paint all surfaces unless it is indicated they are not to be painted.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. SSPC SP1: Solvent Cleaning.

B. SSPC SP6: Commercial Grade Blast Cleaning.

1.4 SUBMITTALS

Not Used.

1.5 SAMPLES

A. Before proceeding with paint application, prepare 8 inches x 10 inches sample(s) of all paint systems on identical substrate materials on which the system will be applied.

B. Identify each sample as to surface preparation, paint system, color, product name and number, and manufacturer.

C. Colors to be selected by Engineer prior to commencement of work.

D. Submit manufacturer's coating product data sheet for each coating type to be applied, prior to initiating surface preparation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in original, unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material.
2. Federal specification number, applicable.
3. Manufacturer's stock number and date of manufacture.
4. Manufacturer's name.
5. Contents by volume, for major pigment and vehicle constituents.
6. Thinning instructions.
7. Application instruction.
8. Color name and number.

B. Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 45 deg. F. in well ventilated area or as recommended by the manufacturer.

C. Take precautionary measures to prevent fire hazards and spontaneous combustion of paint

material. Provide temporary fire extinguishers.

1.7 JOB CONDITIONS

A. Abrasive blast cleaning shall not be performed if humidity is greater than 85 percent, and if surface temperature is less than 5 deg. F. above the dew point of ambient air.

B. Do not apply finishes when temperature exceeds manufacturer's maximum and minimum temperature allowable, nor in dust, smoke laden atmosphere, damp or humid weather.

C. Provide adequate continuous ventilation.

D. Adequately protect other surfaces from paint and damage. Repair damage.

E. Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.

F. Place cotton waste, cloths and material which may constitute a fire hazard in closed metal containers and remove daily from site.

G. Remove electrical plates, surface hardware, fittings and fasteners, prior to painting operations. Carefully store, clean and replace on completion of work in each area. Do not use solvent to clean hardware that has permanent lacquer finish.

H. Post "Wet Paint" signs in freshly painted areas to reduce the potential for damage to the surfaces or damage to people passing the area.

1.8 OPERATING PARTS AND LABELS

A. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting. Unless otherwise indicated, protect by drop clothes or maskings.

B. Do not paint over any code required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Varnish, Stain, Enamel, Lacquer and Fillers: Type and brand as indicated.

B. Paint Accessory Materials: Linseed oil, shellac, turpentine and other materials not specifically indicated.

C. Paints: Ready mix except field catalyzed coatings.

D. Do not provide paints containing lead unless indicated otherwise.

PART 3 - EXECUTION

3.1 OBSERVATION

A. Engineer shall examine surfaces prior to surface preparation and prior to application of each succeeding coating. Correct any condition that may potentially affect proper surface cleaning or coating application.

B. Correct defects and deficiencies in surfaces which may adversely affect work of this section before applying any paint.

3.2 PREPARATION OF SURFACES

A. General: Perform preparation and cleaning procedures per paint manufacturer's instruction and as herein specified, for each particular substrate condition. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.

B. Mildew: Remove mildew by scrubbing with approved chemical solution such as tri sodium phosphate and bleach. Rinse with clean water and allow surface to dry completely.

C. Aluminum Surfaces: Remove surface contamination from aluminum surfaces by steam, high pressure water or solvent washing. Coat surfaces with wash primer.

D. Asphalt or Bituminous Surfaces: Remove dirt, oil, grease, and sand to provide adhesion key. Apply compatible sealer or primer.

E. Cloth Surfaces: Remove dirt, grease and oil before applying paint system.

F. Copper Surfaces: Remove contamination from copper surfaces by steam, high pressure water or solvent washing. Coat surfaces with wash primer.

G. Copper Surfaces Oxidized: Remove contamination from copper surfaces required to be oxidized. Apply oxidizing solution. Rub on repeatedly for correct effect. Once attained, rinse surface well with clear water, allow to dry, and paint.

H. Wallboard: Remove contamination from gypsum wallboard surfaces and prime to show defects, if any. Remove surface dust and dirt with clean water and sand with medium grit sandpaper. Fill hairline cracks, small holes and imperfections on plaster surfaces with patching plaster. Smooth off to match adjacent surfaces. Wash and neutralize high alkali surfaces where they occur.

I. Galvanized Surfaces: Remove surface contamination and oils from galvanized surfaces with solvent. Apply coat of wash primer.

J. Concrete, Concrete Block:

1. New Concrete: Do not start surface preparation until concrete has cured 30 days. Remove contamination, sandblast or acid etch with 100 percent water soluble acid and rinse new concrete surfaces with clear water. Allow to thoroughly dry.
2. Remove dirt, loose mortar, scale, powder and other foreign matter from concrete and concrete block surfaces which are to be painted or to receive a clear seal. Remove oil and grease with a solution of tri sodium phosphate, rinse well and allow to thoroughly dry.
3. Remove stains from concrete and concrete block surfaces caused by weathering of corroding metals with a solution of sodium metasilicate after being thoroughly wetted with water. Allow to thoroughly dry.
4. Test for moisture before painting.

K. Steel Surfaces:

1. Remove grease, dirt and dust from steel and iron surfaces by solvent cleaning (SSPC SP1). Remove rust and mill scale by wire brushing, sandblasting (SSPC SP6) or other satisfactory method indicated. Ensure steel surfaces are satisfactory before paint finishing.
2. Sand and scrape shop primed steel surfaces to remove all loose primer and rust. Feather out edges to make touch up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces including shop primed steels.

L. Wood:

1. Wipe off dust and grit from miscellaneous wood items and millwork prior to priming. Sand wood to required smoothness. Spot coat knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried and sand between coats. Back prime interior and exterior woodwork.
2. Remove dust, grit and foreign matter from exterior wood siding which is to receive paint finish. Seal knots, pitch streak and sappy sections. Fill nail holes with filler after prime coat has been applied.
3. Prior to finishing glue laminated beams, wash down surfaces with solvent and remove grease and dirt.

3.3 PREPARATION OF MATERIAL

A. Mix and thin paint materials per manufacturer's product data sheets.

B. Store materials not in actual use in tightly sealed containers free from foreign particles.

C. Discard paints which have formed a film in the container or exceeded the manufacturer's recommended pot life.

D. Multiple component coatings shall be prepared using all the contents of the container for each component. Partial batches will not be permitted.

3.4 APPLICATION

A. Apply each coat at proper consistency and per the manufacturer's recommendations.

B. Make each coat of paint slightly darker than preceding coat unless otherwise approved.

C. Sand lightly between coats as required to achieve specified finish.

D. Do not apply finishes on surfaces that are damp or wet.

E. Ensure that edges, corners, welds, and other protrusions receive a dry film thickness equivalent to the flat surfaces.

F. Where clear finishes are required on wood ensure tint fillers match wood. Work fillers well into the grain before set. Wipe excess from the surface.

G. Backprime exterior woodwork, which is to receive paint finish, with exterior primer paint.

H. Backprime interior woodwork, which is to receive paint or enamel finish, with enamel undercoat paint.

I. Backprime interior and exterior woodwork, which is to receive stain or varnish finish, with gloss varnish reduced 25 percent with mineral spirits.

J. Prime top and bottom edges of wood and metal doors with enamel undercoat when they are to be painted.

K. Prime top and bottom edges of wood doors with gloss varnish when they are to receive a stain or clear finish.

3.5 MECHANICAL AND ELECTRICAL EQUIPMENT

A. Coordinate with mechanical and electrical sections with respect to painting and finishing requirements, color coding, identification banding of equipment, ducting, piping and conduit.

B. Remove grills, covers and access panels for mechanical and electrical systems from location and paint separately.

C. Finish paint primed equipment to color selected.

D. Prime and paint insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers,

brackets, collars and supports, except where items are plated or covered with a prefinished coating.

E. Replace identification markings on mechanical or electrical equipment when painted over or spattered.

F. Treat and paint interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grills and louvers with one coat of flat black paint, to limits of sight line. Paint dampers exposed immediately behind louvers, grills, convector and baseboard cabinets to match face panels.

G. Paint exposed conduit and electrical equipment occurring in finished areas. Color and texture to match adjacent surfaces.

H. Paint sides and edges of plywood backboard for electrical equipment before installing backboards and mounting equipment.

I. Color Coding:

1. Natural Gas: Orange.
2. Sanitary Sewer: Brown.
3. Storm Drain: Green.
4. Potable Water: Blue.
5. Telephone: Orange.
6. Electrical Power: Red.
7. Danger and Fire: Red.

J. Paint color band and identify flow arrows, naming, numbering, etc.

3.6 CLEANING

A. Section 01 74 13.

B. As work proceeds and upon completion, promptly remove paint where spilled, splashed or spattered.

C. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.

D. Upon completion of work leave premises neat and clean.

3.7 FIELD QUALITY ASSURANCE

A. Minimum Coating Thickness: Maintain minimum thickness recommended by manufacturer.

B. Appearance: Cloudiness, spotting, show through of subsurface, laps, brush marks and other surface imperfections will not be acceptable.

C. Rework: Areas not acceptable will be refinished to the required standards.

D. Holiday Testing: Metal surfaces shall be holiday tested for pinholes and missed areas in the coating. Recoat holiday areas.

E. Drying Time: Do not exceed drying time between coats.

3.8 EXTRA STOCK

A. Furnish not less than 1 gallon of each color.

B. Tightly seal and clearly label all containers.

END OF SECTION

SECTION 10 00 00
BUILDING SAFETY EQUIPMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Section Includes: Fire extinguisher and first aid kit.

1.2 SUBMITTALS

A. Product Data.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of proposed products for minimum 5 years with satisfactory performance record of minimum 5 years.

B. Regulatory Requirements:

1. Comply with UL requirements for specification classification.

1.4 MAINTENANCE

A. Have fire extinguishers inspected and tagged within the final two weeks of the project.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguisher: One of the following or equal:

1. J.L. Industries, Bloomington, MN.
2. Larsen's Manufacturing Company, Minneapolis, MN.
3. Modern Metal Products by Muckle, Owatonna, MN.
4. Watrous, Incorporated, Northbrook, IL.

B. First Aid Kit: One of the following or equal:

1. Mine Safety Appliances Company, Catalog No. 2478.
2. Van Waters and Rogers, No. 56613-048.

2.2 FIRE EXTINGUISHER

A. Type FE20: UL 20A-120B:C with 20-pound capacity of dry chemical with ammonium phosphate base for extinguishing ABC fires.

B. Wall-mount bracket.

2.3 FIRST AID KIT

A. 24-unit first aid kit complying with OSHA, NFPA, and Federal Specification GG-K-391A requirements.
C. Wall-mount bracket.

2.4 NIOSH RECOMMENDED RESPIRATOR

A. Provide a NIOSH recommended respirator that will be stored per manufacturer's recommendations in the pump room (not the chlorination room) at all times. Only applicable when utilizing gas chlorination systems.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's recommendations and NFPA Pamphlet No. 10.

B. Install products plumb and square.

C. Paint area 3-foot square around fire extinguisher OSHA red.

END OF SECTION

SECTION 15 10 10
JOINT GASKETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section specifies rubber gaskets for push-on compression type joints used with fabricated steel pipe, steel pipe, reinforced concrete pipe, concrete cylinder pipe, and cement mortar lined and coated steel pipe.

1.2 RELATED WORK

A. Not Used

1.3 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

1. ASTM D395-84: Rubber Property--Compression Set
2. ASTM D412-83: Rubber Properties in Tension
3. ASTM D471-79: Rubber Property--Effect of Liquids
4. ASTM D573-81: Rubber--Deterioration in an Air Oven
5. ASTM D1149-81: Rubber Deterioration–Surface Ozone Cracking in a Chamber (Flat Specimens)
6. ASTM D2240-85: Rubber Property–Durometer Hardness

1.4 SUBMITTALS

Not Used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gasket stock shall be a synthetic rubber compound in which the elastomer is neoprene. The compound shall contain no less than 50 percent by volume neoprene and shall be free from factice, reclaimed rubber and other deleterious substances.

2.2 PHYSICAL REQUIREMENTS

A. The compound shall meet the following physical requirements when tested in accordance with the specified ASTM standards.

1. Tensile (ASTM D412): The tensile strength shall be 1500 psi minimum and the ultimate elongation shall be 425 percent minimum.
2. Hardness (ASTM D2240, Type A Durometer):
   a. Initial Test: The compound shall have a minimum hardness of 45 + 5 for pipe diameters less than 90 inches and 55 + 5 for pipe diameters greater than 90 inches.
   b. Subsequent Test: After conducting the initial test, the test specimen and the durometer shall be conditioned at -10 degrees C for 48 hours and then shall be

tested. The increase in hardness over the initial test value shall not exceed 15 points.

3. Compression Set (ASTM D395): The compression set shall not exceed 20 percent when compressed for 22 hours at 70 degrees C. The test specimens shall be circular discs cut from the gaskets. Test specimens shall be 0.500 (+ 0.005 - 0.025) inches in height. The diameter of the test specimen shall be that of the gasket but not to exceed 1.129 + 0.010 inches in diameter.
4. Aging (ASTM D573): The test specimen deterioration shall be less than 20 percent reduction in tensile strength, 40 percent reduction in ultimate elongation, and 15 points increase in hardness.
5. Effect of Liquids (ASTM D471): The maximum volume change in oil and in water shall be as follows:
    a. Oil: 100 percent in ASTM oil No. 3.
    b. Water: 15 percent.
    c. The test specimens shall have a thickness of 0.080 + 0.005 inches and shall be circular discs cut from the gasket.
6. Ozone Cracking (ASTM D1149): The test specimen shall be a gasket loop mounted to give at least 20 percent elongation. There shall be no cracking visible at two times magnification of the gasket after 100 hours exposure to 1 mg/1 ozone at 40 degrees C.

2.3 PRODUCT DATA

A. The Contractor shall provide certified copies of test reports indicating that the gasket material has been tested and that the results of the tests comply with the requirements specified.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The gaskets shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 15 13 50
GAGES AND METERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pressure gages and Pressure gage taps.

1.2 REFERENCES

A. ASME - B40.1 - Gages - Pressure Indicating Dial Type - Elastic Element.

B. ASTM E1 - Specification for ASTM Thermometers.

C. ASTM E77 - Verification and Calibration of Liquid-in-Glass Thermometers.

D. AWWA C700 - Cold Water Meters - Displacement Type.

E. AWWA C702 - Cold Water Meters - Compound Type.

F. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

G. UL 393 - Indicating Pressure Gages for Fire and Protection Services.

1.3 SUBMITTALS FOR REVIEW

A. Product Data: Provide list which indicates use, operating range, total range and location for manufactured components.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

1.5 WARRANTY

A. Provide 2-year warranty.

PART 2 - PRODUCTS

2.1 FLOW SENSOR AND MONITOR

A. Sensor Manufacturers:

1. Endress + Hauser

B. Meter Flanged Magnetic flow tube

1. Remote reading 4 to 20 mA output.
2. Neoprene or Teflon Lining.
3. Bullet Nose type 316 stainless steel electrodes.
4. Splash proof and able to stand accidental submergence.
5. Electrodes shall be field replaceable without affecting calibration.
6. Output shall be linear and directly proportional to average velocity of fluid.

C. Meter

1. Service: Cold water, 122 degrees F (50 degrees C).
2. Nominal Flow: Well - 100 gpm.
3. Maximum Flow: Well - 300 gpm.
4. Maximum Operating Pressure: 150 psi.
5. Accuracy: ±0.5 percent.
6. Remote Wall Mounted Readout - flowrate (gpm) and totalizer forward and reverse flow.
7. Size: 4 inch.
8. Empty Pipe detection required.

2.2 PRESSURE GAGES

A. Gage: ASME B40.1, liquid-filled, stainless steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 2-1/2 inch (65 mm) diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi as noted in plans.

2.3 PRESSURE INDICATING TRANSMITTER

A. Manufacturers: One of the following or equal:

1. Rosemount or equivalent.

B. Process Pressure Indicating Transmitters: Provided with microprocessor electronic circuitry and process suitable wetted parts.

C. Type: Loop powered 2-wire, 24 volts direct current.

D. Housing: NEMA 4X, weatherproof corrosion-resistant with operating temperature from 0 to 220 degrees Fahrenheit (-18 to 104 degrees Celsius) and relative humidity of 0 to 100 percent.

E. Overrange Protection: To maximum process line pressure.

F. Accuracy: Within 0.10 percent of calibrated span including combined effects of linearity, hysteresis, and repeatability.

G. Rangeability: 10 to 1 with negligible effect on accuracy from static atmospheric pressure changes and 32 to 212 degrees Fahrenheit (0 to 100 degrees Celsius).

H. Transmitter Output: 4-20 milliampere direct current into 650 ohm load without need for external load adjustments.

I. Adjustments: Electronic zero and span, and elevated or suppressed zero as required by application.

J. Components: Include process shutoff valves, bleed valves, and mounting brackets.

K. Local Indicators: Scaled in Engineering units, calibrated to required range.

2.4 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 300 psig.

B. Needle Valve: Brass,1/2 inch (6 mm) NPT for minimum psig.

C. Pulsation Damper: Pressure snubber, brass with 1/2 inch (6 mm) connections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide pressure gages as shown on plans.

C. Install pressure gages with pulsation dampers. Provide needle valve to isolate each gage. Extend nipples to allow clearance from insulation.

D. Coil and conceal excess capillary on remote element instruments.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gages in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gages to final angle, clean windows and lenses, and calibrate to zero.

END OF SECTION

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SECTION 15 55 10
HEATING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electric unit heaters.

B. Related Sections:

1. 260505 - Electrical Equipment.
2. 260519 - Wire and Cables - 600 Volt or Less.
3. 260533 - Boxes.

1.2 REFERENCES

A. National Electric Code (NEC).

B. Underwriters Laboratories (UL).

C. Uniform Building Code (UBC).

D. Uniform Plumbing Code (UPC).

E. Uniform Mechanical Code (UMC).

F. National Fire Protection Association (NFPA).

1.3 SYSTEM DESCRIPTION

A. Design Requirements:

1. Provide seismic supports.
2. Electrical components: UL listed and meeting the design and installation requirements of the NEC.

B. Performance requirements are included on the Unit Heater Schedule at the end of this Section.

1.4 SUBMITTALS

A. Shop Drawings:

1. System layout, mechanical, electrical power, and control diagrams.
2. Materials.
3. Supports and seismic bracing calculations and details.
4. Cut sheets on primary and ancillary equipment.
5. Sound ratings of fans in sones per AMCA Publication 302.
6. Fans performance curves at altitude of 4,800 feet and at temperatures of 70°F and 0°F.

B. Operation and maintenance data.

C. Warranties.

1.5 QUALITY ASSURANCE

A. Provide heating units and controls that are listed by Underwriters' Laboratories and in compliance with Factory Mutual (FM) requirements.

B. Regulatory Requirements:

1. Heating units furnaces shall be certified by AGA and CGA and comply with the latest ANSI standards for safe and efficient performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment from dust and atmospheric exposure as recommended by the unit manufacturer.

1.7 SITE CONDITIONS

A. Elevation for installation of heating unit is 4,600 feet above mean sea level.

1.8 WARRANTY

A. One-year standard manufacturer's warranty on all components.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

A. Manufacturers: One of the following or equal.

1. QMARK

B. Fan Type: Aluminum axial flow.

1. Including fan guards.
2. Dynamically balanced.
3. Quiet operation.
4. Permanently lubricated ball bearings.
5. Automatic reset thermal overload protection.

C. Heating Element Characteristics.

1. Fin type, steel plated heater elements, with elements brazed to common fins, designed for maximum strength and maximum heat transfer.
2. Over temperature cut-out with automatic reset.

D. Features (if applicable):

1. Control transformer as indicated in the Schedule.
2. Required mounting brackets.
3. Adjustable outlet louvers.
4. Cabinet formed of minimum thickness 18 gauge steel with steel stiffeners.

E. Thermostat Features:

1. Single pole double throw dry contact with sufficient ampacity for heating unit.
2. 45 to 90 degrees Fahrenheit setpoint range.
3. Bi-metallic or mercury contact.
4. Heat only, fan on-off-auto selections, system heat-off selections.

5. Wall or ceiling mounted.
6. Dial or lever adjustment for temperature selection.
7. Setpoint and temperature indication.
8. Control voltage as indicated in the attached schedule.

F. Finishes:

1. Casing finish backed enamel in manufacturer's standard color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and verify that work is in condition to receive installation specified in this Section.

1. Take measurements and verify dimensions to ascertain fit of installation.
2. Ascertain structural sufficiency to support installation.
3. Ascertain that chassis, shafts, and openings are correctly located. Otherwise cut new openings where required.
4. Confirm specified thermostat and other controls are compatible with specified equipment.

B. Examine and verify structural details and sections indicated on the Drawings, ascertain adequacy, and determine possible conflicts in dimensions and clearances.

3.2 PREPARATION

A. Before installation remove dust and debris from equipment and ducts.

B. During installation and until equipment is operated, protect equipment and ducts fromdust and debris by covering openings.

3.3 INSTALLATION

A. Anchoring and Support: Install anchoring for seismic and wind forces in accordance with Section 01072.

B. Alignment: Adjust ductwork alignment when necessary to resolve conflicts with architectural and structural features or to resolve conflicts with work of other trades.

C. Install and wire unit heaters and thermostats in accordance with manufacturer's recommendations.

1. Provide local disconnect switches.

D. Adjust heater units with louvers and registers for optimum air circulation.

E. Provide venting in accordance with Uniform Plumbing Code, the Uniform Mechanical Code, and in accordance with NFPA 54.

3.4 FIELD QUALITY CONTROL

A. Test equipment and installation to verify operation is within manufacturer's standards and that noise levels do not exceed levels identified in Subparagraph 1.03A4.

3.5 SCHEDULES

A. Minimum 5KW heater, corrosion resistant

END OF SECTION

SECTION 15 99 20
PIPING SYSTEMS TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Test requirements for piping systems.

B. Related Sections:

1. Section 15052 - Basic Piping Materials and Methods.

1.2 TESTING REQUIREMENTS

A. Testing requirements are stipulated in Laws and Regulations; are included in the PIPING SCHEDULE in Section 15052; are specified in the Specifications covering the various types of piping; and are specified herein.

1. The order of precedence in case of conflict, wherein the requirements listed first supersede those following:

A. Requirements in Laws and Regulations supersede other requirements of Contract Documents, except where requirements of Contract Documents are more stringent, including higher test pressures, longer test times, and lower leakage allowances.

B. Requirements of Sections of the Specifications covering the various types of piping supersede the requirements of this Section.

B. Test piping, except storm drains and culverts, for visible leaks and under pressure with a maximum leakage allowance.

1. Test pressure piping for which test pressure is not specified under 25 pounds per square inch higher than the operating head, but not higher than the pressure that the piping system can safely withstand, using the specified test method.

2. When testing with water, the specified test pressure is considered to be the pressure at the lowest point of the piping section under test.

C. Furnish necessary personnel, materials, and equipment, including bulkheads, restraints, anchors, temporary connections, pumps, water, pressure gauges, and other means and facilities required to perform tests.

D. Test only those portions of pipes that have been installed as part of this Contract. Test new pipe sections prior to making final corrections to existing piping. Furnish and install test plugs, bulkheads, and restraints required to isolate new pipe sections. Do not use existing valves as test plug or bulkhead.

E. Unsuccessful Tests:

1. Where tests are not successful, correct defects or remove defective piping and appurtenances and install good piping and appurtenances.

2. Repeat testing until tests are successful.

F. Drain and leave piping clean after successful completion of testing.

1.3 SUBMITTALS

A. Schedule and Notification of Tests:

1. Submit a list of scheduled piping tests by noon of the working day preceding the date of the scheduled tests.
2. Notification of Readiness to Test: Immediately before testing, notify Engineer in writing of readiness, not just intention, to test piping. Have personnel, materials, and equipment specified in place before submitting notification of readiness.
3. Submit written report to City of test results.

1.4 SEQUENCE

A. Test piping after cleaning.

B. Test gravity piping underground, including sanitary sewers, for visible leaks before backfilling and compacting.

C. Underground pressure piping may be tested before or after backfilling when not indicated or specified otherwise.

D. Backfill and compact trench or provide blocking that prevents pipe movement before testing underground piping with a maximum leakage allowance.

E. Test underground piping before encasing piping in concrete or covering piping with slab, structure, or permanent improvement.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 TESTING ALIGNMENT, GRADE, AND DEFLECTION

A. Alignment and Grade:

1. Visually inspect the interior of gravity piping with artificial light, reflected light, or laser beam.
2. Consider inspection complete when no broken or collapsed piping, no open or poorly made joints, no grade changes that affect the piping capacity, or no other defects are observed.

3.2 TESTING HIGH-HEAD PRESSURE PIPING

A. Test high head pressure piping or piping with specified test pressure of 200 pounds per square inch gauge or greater, indicated "HH" in the Piping schedule.

B. General:

1. Test connections, hydrants, valves, blow offs, and closure pieces with the piping.
2. During the performance of the tests, test pressure shall not vary more than plus or minus 5 pounds per square inch gauge with respect to the specified test pressure.
3. Select the limits of testing to sections of piping. Select sections that have the same piping material and test pressure.
4. When test results indicate failure of selected sections, limit tests to piping:
    A. Between valves.
    B. Between a valve and the end of the piping.
    C. Less than 500 feet long.

5. Test piping for minimum 2 hours for visible leaks test and minimum 2 hours for the pressure test with maximum leakage allowance.

C. Testing Procedures:

1. Fill piping section under test slowly with potable water while venting air.
2. Before pressurizing for the tests, retain water in piping under slight pressure for the water absorption period of minimum 24 hours.
3. Inspect piping visually for leaks during the water absorption period. Consider testing for water absorption complete when no visible leaks are observed.

D. Pressure Test with Maximum Leakage Allowance:

1. Pressure test piping after completion of visible leaks test during water absorption period.
2. Accurately measure the makeup water necessary to maintain the pressure in the piping section under test during the pressure test period.
   A. Consider the pressure test to be complete when makeup water added is less than the allowable leakage and no damage to piping and appurtenances has occurred.
   B. Successful completion of the pressure test with maximum leakage allowance shall have been achieved when the observed leakage during the test period is equal or less than the allowable leakage and no damage to piping and appurtenances has occurred.
   C. The allowable leakage shall not be greater than 0.0092 gallon per inch of dia. Per 1000 feet of pipe per hour.
   D. The allowable leakage in acid piping and tubing shall be zero.

END OF SECTION

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SECTION 22 05 01
GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Includes But Not Limited To:

1. Common requirements and procedures for plumbing systems.
2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
3. Furnish and install sealants relating to installation of systems installed under this Division.
4. Furnish and install Firestop Penetration Systems for plumbing systems penetrations as described in Contract Documents.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

Not Used.

1.4 SUBMITTALS

A. Action Submittals:

1. Product Data:
   a. Manufacturer's catalog data for each manufactured item.
      (i) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
2. Include name, address, and phone number of each supplier.

B. Closeout Submittals:

1. Operation And Maintenance Manual Data:
   a. Modify and add to requirements of Section 01 78 00 as follows:
      (i) At beginning of Plumbing section of Operations And Maintenance Manual, provide master index showing items included.
      (ii) Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and Plumbing subcontractor.
      (iii) Provide operating instructions to include:
         a. General description of each plumbing system.
         b. Step by step procedure to follow in putting each piece of plumbing equipment into operation.
      (iv) Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
         a. List of plumbing equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.

b. Manufacturer's maintenance instructions for each piece of plumbing equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance instructions.

(v) Include copies of warranties required in individual Sections of Division 22.

1.5 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Perform work in accordance with applicable provisions of Plumbing Codes applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.

2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.

B. Identification:

1. Motor and equipment name plates as well as applicable UL / ULC and AGA / CGA labels shall be in place when Project is turned over to Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Storage:

1. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by Architect until installed.

2. Store items subject to moisture damage in dry, heated spaces.

1.7 WARRANTY

A. Guarantee plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

B. Provide certificates of warranty for each piece of equipment made out in favor of Owner.

C. If plumbing sub contractor with offices located more than 150 miles 240 km from Project site is used, provide service / warranty work agreement for warranty period with local plumbing sub contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Pipe And Pipe Fittings: Weld O Let and Screw O Let fittings are acceptable. Use domestic made pipe and pipe fittings on Project, except non domestic made cast iron pipe and fittings by MATCO NORCA are acceptable.

B. Sleeves:

1. In Framing And Suspended Floor Slabs: Standard weight galvanized iron pipe,

Schedule 40 PVC, or 14 ga 2 mm galvanized sheet metal two sizes larger than bare pipe or insulation on insulated pipe.

2. In Concrete And Masonry: Sleeves through outside walls, interior shear walls, and footings shall be schedule 80 black steel pipe with welded plate.

C. Valves: Valves of same type shall be of same manufacturer.

D. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Drawings:

1. Plumbing Drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.

2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing Drawings.

3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification of Conditions:

1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which plumbing work is dependent for efficiency and report work that requires correction.

2. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

3. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.

4. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

3.2 PREPARATION

A. Changes Due To Equipment Selection:

1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings showing proposed installations.

2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise

necessary.

3. Provide additional motors, valves, controllers, fittings, and other equipment required for proper operation of systems resulting from selection of equipment.
4. Be responsible for proper location of rough in and connections provided under other Divisions.

3.3 INSTALLATION

A. Interface With Other Work:

1. Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
2. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and confirm that they are properly installed.

B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

C. Locating Equipment:

1. Arrange pipes and equipment to permit ready access to valves, cocks, unions, traps, and to clear openings of doors and access panels.
2. Adjust locations of pipes, equipment, and fixtures to accommodate work to interferences anticipated and encountered.
3. Install plumbing work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
4. Determine exact route and location of each pipe before fabrication.
   a. Right Of Way:
      (i) Lines that pitch shall have right of way over those that do not pitch. For example, plumbing drains shall normally have right of way.
      (ii) Lines whose elevations cannot be changed shall have right of way over lines whose elevations can be changed.
   b. Offsets, Transitions, and Changes in Direction:
      (i) Make offsets, transitions, and changes in direction in pipes as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
      (ii) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

D. Penetration Firestops: Install Penetration Firestop System appropriate for penetration at plumbing systems penetrations through walls, ceilings, roofs, and top plates of walls.

E. Sealants:

1. Seal openings through building exterior caused by penetrations of elements of plumbing systems.
2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

F. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus.

1. Pipe drawings are diagrammatic and indicate general location and connections.

Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper installation of plumbing systems.

2. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings.
    a. Arrange so as to facilitate removal of tube bundles.
    b. Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
        (i) Make connections of dissimilar metals with di electric unions.
        (ii) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
    c. Do not use reducing bushings, bull head tees, close nipples, or running couplings. Street elbows are allowed only on potable water pipe 3/4 inch 19 mm in diameter and smaller.
    d. Install piping systems so they may be easily drained
    e. Install piping to insure noiseless circulation.
    f. Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
3. Do not install piping in shear walls.
4. Cut piping accurately to measurements established at site. Remove burr and cutting slag from pipes.
5. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
6. Make changes in direction with proper fittings.
7. Expansion of Thermoplastic Pipe:
    a. Provide for expansion in every 30 feet 9 meters of straight run.
    b. Provide 12 inch 300 mm offset below roof line in each vent line penetrating roof.
8. Expansion of PEX Pipe: Allow for expansion and contraction of PEX pipe as recommended by Pipe Manufacturer.

G. Sleeves:
1. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete slabs on grade.
2. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Seal sleeves with specified sealants. Follow Pipe Manufacturer's recommendations for PEX pipe penetrations through studs and floor slabs.
3. Sleeves through floors shall extend 1/4 inch 6 mm above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
4. Sleeves through floors and foundation walls shall be watertight.

H. Escutcheons:
1. Provide spring clamp plates where pipes run through walls, floors, or ceilings and are

exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.

3.4 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
2. Surface finishes shall exactly match existing finishes of same materials.

3.5 FIELD QUALITY CONTROL

A. Field Tests:

1. Perform tests on plumbing piping systems. Furnish devices required for testing purposes.
2. Replace material or workmanship proven defective with sound material at no additional cost to Owner. Repeat tests on new material, if requested.

3.6 CLEANING

A. Remove dirt, grease, and other foreign matter from each length of piping before installation.

1. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
2. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
3. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

B. Clean exposed piping, equipment, and fixtures. Remove stickers from fixtures and adjust flush valves.

3.7 CLOSEOUT ACTIVITIES

A. Instruction of Owner: Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of plumbing systems utilizing Operation and Maintenance Manual when so doing. Conduct instruction period after Substantial Completion inspection when systems are properly working and before final payment is made.

3.8 PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Includes But Not Limited To:

1. Common hanger and support requirements and procedures for plumbing systems.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

Not Used.

1.4 SUBMITTALS

A. Action Submittals:

1. Product Data:

a. Manufacturer's catalog data for each manufactured item.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:

1. Manufacturer Contact List:

a. Anvil International, Portsmouth, NH www.anvilintl.com.

b. Cooper B Line, Highland, IL www.b-line.com.

c. Unistrut, Wayne, MI www.tyco-unistrut.com.

B. Materials:

1. Hangers, Rods, And Inserts

a. Galvanized and UL approved for service intended.

b. Support horizontal piping from hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on Drawings. Hangers shall have double nuts.

(i) Support insulated pipes 2 inches 50 mm in diameter and smaller with adjustable swivel ring hanger with insulation protection shield. Gauge and length of shield shall be in accordance with Anvil design data.

a. Type Two Acceptable Products:

i. Swivel Ring Hanger: Anvil Fig. 69.

ii. Insulation Protection Shield: Anvil Fig. 167.

iii. Equals by Cooper B Line.

(ii) Support insulated pipes 2 1/2 inches 63 mm in diameter and larger with clevis hanger or roller assembly with an insulation protection shield. Gauge and

length of shield shall be according to Anvil design data.

a. Type Two Acceptable Products:
   i. Clevis Hanger: Anvil Fig. 260.
   ii. Roller Assembly: Anvil Fig. 171.
   iii. Insulation Protection Shield: Anvil Fig. 167.
   iv. Equals by Cooper B Line.

(iii) Support uninsulated copper pipe 2 inches 50 mm in diameter and smaller from swivel ring hanger, copper plated and otherwise fully suitable for use with copper tubing. Support non copper uninsulated pipes from swivel ring hanger.

a. Type Two Acceptable Products:
   i. Swivel Ring Hanger For Copper Pipe: Anvil Fig. CT 69.
   ii. Swivel Ring Hanger For Other Pipe: Anvil Fig. 69.
   iii. Equals by Cooper B Line.

(iv) Support uninsulated copper pipe 2 1/2 inches 63 mm in diameter and larger from clevis hanger, copper plated hangers and otherwise fully suitable for use with copper tubing. Support non copper uninsulated pipes from clevis hanger.

a. Type Two Acceptable Products:
   i. Clevis Hanger For Copper Pipe: Anvil Fig. CT 65.
   ii. Clevis Hanger For Other Pipe: Anvil Fig. 260.
   iii. Equals by Cooper B Line.

c. Support rods for single pipe shall be in accordance with following table:

Rod Diameter	Pipe Size
3/8 inch	2 inches and smaller
1/2 inch	2-1/2 to 3-1/2 inches
5/8 inch	4 to 5 inches
3/4 inch	6 inches
7/8 inch	8 to 12 inches

d. Support rods for multiple pipe supported on steel angle trapeze hangers shall be in accordance with following table:

Rods		Number of Pipes per Hanger for Each Pipe Size						
Number	Diameter	2 inch	2.5 inch	3 inch	4 inch	5 inch	6 inch	8 inch
2	3/8 inch	Two	0	0	0	0	0	0
2	1/2 inch	Three	Three	Two	0	0	0	0
2	5/8 inch	Six	Four	Three	Two	0	0	0
3	5/8 inch	Nine	Seven	Five	Three	Two	Two	0
4	5/8 inch	Twelve	Nine	Seven	Five	Three	Two	Two

(i) Size trapeze angles so bending stress is less than 10,000 psi 69 MPa.

e. Riser Clamps For Vertical Piping:

(i) Type Two Acceptable Products:
a. Anvil Fig. 261.
b. Equals by Cooper B Line.

f. Concrete Inserts:

(i) Individual Inserts:
a. Suitable for special nuts size 3/8 inch through 7/8 inch with yoke to receive concrete reinforcing rods, and with malleable iron lugs for attaching to forms.
b. Type Two Acceptable Products:
i. Anvil Fig. 282.
ii. Equals by Cooper B Line.

(ii) Continuous Inserts:
a. Class Two Quality Standard: Equal to Unistrut P 3200 series.

g. Steel Deck Bracket:

(i) Class Two Quality Standard: Equal to Unistrut P1000 with clamp nut, minimum 6 inch length.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Piping:

1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.

a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.

b. Supports For Horizontal Piping:

(i) Support metal piping at 96 inches 2 400 mm on center maximum for pipe 1 1/4 inches 31 mm or larger and 72 inches 1 800 mm on center maximum for pipe 1 1/8 inch 28 mm or less.
(ii) Support thermoplastic pipe at 48 inches 1 200 mm on center maximum.
(iii) Support PEX pipe at 32 inches minimum on center.
(iv) Provide support at each elbow. Install additional support as required.

c. Supports for Vertical Piping:

(i) Place riser clamps at each floor or ceiling level.
(ii) Securely support clamps by structural members, which in turn are supported directly from building structure.
(iii) Provide clamps as necessary to brace pipe to wall.

d. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.

END OF SECTION

SECTION 22 11 13
FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Includes But Not Limited To

1. Perform excavating and backfilling required by work of this Section.
2. Furnish and install potable water piping complete with necessary valves, connections, and accessories inside building and connect with outside utility lines 5 feet from building perimeter as described in Contract Documents.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. American Society For Testing And Materials

1. ASTM B 88 - Standard Specification for Seamless Copper Water Tube

1.4 SUBMITTALS

Not Used.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Pipe

1. Above-Grade
   a. Copper meeting requirements of ASTM B 88, Type M, seamless drawn temper (rigid).
2. Below-Grade
   a. Copper meeting requirements of ASTM B 88, Type K . 3/4 inch minimum under slabs.

B. Fittings - Wrought copper

C. Connections

1. Above-Grade - Sweat copper type with Sn 94 or Sn95 solder. Solder shall not contain more than 0.10% lead. Solder shall meet requirements of NSF 61
2. Below Grade -
   a. Copper -
      (i) Brazed using following type rods -
         a. Copper to Copper Connections -
            i. AWS Classification BCuP-4 Copper Phosphorus (6percent silver).
            ii. AWS Classification BCuP-5 Copper Phosphorus (15 percent silver).
         b. Copper to Brass or Copper to Steel Connections - AWS Classification

BAg-5 Silver (45 percent silver).

c. Do not use rods containing Cadmium.

(ii) Brazing Flux -

a. Approved Manufacturers -

i. Stay-Silv white brazing flux by J W Harris

ii. High quality silver solder flux by Handy & Harmon

(iii) Joints under slabs acceptable only if allowed by local codes.

D. Ball Valves

1. Use ball valves exclusively unless otherwise specified. Ball valves shall be by single manufacturer from approved list below. Valves shall be two piece, single union, threaded, full port for 150 PSI SWP.
2. Quality Standard - Nibco T585-70-SU
3. Approved Manufacturers -
   a. Hammond
   b. Honeywell-Braukmann
   c. Jenkins
   d. Milwaukee
   e. Nibco

E. Stop And Waste Valves

1. Approved Manufacturers And Models -
   a. Mueller - Mark II Oriseal stop and waste valve H10288
   b. Mueller - Buffalo screw type curb box H-10350 complete with lid and H-10349 enlarged base

F. Combination Pressure Reducing Valve / Strainer

1. Integral stainless steel strainer, or separate 'Y' strainer installed upstream of pressure reducing valve.
2. Built-in thermal expansion bypass check valve.
3. Quality Standard - Watts U5B
4. Approved Manufacturers -
   a. Cash Valve
   b. Cla-Val - Hi Capacity
   c. Honeywell-Braukmann
   d. Spence - Hi Capacity
   e. Watts

PART 3 - EXECUTION

3.1 INSTALLATION

A. Below Grade

1. Install piping under slabs without joints where possible.
2. Insulate water piping buried within building perimeter.

3. Bury water piping 6 inches minimum below bottom of slab and encase in 2 inches minimum of sand.

B. Above Grade

1. Cavity installation - locate to minimize interference with insulation
2. Surface mounted installation (exposed) - support at 48" intervals with copper clips or hangers compatible with copper.

C. Locate cold water lines a minimum of 6 inches from hot water line.

3.2 FIELD QUALITY CONTROL

A. Site Tests - Before pipes are covered, test systems in presence of Architect at 125 psi hydrostatic pressure for 4 hours and show no leaks. Disconnect equipment not suitable for 125 psig pressure from piping system during test period.

3.3 CLEANING

A. Sterilize potable water system with solution containing 200 parts per million minimum of available chlorine and maintaining pH of 7.5 minimum. Introduce chlorinating materials into system in manner approved by Architect. Allow sterilization solution to remain for 24 hours and open and close valves and faucets several times during that time.

B. After sterilization, flush solution from system with clean water until residual chlorine content is less than 0.2 parts per million.

C. Water system will not be accepted until negative bacteriological test is made on water taken from system. Repeat dosing as necessary until such negative test is accomplished.

END OF SECTION

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SECTION 22 11 23
SUBMERSIBLE PUMP AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope. This section covers the work necessary to furnish and install, complete, the submersible well pump and motor specified herein.

B. Submittals. Shop drawings shall be submitted in accordance with section 01 00 00 and shall include descriptive information as required to fully describe the pump, controls (if required), and overall operating performance. The shop drawings shall clearly state any deviations from the specified requirements. The following shall also be furnished with the shop drawings. Performance requirements specified hereinafter shall be defined in the hydraulic institute standards and ANSI/AWWA e101-88.

1. Performance data curves (adjusted for operating speed) showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. The equipment manufactured shall indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the specified design point.
2. Equipment manufactured shall provide complete and detailed information regarding the installation of the pumps. Any installation requirements or operating conditions which the supplier or manufacturer feels to be critical to the safe and reliable operation of the pumps should be identified and described in detail.
3. Operating and maintenance manuals and maintenance summary sheets for the equipment specified herein shall be furnished as specified in section 01 00 00.

1.2 DESIGN CRITERIA

A. General. Pumps shall be capable of continuous operation while pumping untreated groundwater. The pump bowl and discharge head shall be NSF61, annex g, certified.

B. Operating capacity

Pump Setting Depth	80 ft bgs
Typical Operating Capacity	100 gpm
Total Dynamic Head	300 ft
Nominal Operating Speed	3,600 RPM
Minimum Efficiency	80%
Column Size	6"

C. The pump and motor shall be capable of operating within specified parameters without permanent damage.

D. The pump and motor shall be controlled by a reduced voltage soft starter (RVSS). The pump and motor shall be selected to operate at capacities listed above.

PART 2 - PRODUCTS

2.1 PUMP DESIGN

A. General. Pump shall include an integral check valve designed into the discharge of the pump. Pump shall include an integral carbon graphite bearing to handle momentary upthrust loads. An upthrust bumper bolt in the discharge of the pump will not be acceptable. Pump downthrust shall be absorbed by the motor thrust bearing. Each impeller shall be fitted with a seal ring around its eye or skirt to prevent hydraulic loss. A filter screen shall be included as part of the suction inlet assembly. All metallic components of the pump shall be stainless steel. All elastomeric components shall be Nitrile Rubber.

2.2 MOTOR DESIGN

A. General. The motor shall be a squirrel cage induction motor designed for continuous underwater operation in conformance with NEMA standards. A Kingsbury type thrust bearing shall be used to carry the pump downthrust load. The bearing shall be rated for a minimum of 130% of the maximum pump down thrust load. Motor shall be filled with a water & propylene glycol solution for cooling and lubrication. No oils or grease lubrication shall be used. A flexible diaphragm shall be provided to permit expansion of internal motor fluid. The shaft seal shall be a Nitrile Rubber lip seal or a Nitrile, Carbon, Carbide and/or Ceramic face seal. A mercury type shaft seal will not be acceptable. Motor shall be premium efficiency and VFD rated. Motor casing to be sealed to prevent entrance of water under vibration or movement of conductors or cables.

2.3 ELECTRICAL CABLE

A. See electrical specifications.

2.4 DISCHARGE COLUMN

A. General. The discharge column shall be of a black steel pipe conforming to ASTM A53 Grade A for sizes 6" or smaller. Thread shall be a .75" taper National Pipe Thread. For column lengths over 300 feet intermediate check valves shall be placed at intervals no greater than 200 feet. Intermediate check valves shall be of ductile iron construction and shall include a bronze break off plug.

2.5 SOUNDER TUBE

A. General. A PVC sounder tube shall be installed with the column. The sounder tube shall be a minimum of 0.75" schedule 80 flush thread PVC pipe. Threads shall conform to ASTM F480. The sounder tube shall extend from the top of the pump assembly to the surface. The bottom of the sounder tube shall be capped. The bottom 10 feet of the sounder tube shall be slotted. Slot size shall be .020" and conform to ASTM F-480. The sounder tube shall be strapped to the discharge column with stainless steel bands. The sounder tube shall be equipped with a means of feeding the transducer into the sounder tube.

2.6 WATER LEVEL INDICATOR

A. General. A complete water level indication system for the water well shall be provided. The system shall consist of two components. A submersible analog transmitter and a digital indicator. See electrical specifications for unit to be used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation shall be in accordance with manufacturers written recommendations. The installation shall be as shown in the drawings.

B. Water Level Transducer must be attached to the pump column at a maximum of 20ft intervals.

3.2 PAINTING

A. Shop and field painting shall be specified by owner.

3.3 FUNCTIONAL TEST

A. Prior to owner acceptance and formal pump station start-up, all equipment shall be inspected for proper alignment, quiet operation, proper connection, and satisfactory performance by means of a function test. A start up report showing function testing, motor voltages, running amperages and well water levels shall be provided to the engineer after pump station start-up.

3.4 SUPPLIER

A. The supplier of the well pump, motor and appurtenances shall have been in business for not less than 10 years. The primary function of the supplier shall be water well pumps and motors. This supplier shall have sole responsibility for all materials contained within this specification section.

B. Approved manufacturers are: Flowserve pump co, national pump co., or preapproved equal. Any alternate manufacturers must be NSF 61, annex g, certified. Certifications must be provided, to engineer, 14 days prior to bid, for approval.

END OF SECTION

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SECTION 22 13 16
FACILITY SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Includes But Not Limited To

1. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5 feet out from building where applicable.
2. Perform excavation and backfill required by work of this Section.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. American Society For Testing And Materials

1. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
2. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
3. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain Waste and Vent Pipe and Fittings
4. ASTM D2729 - Standard Specifications for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
5. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride)(PVC) Plastic Piping Systems
6. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride)(PVC) Plastic Pipe and Fittings

1.4 SUBMITTALS

Not Used.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Buried underground piping and fittings outside of building limits

1. Minimum size of sewer and drain piping installed underground shall be 4 inches.
2. Approved Type –
   a. PVC solid core plastic pipe meeting requirements of ASTM D2729 joined with pipe cement meeting requirements of ASTM D2564.

B. Buried piping under floor slab on grade

1. Minimum size of waste piping installed under floor slab on grade shall be 2 inches.
2. Approved Type -

a. PVC Schedule 40 solid core plastic pipe meeting requirements of ASTM D2665 joined with pipe cement meeting requirements of ASTM D2564.

C. Above Grade Piping and Vent Lines

1. Approved Type -

a. PVC Schedule 40 solid core plastic pipe meeting requirements of ASTM D2665 joined with pipe cement meeting requirements of ASTM D2564.

D. Fittings - PVC Schedule 40 solid core plastic pipe fittings meeting requirements of ASTM D2665 joined with pipe cement meeting requirements of ASTM D2564.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Excavate and backfill

1. Runs shall be as close as possible to those shown on Drawings.
2. Excavate to required depth and grade to obtain fall required. Grade soil and waste lines within building perimeter 1/4 inch fall in one foot in direction of flow.
3. Bottom of trenches shall be hard. Tamp as required.
4. Remove debris from trench prior to laying of pipe.
5. Do not cut trenches near footings without consulting Architect.

B. Thermoplastic Pipe And Fittings

1. General - Piping and joints shall be clean and installed according to Manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.
2. Above Grade - Locate pipe hangers every 4 feet on center maximum and at elbows.
3. Below Grade -

a. Install in accordance with Manufacturer's recommendations and ASTM D2321.

b. Stabilize unstable trench bottoms.

c. Bed pipe true to line and grade with continuous support from firm base.

(i) Bedding depth - 4 to 6 inches.
(ii) Material and compaction to meet ASTM standard noted above.

d. Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.

e. Trench width at top of pipe -

(i) Minimum - 18 inches or diameter of pipe plus 12 inches, whichever is greater.
(ii) Maximum - Outside diameter of pipe plus 24 inches.

f. Do not use back hoe or power equipment to assemble pipe.

g. Initial backfill shall be 12 inches above top of pipe with material specified in referenced ASTM standard.

h. Minimum cover over top of pipe not under building slab –

(i) 36 inches before wheel loading.

(ii) 48 inches before compaction.

C. Install piping so cleanouts may be installed as follows

1. Where shown on Drawings and near bottom of each stack and riser.
2. At every 135 degrees of accumulative change in direction for horizontal lines.
3. Every 100 feet of horizontal run.
4. Extend piping to accessible surface. Do not install piping so cleanouts must be installed in carpeted floors. In such locations, configure piping so wall type cleanouts may be used.

D. Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have seal trap in connection with complete venting system so gasses pass freely to atmosphere with no pressure or syphon condition on water seal.

E. Vent entire waste system to atmosphere. Join lines together in fewest practicable number before projecting above roof. Set back vent lines so they will not pierce roof near edge or valley. Vent line terminations shall be

1. 6 inches minimum above roof and 12 inches minimum from any vertical surface.
2. Same size as vent pipe.
3. In areas where minimum design temperature is below 0 deg F or where frost or snow closure may be possible -
   a. Vent line terminations shall be same size as vent pipe, except no smaller than 2 inches in diameter.
   b. Vents shall terminate 10 inches minimum above roof or higher if required by local codes.

F. Furnish and install firestopping at penetrations of fire-rated structures.

3.2 FIELD QUALITY CONTROL

A. Site Tests

1. Conduct tests for leaks and defective work. Notify Architect prior to testing.
2. Thermoplastic Pipe System -
   a. Before backfilling and compacting of trenches, cap all open ends and pressure test to 20 psi for 4 hours with no leaks. Correct leaks and defective work.
   b. After backfilling and compacting of trenches is complete but before placing floor slab, re-test as specified above. Uncover pipe and correct leaks and defective work. Re-backfill and compact and re-test.

END OF SECTION

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SECTION 23 05 00
GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General requirements for mechanical systems.

B. General requirements for submittals, labeling, and servicing mechanical systems.

C. Locating equipment and test run mechanical systems.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

Not Used.

1.4 SUBMITTALS

A. General: Submittals must indicate proper arrangements to suit installation and maintenance requirements such as but not limited to motor location, access door openings, filter removal, piping connections. Clearly mark equipment submittal sheets indicating equipment symbol and exact selection of proposed equipment.

B. Shop Drawings: Submit complete, bound, indexed, loose leaf binder large enough for all items, including:

1. Equipment schedule items.
2. Vibration elimination devices.
3. Valves.
4. Insulation.
5. Registers and grilles.
6. Automatic temperature controls.
7. Certificates of guarantee.

C. Pipe Tests: When requested, submit a report of tests performed by pipe manufacturer and the date each test was completed.

1.5 LABELING

A. Identify all critical items of equipment with permanently etched, laminated plastic labels indicating function or relationship of each piece of equipment to system involved. Secure all labels in place in a clearly visible location with appropriate self tapping screws.

B. Mark pipe continuously to identify such information as nominal size, pressure rating, industry standards designation number, etc.

1.6 SERVICE

A. Provide emergency service for mechanical systems.

B. In the event of a system Failure, Owner shall be able to telephone a single request for complete service call by using a number furnished under the contract. The service

organization shall dispatch in the time specified by the Engineer a person to the site who shall be able to analyze the systems and locate the malfunction. If work should be required out of the normal trade definition, it shall be the responsibility of this service organization to contact the Contractor or any other specialty involved, and take the responsibility of completing the repairs and putting the system into operation.

C. Service shall be provided by a service business, established and experienced in this work. Complete information in regard to this service organization, showing the personnel, equipment, location, experience, etc., shall be submitted for review along with other items of the system.

D. This service shall be provided starting at the date of Substantial Completion, and for the duration of the Contractor's guarantee period.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Where 2 or more units of the same class of new equipment are required, provide units of single manufacturer.

B. Use standard products of the manufacturer unless indicated otherwise.

PART 3 - EXECUTION

3.1 ROUGH IN REQUIREMENTS

A. Refer to architectural, structural, mechanical, civil and electrical Drawings.

B. Verify that equipment dimensions meet space requirements with sufficient clearances as may be required by equipment used and as indicated.

C. Check building and equipment dimensions for exact placement of sleeves, conduit and equipment.

D. Determine requirements and dimensions relating to manufacturer's Shop Drawings.

E. Make changes required due to lack of coordination at no additional cost to Owner.

3.2 ACCESSIBILITY FOR MAINTENANCE

A. Coordinate location of equipment such as valves, dampers, fixtures, motors, fans, controls, etc. to allow accessibility for maintenance.

B. Ensure access for service or maintenance for proper operation and function.

C. To facilitate function, coordinate mechanical work of all other trades to avoid concealing equipment.

D. Refer any critical location or assembly conflicts to the Engineer.

3.3 TEST RUN

A. Perform preliminary operation of all mechanical systems in cooperation with all trades involved.

B. Arrange time of test run.

C. Make operating test by a team consisting of manufacturer's representative, Contractor's

representative and Engineer.

D. Complete test run in 1 working day including possible different date identification and recheck of significant items under different working conditions.

END OF SECTION

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SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall exhausters

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

A. AMCA 99 – Standards Handbook.

B. AMCA 210 – Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 300 – Test Code for Sound Rating Air Moving Devices.

D. NEMA MG1 – Motors and Generators.

E. NFPA 70 – National Electrical Code.

1.4 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts lists, and wiring diagrams.

1.6 EXTRA MATERIALS

A. Provide two sets of belts for each fan.

1.7 WARRANTY

A. Provide two-year warranty.

PART 2 - PRODUCTS

2.1 WALL EXHAUSTERS

A. Manufacturers & Product:

1. Fantech Model 2SHE1021with gravity louvers.
2. Other acceptable manufacturers offering equivalent products.

B. Performance

1. Air Flow: 585 cfm
2. Static Pressure (in inches of water): 0.200.
3. Fan RPM: 1,725 maximum

4. Sound Pressure Level: Shall not exceed 45dBA at five feet from the unit.

C. Fan Unit: Centrifugal with spun aluminum housing; resiliently mounted motor; ½ inch (13 mm) mesh, 16 gage (2.0) aluminum bird screen.

D. Electrical Characteristics and Components:

1. Electrical Characteristics:

a. 115 volts, single phase, 60 Hz.

2. Motor: NEMA MG1

3. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

4. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted.

E. Backdraft Damper: Gravity activated, aluminum multiple blade construction, felt edged with nylon bearings.

F. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure wall exhausters with stainless steel lag screws to structure.

C. Provide sheaves required for final air balance.

D. Install backdraft dampers for inlet wall exhausters.

END OF SECTION

SECTION 23 37 14
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Includes But Not Limited To:

1. Furnish and install louvers and vents with required appurtenances for proper function.

1.2 RELATED WORK

Not Used.

1.3 REFERENCES

Not Used.

1.4 SUBMITTALS

Not Used.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Louvers:

1. General:
   a. Extruded aluminum, with blades welded or screwed into frames.
   b. Frames shall have mitered corners.
   c. Louvers shall be recessed, flanged, stationary, or removable as noted on Drawings.
   d. Finish:
      (i) Polyvinyledene Fluoride (PVF2) Resin base finish (Kynar 500 or Hylar 5000) containing 70 percent minimum PVF2 in resin portion of formula. Thermo cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
      (ii) Color as selected by owner from Manufacturer's standard colors.
2. Louvers Connected To Ductwork:
   a. 1/2 inch mesh 16 ga 1.59 mm aluminum bird screen.
   b. Approved Products.
      (i) K638 by Airolite.
      (ii) LE 1 by Air Rite Manufacturing.
      (iii) LE48 by American Warming & Ventilating.
      (iv) EA 405 by Arrow United Industries.
      (v) FKDA by Carnes.
      (vi) 455 XP by Industrial Louvers.
      (vii) Equals as approved by the Engineer
3. Architectural Louvers:

a. Aluminum bug screen.

b. Class One Quality Standards:

(i) T608 by Airolite.
(ii) LE57 by American Warming & Ventilating.
(iii) Equals by Arrow United Industries, Carnes, or Industrial Louvers as approved by Architect before installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor securely into openings.

B. Where louvers touch masonry or dissimilar metals, protect with heavy coat of asphaltum paint.

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. General electrical requirements for equipment and services including, but not limited to:

1. Shop finish.
2. Rust-inhibiting compounds.
3. Galvanizing.
4. Fireproofing and fire ratings.

1.2 DESIGN REQUIREMENTS

A. Service conditions: Provide equipment and material suitable for intended service and installation at location indicated.

B. Low-voltage auxiliary and control power.

1. Electrical power for ac control and instrumentation equipment:
   a. Provide devices necessary for proper operation and protection of equipment during electrical power supply and ambient temperature fluctuations specified.
   b. Design for continuous operation at any voltage from 85% to 110% of nominal voltage. Dropout voltage shall be 60% of nominal for relays and 75% for contactors and starters.
2. Electrical power for dc devices:
   a. Design for continuous operation on ungrounded station battery system, capable of maintaining operation at any voltage from 80% to 112% of nominal voltage.
   b. Electrical devices served shall not impose ground connection on supply.

C. Auxiliary power: Design auxiliary equipment for low voltage service, with electrical power designed to operate from one of nominal electrical power sources as follows and as indicated on Drawings:

Volts	Phase	Frequency
480Y/277	3	60
208Y/120	3	60

1.1 SUBMITTALS

A. Product Data:

1. List of proposed material identifying manufacturer, type and model number for equipment to be provided for complete job.
2. Manufacturer's catalog sheets marked to indicate specific type, model or catalog number of equipment to be provided.
3. Equipment drawings, elementary diagrams, schematics, wiring, performance curves, instruction manuals, and all other documentation necessary for complete description of material being supplied and as required to support installation, commissioning and maintenance of equipment. Manufacturer's standard connection diagram or schematic showing more than one scheme of connection will not be accepted.
4. List of recommended spare parts required for equipment start-up, commissioning and operation.
5. List of special maintenance tools required for installation and operation of equipment. If necessary, provide additional data to clearly demonstrate that proposed alternate equipment meets or exceeds equipment as specified.

B. Operation and maintenance manuals. Provide at minimum:

1. Itemized equipment list.
2. General description and technical data.
3. Receiving, storage, installation, and testing instructions.
4. Operating and maintenance procedures.
5. Complete set of final drawings requiring no further action.
6. Complete documentation of inspections and tests performed, including logs, curves, and certificates. Documentation shall note any replacement of equipment or components that failed during testing.
7. Spare parts list.
8. Lubrication recommendations.
9. Warranty information.

1.2 QUALITY ASSURANCE

A. Manufacturer qualifications:

1. Manufacturer of equipment specified shall be recognized in industry for normally supplying this type of equipment.
2. Manufacturer shall be ISO certified.

B. Installer qualifications:

1. Installer shall be skilled in trade and shall have thorough knowledge of products and equipment specified.
2. Cutting, drilling, trenching, or channeling necessary to properly install equipment shall be performed by competent skilled crafts people in safe, professional manner.

C. Regulatory requirements: Perform electrical construction in accordance with NEC, local and state codes as applicable to job site.

D. Materials and equipment furnished for permanent installation shall be new, unused, and undamaged.

E. Asbestos not allowed.

F. Parts shall be manufactured to American industry standard sizes and gages to facilitate maintenance and interchangeability. Metric sized components not allowed unless specifically requested and approved.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Pack, ship, handle, and store in accordance with manufacturer's requirements.

B. Ship equipment completely factory assembled unless physical size, arrangement, configuration, or shipping and handling limitations make this impracticable. Shipping splits and required field assembly shall be identified with equipment submittals.

C. Costs associated with sections, accessories, or appurtenances requiring field assembly shall be Contractor's responsibility.

D. Separately packaged parts and accessories shall be consolidated and shipped together with equipment. Mark each container clearly to identify contents and as belonging with main equipment.

1. Provide individual weatherproof itemized packing slips attached to outside of each container for contents included. Provide duplicate inside each container.
2. Attach master packing list, covering accessory items for equipment, to main piece of equipment.
3. Mark each container with project identification number for equipment and container

number followed by total number of containers.

E. Equipment shall be suitably protected during shipment, handling, and storage. Damage incurred during shipment shall be repaired at not cost to Owner.

F. Protect coated surfaces against impact, abrasion, and discoloration.

G. Electrical equipment and insulation systems shall be protected against ingress of moisture. Use space heaters if necessary to protect against moisture.

H. Exposed threads shall be greased and protected.

I. Pipe, tube, and conduit connections shall be closed with rough usage plugs. Seal and tape open ends of piping, tubing, and conduit.

J. Equipment openings shall have covers, and taped to seal equipment.

K. Store materials in clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage in accordance with manufacturer's instructions.

1.4 SCHEDULING

A. Coordinate with Owner early and late shipping and delivery schedules for items requiring storage and handling at Site.

1.5 WARRANTY

A. Electrical equipment shall be provided with manufacturer's standard warranty, but not less than 1 year.

1.6 MAINTENANCE

A. Extra materials: Provide touchup paint in same type and color to repair at least 25% of finish-painted equipment surface. Paint shall be sufficient to perform touch-up painting in accordance with shop-applied material instructions for repair painting.

B. Each piece of equipment shall be furnished with special tools as required for installation, maintenance, and dismantling of equipment.
   1. Furnish in quantities as necessary to complete work on schedule.
   2. Tools shall be new and shall become property of Owner.
   3. Tools and intended use shall be identified in assembly instructions. Tools shall only be used for their intended purpose.

PART 2 — PRODUCTS

2.1 FINISHES

A. Manufacturer's standard coating systems shall be factory-applied. Coating systems shall provide resistance to corrosion caused by weather and industrial environments.

   1. Surfaces inaccessible after factory or field assembly shall be protected for life of equipment.
   2. Painted surfaces shall be filled to provide smooth, uniform base for painting.
   3. Surfaces requiring field welds shall not be coated within 3" (75 mm) of field weld.

B. Coating material and application techniques shall conform to regulations of air quality management agency having jurisdiction.

C. Exterior surfaces of control and electrical equipment, including panels, cabinets, switchgear, transformers, and motors shall be manufacturer's standard colors unless specified otherwise.

D. Apply high-temperature coating systems to uninsulated equipment operating at temperatures at

or above 200°F.

2.2 RUST-INHIBITOR COMPOUNDS

A. Uncoated machined and ferrous surfaces subject to corrosion shall be protected with rust-inhibitor compounds.

B. Rust-inhibitor compounds used to protect surfaces of equipment and piping exposed to feedwater or steam shall be completely water-soluble.

C. Surfaces to be field welded shall be coated with consumable rust-inhibitor compounds that will not affect quality of weld.

D. External gasket surfaces, flange faces, couplings, rotating equipment shafts and bearings shall be thoroughly cleaned and coated with rust-inhibitor compounds.

2.3 GALVANIZING

A. Galvanized structural steel members and steel assemblies shall be pickled after fabrication. Remove scale, rust, grease, and other impurities, then hot-dip galvanized in accordance with ASTM.

B. If galvanized member is to be bolted, structural bolts shall be galvanized in accordance with ASTM.

2.4 HARDWARE

A. Provide hardware including, but not limited to, anchor bolts, nuts, washers, expansion anchors, wire nuts needed for installation.

B. Hardware smaller than 3/4" (19 mm) shall match NEMA standard size bolt holes on motors and electrical equipment.

PART 3 — EXECUTION

3.1 EXAMINATION OF SITE

A. Contractor shall be responsible for familiarity with Project Site conditions. Equipment furnished and installed shall be capable of withstanding most severe conditions that will be encountered.

3.2 PROTECTION OF WORK

A. Protect installed Work and provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

B. Damage occurring to building or equipment during installation shall be repaired or replaced to conditions existing prior to damage at no additional cost or delay to project or Owner.

3.3 INSTALLATION

A. Install equipment and materials in accordance with manufacturer's recommendations and Drawings.

B. Details for equipment and systems installed in accordance with industry standard techniques will not be furnished.

C. Installation details furnished on Drawings shall be followed unless found to be unsafe, inappropriate for equipment specified, or unachievable due to site conditions.

D. Install equipment indicated on Drawings as furnished by others, unless noted as installed by others, including but not limited to:

1. Filtration Systems (including all control panels.)

2. Sodium hypochlorite generation, storage and dosing equipment.
3. Chemical mixing and dosing equipment

E. Except as otherwise specified or indicated on Drawings, equipment shall be installed plumb, square, and level.

F. Sheet metal junction boxes, equipment enclosures, sheet metal raceways, and similar items mounted on earth-bearing walls shall be separated from wall not less than 1/4" (6 mm) by corrosion-resistant spacers.

G. Equipment located outdoors shall be permanently sealed at base. Openings into equipment shall be screened or sealed as to prevent entrance of birds, rodents, and insects the size of wasps and mud daubers.

1. Sealing material at base shall be concrete grout.
2. Small cracks and openings shall be sealed from inside with silicone sealant.
3. Large openings shall use galvanized screen mesh.

3.4 FIRE PROOFING AND FIRE RATINGS

A. Maintain fire-resistive integrity during construction.

B. Penetrations through fire-resistive structures shall be sealed with fire-resistive material compatible with construction penetration.

C. Where required by codes, local building officials, or fire marshal, furnish UL fire sealing systems and install in accordance with manufacturer's recommendations.

3.5 STARTUP AND TESTING

A. Clean equipment interiors and exteriors prior to start-up and testing.

B. Unless specified otherwise, tests performed shall be standard tests listed by ANSI/IEEE for intended equipment.

C. Equipment shall be checked and placed in service ready for operation.

D. Circuits shall be electrically tested after installation. Test power and motor circuits prior to final connection to equipment. Splices shall be complete prior to testing.

1. Provide equipment and labor required for testing.
2. Circuit failing to test satisfactorily shall be replaced or repaired, and retested at no additional cost to Owner.
3. Check power and motor circuits, dc power, and control circuits for:
   a. Correct terminations.
   b. Continuity.
   c. Unintentional shorts and grounds.
4. Check power conductors for correct phasing.
5. Motor circuits shall be checked for proper rotation and motors "bumped" to verify correct machine rotation.
6. Control, instrumentation, and thermocouple wire shall be checked for correct termination, continuity, freedom from shorts or grounds, and identification.
7. Current transformer wiring shall be loop checked by injecting current at one end of loop and checking with clip-on ammeter at each field termination point to assure continuity and phase identification.
8. Voltage transformer wiring shall be tested by applying voltage at one point and checking with voltmeter phase rotation meter and phase angle meter at each field termination point to assure continuity, identification and phase shift.

3.6 DEMONSTRATION

A. Final start-up and check out shall be completed prior to Owner acceptance of project.

B. Electrical installation shall be complete in every detail and capable of normal operation in presence of Owner or Owner's Representative to verify its readiness.

END OF SECTION

SECTION 26 05 05
ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 DESCRIPTION

A. This section includes general electrical equipment used to complete the electrical system.

1.2 RELATED SECTIONS

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

1. Section 01 33 00 - Submittal Procedures
2. Section 26 05 00 - Electrical General Requirements
3. Section 26 05 13 - Conductors and Cables
4. Section 26 05 33 - Conduit and Raceways
5. Section 26 05 34 - Electrical Boxes and Fittings

1.3 SUBMITTALS

A. Submittals will be required for all electrical equipment and shall be made in accordance with Section 01 33 00, CONTRACTOR's Submittals.

PART 2 MATERIALS

2.1 THERMOSTATS

A. Unit Heaters:

1. Provide a Heating only, digital thermostat capable of operating the unit heaters together.

B. Cooling:

1. Provide a Cooling only, digital thermostat, wire to control the exhaust fan in AUTO as shown on the drawings.

2.2 FULL-VOLTAGE, NON-REVERSING MOTOR CONTROLLERS

A. GENERAL

1. Provide each motor with a suitable controller and devices that will function as specified for the respective motors and meeting NEMA ICS 2, the NEC, and UL.
2. Provide each motor controller with thermal overload protection in all ungrounded phases. Use protection consisting of thermal overload relays meeting NEMA ICS 2 which are sensitive to motor current and mounted within the motor controller, or a combination of thermal protectors embedded within the motor windings and controller-mounted overload relays, as indicated. Use overload protection devices of the inverse-time-limit type.
3. Provide controller-mounted overload relays of the manual-reset type with externally operated reset button when used without motor thermal protectors; when used in conjunction with thermal protectors, provide the automatic reset type. Select and install overload relay heaters after the actual nameplate full-load current rating of the motor has been determined.
4. Install and connect any required thermal protector monitoring relay provided by motor manufacturer in motor-control circuit and provide manual reset function. Fuse thermal-protector circuits according to the manufacturer's recommendations.
5. The Booster Pump controller shall be provided with two sets of thermal overload

devices, rated for the full load current of the existing motors. The controller shall have a selection switch on the front selecting which thermal overload will be in service.

B. FULL VOLTAGE MAGNETIC STARTERS

1. Provide starters meeting NEMA ICA 2, Class A, with the rating and enclosure shown.
2. Supply individual control power transformers where indicated. The transformers shall have sufficient capacity to serve the connected load and limit voltage regulation to 10-percent during contact or pickup. Fuse one side of the secondary winding and ground the other side. Provide primary, current limiting fuses on all control power transformers.
3. Provide a panel type voltmeter, nominal 4-1/2 inch model with 3-phase, OFF four position selector switch.
4. Provide a panel type ammeter, nominal 4-1/2 inch model with 3-phase, OFF four position selector switch, C.T.'s with proper ratio.
5. For nonhazardous, indoor, dry locations, provide heavy-duty, indicating lights, selector switches, and stations. Utilize General Electric Type CR 104P, or equivalent by Square D, Cutler-Hammer, or other acceptable manufacturer. Acceptable manufacturer. The use of other manufacturer's names referenced to materials herein, shall indicate the quality of material to be provided.

2.3 MODULAR OVERLOAD RELAYS

A. Where called for on the Plans, modular overload relays shall be provided with the motor starters. The modular overload relays shall be 3-pole solid state devices set by one plug-in heater and shall protect all 3 phase of the motor in ambient temperatures ranging from -20 degrees to +70 degrees C.

B. The jam modules shall plug in the modular overload relays and shall provide for instantaneous trip of the overload relay should the current exceed a preset value at any time after the motor has accelerated. The modules shall be adjustable to any value between the 150 percent and 400 percent of the motor full-load current.

C. The underload modules shall plug in the MOR and shall provide for overload relay trip whenever the current falls below a set value after the motor has accelerated. The modules shall be adjustable between 50 percent and 90 percent of the full load value of the motor full load current.

2.4 CONTROL PANELS

A. ENCLOSURES

1. Manufacturers:
   a. Hammond Manufacturing
   b. Hoffman
   c. Rittal
   d. Or approved equal.
2. This specification includes enclosures to house electrical controls, instruments, terminal blocks, etc. If not indicated otherwise they shall be NEMA 12 for indoor and NEMA 3R for outdoor installations.
3. A rolled lip shall be provided around three sides of the door and around all sides of the enclosure opening. The gasket shall be attached with oil-resistant adhesive and held in place with steel retaining strips. Exterior hardware, such as clamps, screws, and hinge pins, shall be of stainless steel for outdoor installations. A hasp and staple shall be provided for padlocking. Each enclosure shall have a print pocket.
4. Enclosures shall be from 14 gauge steel with seams that are continuously welded. Doors shall have full length piano hinges with the door removable by pulling the hinge pin. They shall be as manufactured by Hoffman, Fischer & Porter, or equal.

5. Finish - Steel: Finish shall be white enamel interior, light grey enamel, ANSI 61 exterior, over phosphatized surfaces. Special finishes and colors shall be furnished for wet locations. Plans should be checked for special conditions.

B. PILOT DEVICES:

1. Manufacturers:
   a. Allen-Bradley, Bulletin 800T, 30 mm
   b. Cutler-Hammer
   c. Square D, Type K, 30 mm - Class 9001
   d. Or equal.
2. Indicating lights, pushbuttons and selector switches shall be miniature oiltight units. Contact blocks in control circuits shall be NEMA ICS, B150, rated 5 amperes inductive at 120 volts AC. Contact blocks for signal circuits shall be rated 0.06 amperes at 30 volts AC or DC and shall be hermetically sealed and reed switches. Pilot lights for 120 volt AC circuits shall be LED type. Where group lamp test circuits are not specified, individual pilot light assemblies shall be "push-to-test" type. Pilot lights shall be capable of being changed from the front of the panel without special tools.

C. TERMINAL BLOCKS:

1. Manufacturers:
   a. Entrelec (ABB) M4/6
   b. Square D Co.,
   c. Buchanan,
   d. Allen-Bradley,
   e. Or equal
2. Terminal blocks shall be of the size required for conductors therein and a minimum of 50 percent spares shall be provided in each terminal box.

D. FUSE BLOCKS:

1. Manufacturers:
   a. Entrelec (ABB), M10/13.SF2
   b. Or approved equal.
2. DIN rail mounted.
3. Terminals shall accommodate 22-10 AWG solid or stranded wires.
4. Provide terminals rated for 600 VAC/VDC and 15 amperes.
5. Device shall be UL listed.

E. CONTROL RELAYS:

1. Manufacturer:
   a. Idec RH series.
   b. Allen-Bradley
   c. Or equal.
2. Control relays shall be general purpose “midget” relays, 10 ampere contact rating, with 1, 2, 3 or 4 Form C contacts as shown on the drawings.
3. Relay shall be provided with blade style terminals.
4. Provide LED indicator light with relay.
5. Provide a standard DIN rail mount relay socket.
6. Relay life expectancy shall be in excess of 500,000 operations at 120 VAC.
7. Device shall be UL listed.

F. PROGRAMMABLE LOGIC CONTROLLER

1. Manufacturer/Model
   a. Allen-Bradley MicroLogix Series.
   b. Or approved equal.
2. Power: 24 VDC

3. Provide appropriate Input/Output capability for the I/O list as indicated on the drawings.
4. Unit shall include ethernet, RS485 and programming communications ports.

G. 10-INCH OPERATOR TOUCHSCREEN:

1. Manufacturer/Model
   a. Automation Direct/EA9-T10WCL
   b. Beijer/X2 Pro 10
   c. Or approved equal.
2. Description: Panel mounted ethernet color operator touchscreen.
3. Power Supply: 24 VDC (18 to 32 VDC)
4. Display:
   a. Resolution: 1024 x 600 (min)
   b. Backlight: LED
   c. Backlight life time: 20,000 hours
   d. Brightness: 500 cd/m2
5. Communications:
   a. 10/100 Base T Ethernet port
   b. One RS232 Serial port
   c. One RS422/485 Serial port
6. Environmental:
   a. Operating Temperature: -10-deg C to +60-deg C.
   b. Storage Temperature: -20-deg C to +70-deg C.
   c. Humidity: 5% - 85% non-condensing.

2.5 INSTRUMENTATION

A. PRESSURE TRANSMITTER

1. Manufacturer/Model:
   a. Rosemont, 2088 Gage and Absolute Pressure Transmitter
   b. Or Approved equals.
2. An electronic gage pressure measurement device tailored to the installation as shown on the drawings and suitable for the planned application shall be installed. The system shall include a pressure transducer with integral diaphragm seal to be installed in the station discharge piping. The pressure transmitter shall operate on 24 VDC, and shall provide a 4-20 mA DC signal to the level controller.
3. Pressure Range: 0-150 PSI
4. Unit shall have a stainless steel process connection, 316L stainless steel isolating diaphragm, and filled wiht silicone.
5. Conduit Entry shall be 1/2-14 NPT.
6. Provide a pressure transmitter with an integral LCD display.
7. Unit shall have NSF drinking water approval.

B. WELL LEVEL MEASUREMENT SYSTEM:

1. Manufacturer:
   a. Druck Series PTX 1830
   b. Approved equal.
2. Well level measurement shall consist of a downwell submersible level sensor with transmitter.
3. Level sensor shall be enclosed in a 0.68-inch diameter titanium body tube welded to the sensor to provide high stability and integrity for the sensing elements and to encapsulate the electronics.
4. A cable shall be molded directly to the sensor to give NEMA 6 rating for permanent immersion. Cable shall consist of electrical conductors, vent tube, and Kelvar strain relieving cord within a thick walled polyurethane sheath. Cable length shall be as shown on the drawings.
5. Sensor shall provide a 4-20 mA output proportional to displayed value.
6. Cable from sensor shall terminate in a sensor termination enclosure with desiccant.

7. The sensor shall be attached to the pump column at a maximum of 20ft intervals.
8. Well level measurement sensor with transmitter shall be or full scale range: 15 psi.

2.6 PROCESS SWITCHES

A. LEVEL SWITCH - FLOAT

1. Manufacturer/Model:
   a. IMO Industries, Inc. Gems Sensors Division, 1702.
   b. Or approved equal.
2. Stem: 316 Stainless steel
3. Float: Buna N
4. Operating Temperature:
   a. Water: to 180-degrees F.
5. Minimum Liquid Specific Gravity: .65
6. Pressure (MAX): 150 PSI
7. Switch Rating: 20 VA
8. Electrical Termination: No. 22 AWG, 24-inches long, Polymeric Lead Wires.
9. Selectable Normally Open (NO) or Normally Closed (NC) by inverting float on unit stem.

B. PRESSURE SWITCH

1. Manufacturer:
   a. Mercoid: Model DA-31-3-7
   b. Or approved equal.
2. Brass bourdon tube material
3. Pressure: 5-150 psig
4. Minimum Deadband (psig): 6.
5. Switch: SPDT, closes on increase pressure, 10A120 VAC, Adjustable Deadband.
6. Application:
   a. Well High Discharge Pressure.

2.7 MISCELLANEOUS

A. HATCH POSITION SWITCH

1. Manufacturer:
   a. Square D Company
   b. Or approved equal.
2. Heavy duty turret head lever arm type switch. Provide a offset type lever arm with sufficient length to contact hatch lid.
3. Rated NEMA 6P
4. Rated: 120 VAC, 6 amps.
5. Application:
   a. Roof Hatches

B. MAGNETIC DOOR SWITCH (MAN-DOOR)

1. Manufacturer
   a. Ademco, 7939GY
   b. Edwards, Model 60
   c. GE 2505A
   d. Substitutions: Refer to Section 01600 - Product Requirements
2. Provide a gray Normally Open (NO) magnetic door switch, where the switch closes when the magnet engages. Provide appropriate hardware to install on door.

C. ALARM LIGHT

1. Manufacturer/Model:

a. Federal Pacific/FB2PST
b. Or approved equal.

2. Power: 24VDC
3. Lens Color: Red.
4. Tube: 10,000 hour strobe.
5. Suitable for indoor or outdoor use.
6. UL Listed.

PART 3 INSTALLATION

A. Installation shall be as per manufacturers specifications.

****END OF SECTION****

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART I — GENERAL

1.1 SECTION INCLUDES:

A. Wire and cable markings.

B. 600 Volt single-conductor cable.

C. Multiple conductor, low-voltage cable.

D. Fixture wire.

E. Bare conductor.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM B 3 Specification for Soft or Annealed Copper Wire
2. ASTM D 1000 Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
3. ASTM D 1518 Test Method for Thermal Transmittance of Textile Materials
4. ASTM D3005 Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
5. ASTM D 5034 Breaking Force and Elongation of Textiles Fabrics (Grab Test)

B. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE 383 Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations

C. National Electrical Contractors Association

1. NECA 1 Standard Practices for Good Workmanship in Electrical Contracting

D. National Electrical Manufacturers Association (NEMA):

1. NEMA WC 70 Non-Shielded Power Cable 2000 V or Less

1.3 SUBMITTALS

A. Refer to Section 01 33 00, Submittal Procedures for submittal procedures.

B. Submittal Requirements: Before installation of wire and cable, submit the following information for each type and size of wire and cable:

1. Manufacturer of wire and cable, and certificate of compliance;
2. Number and size of strands composing each conductor;
3. Average overall diameter of finished wire and cable;
4. Minimum insulation resistance in megohms per 1000 feet at 30 degrees C ambient;
5. Jacket composition and thickness in mils;
6. Total number of conductors per cable;
7. Shield material (if any) and thickness;
8. Conductor resistance and reactance in ohms per 1000 feet at 25 degrees C ambient; and
9. Conductor ampacity at 30 degrees C ambient for 600 V wire and cable.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Ship each unit securely wrapped, packaged, and labeled for safe handling in shipment and to avoid damage.

B. Store wire and cable in secure and dry storage facility, in accordance with NECA 1.

PART 2 — PRODUCTS

2.1 WIRE AND CABLE MARKINGS

A. Verify that wire and cable markings are in accordance with applicable NEMA and National Electrical Code requirements.

2.2 600 VOLT SINGLE CONDUCTOR CABLE

A. Conductor Material: ICEA stranded or solid copper meeting requirements of ASTM B 3, soft drawn.

B. Conductor Type:
1. Size 12 AWG (4.0mm^2) and Smaller: Solid conductor.
2. Size 10 AWG and Larger: Class B stranded.
3. Size 14 to 1/0 AWG: Type XHHW-2, cross-linked polyethylene insulated in accordance with NEMA WC 70.
4. Size 2/0 AWG and Larger: Type XHHW-2, cross-linked polyethylene insulated in accordance with NEMA WC 70 or type RHH/RHW, ethylene-propylene-rubber-insulated in accordance with NEMA WC 70.

C. Temperature Rating: Use cables temperature rated not less than 75 degrees C.

D. Insulation Rating: 600 V.

E. Provide conductor sizes No. 8 AWG and smaller in colors to match wire color-codes. Sizes No. 6 AWG and larger shall be color-coded with field-applied tape.

2.3 MULTICONDUCTOR, LOW-VOLTAGE POWER CABLES FOR MOTORS, FEEDERS, AND BRANCH CIRCUITS ROUTED IN CABLE TRAY, CONDUIT OR DUCT BANK:

A. Voltage rating: 600-volt.

B. Conductors: Annealed, bare copper, Class B, stranded, minimum size No. 12 AWG (4.0mm^2).

C. Insulation: Flame-retardant, cross-linked polyethylene (XLPE) or cross-linked polyolefin (XLPO), complying with physical and electrical requirements for NEC Type XHHW-2.

D. Jacket: Flame-retardant, heat, moisture, and sunlight-resistant; cross-linked, low-smoke, nonhalogen polyolefin (XLPO).

E. Phase conductors shall be cabled together with Class B stranded, uncoated copper grounding conductor and fillers. Ground wire size shall comply with requirements of UL 1277.

F. Cover cable assembly with helically applied polyester binder tape with minimum 10% overlap.

G. Marking: Insulated phase conductors shall be black and shall have printed numbers in accordance with ICEA Method 4. Each cable shall be identified by means of surface ink printing indicating manufacturer, number of conductors, size, metal, voltage rating, and UL listing as suitable for cable tray use.

H. Cables shall pass IEEE 1202 70,000 Btu/hr, and ICEA T-29-520, 210,000 Btu/hr vertical tray flame tests, and individual conductors UL VW-1 vertical flame test.

I. Conductors shall be temperature rated for 90°C maximum continuous operating temperature in wet or dry locations.

2.4 FIXTURE WIRE

A. Provide fixture wire conforming to the following requirements:
   1. Type: SF-2 silicone rubber insulated.
   2. Conductor: Stranded copper conductor 16 AWG or larger as indicated.

2.5 BARE CONDUCTOR

A. Use ASTM B 3, Class B stranded, annealed soft-drawn copper conductor unless otherwise indicated. Size as indicated. Use bare conductor for ground wire only.

2.6 INSTRUMENTATION

A. Instrumentation cable shall have the number of twisted pairs indicated on the Plans and shall be insulated for not less than 600 volts. Unless otherwise indicated, conductor size shall be No. 18 AWG minimum.

B. The jacket shall be flame retardant Flamenal or Okoseal, 90 degrees C temperature rating. The cable shield shall be minimum of 2.3 mil aluminum or copper tape overlapped to provide 100 percent coverage and a tinned copper drain wire.

C. The conductors shall be bare soft annealed copper, Class B, 7 strand minimum concentric lay with Okoseal or Vulkene, 15 mils nominal thickness, nylon jacket, 4 mil nominal thickness, 90 degrees C temperature rating. One conductor within each pair shall be numerically identified.

2.7 VFD CONDUCTORS

A. Manufacturers:

   1. Belden 29505 (AWG #6)
   2. Approved Equal

B. Provide 3 conductor plus (3) symmetrical bare copper circuit conductors plus (2) spiral copper tape shields (100% coverage) with PVC insulation, XLPE insulation. Provide a 100% foil plus dual copper tape shield. Cable shall be sun and oil resistant.

C. Cable shall be suitable for Variable Frequency Drives.

D. Cable shall be suitable for indoor installation.

2.8 COLOR CODING OF CONDUCTORS (600 V)

A. Identify individual conductors of multi-conductor cables by means of solid colors, stripes, or printing, unless otherwise approved by the Resident Engineer.

   1. Jacket Printing: Use cables which have printing on the jacket or a printed marker tape under the jacket. Verify that jacket printing includes, but is not be limited to, the number of conductors, conductor size, voltage rating, name of manufacturer, manufacturer's type, and date of manufacture; and that this information appears at intervals of not more than 30 inches.
   2. Footage Marker Tape: Provide cables with a footage marker tape under the jacket or hot-foil footage printing on the jacket.
   3. Power Cables: Conform to the following color coding for power cables:

Conductor		480Y/277 V	208Y/120 V
Phase A		Brown	Black
Phase B		Orange	Red
Phase C		Yellow	Blue
Neutral		White	White
Ground	Green	Green	

B. Use solid color insulation or solid color coating for branch circuit phase conductors 10 AWG and smaller and all neutral and equipment ground conductors.

C. Use a background color other than white or green for phase conductors with colored tracers.

D. For solid color coatings and tracers, use a strongly adherent paint or dye not injurious to the insulation which will not be obliterated by pulling into a conduit or raceway.

E. On-site coloring of ends of conductor may be permitted by the Resident Engineer upon receipt of satisfactory evidence that the Contractor is unable to order color-coded wire and cable as specified. Provide certification from the cable manufacturer that the paint or dye proposed for field application is noninjurious to the insulation.

2.9 CONNECTORS AND INSULATING TAPES

A. Splice and Terminal Connectors:

1. Provide termination fittings listed for use with the cable furnished, NEMA standard.
2. For termination and splice fittings on No. 10 and smaller conductors use compression type or insulated, expanding-spring type. Make wire splices either self-insulating or provided with an insulating cap or heat-shrink insulating sleeve.
3. For termination and splice fittings on No. 8 and larger conductors use tool-applied compression connectors of material and design compatible with the conductors for which they are used.
4. For terminal connectors on conductors size No. 4/0 and larger use long-barrel, double-compression type, and furnish with two NEMA standard bolt holes in the tongue.

B. Insulating Material for Splices and Terminations:

1. Provide insulating material for splices and terminations of type accepted by the Resident Engineer for the particular use, location, and voltage.
2. For general use electrical insulating tape use vinyl plastic with rubber based pressure sensitive adhesive, which is pliable from temperatures of minus 18 degrees C to 105 degrees C. Verify the tape has the following minimum properties when tested in accordance with ASTM D 3005:
   a. Thickness: 7 mils.
   b. Breaking Strength: 15 pounds per inch.
   c. Elongation: 200 percent.
   d. Dielectric Strength: 10 kV/mil.
   e. Insulation Resistance (Direct method of electrolytic corrosion): 10 MW.
3. For rubber electrical insulating tape for protective overwrapping use silicone rubber with a silicone pressure-sensitive adhesive. Verify the tape has the following minimum properties when tested in accordance with ASTM D1000:
   a. Elongation: 525 percent.
   b. Dielectric Strength: 13 kV.
   c. Insulation Resistance (Indirect Method of Electrolytic Corrosion): 10 MW.
4. For Arcproof tape use flexible, conformable organic fabric, coated one side with a flame-retardant flexible elastomer, self-extinguishing, with the following minimum properties:
   a. Thickness, ASTM D 1000: 55 mils.
   b. Tensile Strength, ASTM D 5034: 50 pounds per inch.
   c. Thermal Conductivity, ASTM D 1518: 0.0478 Btu (h/ft2/F).
   d. Electrical Arc Resistance: Withstand 200 A arc for 40 seconds.
5. Mark each tape package to indicate shelf-life expiration date.

2.10 TERMINALS

A. Conductors No. 10 AWG and smaller: Marathon 1500 Series.

B. Conductors larger than No. 4/0 AWG: Terminate to tinned copper bus bar drilled and tapped with standard NEMA sized and spaced holes.

2.11 CONDUCTOR BUNDLING STRAPS

A. Provide conductor bundling straps formed from self-extinguishing nylon having a temperature range of -40 degrees F to 185 degrees F.

B. Equip each strap with a locking hub or head with a stainless steel locking barb on one end and a taper

on the other end.

C. Ensure all wire and cable ties installed outdoors and in exposed locations are made of ultraviolet-resistant material.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Furnish wires and cables to the site in unbroken standard coils or reels upon which a tag is attached bearing the manufacturer's name, trade name of the wire, and listing information.

B. Complete wiring as indicated. Provide ample slack for field terminated wires and preformed cables with connections, including wires for motor loops, service connections, and extensions. In outlet or junction boxes provided for installation of equipment by others, tape ends of wires and install blank covers.

C. Do not bend cables during installation, either permanently or temporarily, to radii less than 12 times the outer diameters, except where conditions make. the specified radius impractical and shorter radii are permitted by the manufacturer.

D. Bundle cable and conductors neatly and securely with nylon straps in branch circuit panelboards, cabinets, control boards, switchboards, and motor control centers. Bundle power cables separately from control cables.

E. Install motor feeders, service connections, and extensions in accordance with the referenced codes. Install motor feeder in liquid-tight flexible conduit of 18 inches minimum length at motor conduit box.

F. For wire pulling, comply with NECA 1 and the following:

1. Install wire and cable in conduit as indicated. Do not use block and tackle or other mechanical means for pulling conductors smaller than 2 AWG in raceways.
2. Provide suitable installation equipment to prevent cutting and abrasion of conduits and wire during the pulling of feeders. Use lubricant and installation procedure as recommended by the cable manufacturer.
3. Do not exceed the manufacturer's recommended pulling tension. For conduit runs with three bends, and cable sized larger than 2 AWG, provide cable tension measuring equipment and record the highest cable tension. Notify Resident Engineer 48 hours prior to such pulling operations and adjust schedule as necessary to permit observation.
4. Provide masking or other means to prevent obliteration of cable identifications when solid color coating or colored tracers are used.

G. Power and Control Cable Installation in Manholes and Pull boxes: Route cables along the manhole or handhole walls providing the longest possible slack. Form cables closely parallel to the walls. Prevent cable interference with duct entrances, and support cables on brackets and cable insulators, spaced at a maximum of 4 feet. In existing manholes and handholes where new ducts are to be terminated or where new cables are to be installed, the existing locations of cables, cable supports, and grounding shall be modified as required to provide a properly arranged and supported installation.

H. Splices and Terminations:

1. Use continuous lengths of wire and cable shall between power source and equipment. Where splices are required, make them only in approved fittings or junction boxes. Splices are subject to approval by the Resident Engineer. Follow manufacturer's instructions in splicing wire and cable.
2. Splices allowed in lighting and general-purpose power circuits.
3. Provide wire and cable connectors of high-conductivity, corrosion-resistant material with contact area equal to at least current carrying capacity of wire or cable.
4. General lighting and general-purpose building power circuits:
    a. Twist-type, insulated spring connectors for splices on solid or stranded conductors smaller than No. 6 AWG.
    b. Use indent, hex screw, or bolt clamp-type connectors, with or without tongue for splices on solid or stranded conductors No. 6 AWG and larger.

c. Apply insulating 600-volt tape.

5. Make wire and cable splices only in outlet, junction or pull boxes, or in equipment cabinets.
6. Use splice and terminator installation tools and installation techniques recommended by the manufacturer.
   a. Mechanical hand tools, with dies for each conductor size as recommended by the manufacturer, may be used on conductor sizes through #6 AWG.
   b. For conductor sizes larger than #6 AWG, use hydraulic tools with hexagonal or circumferential dies as recommended by the manufacturer.
   c. Use compression tools which permanently imprint die information on the completed connection.
7. Control Cables: Terminate each wire held with screw-type terminals using an insulated sleeve (nylon), ring-tongue-type or locking spade-type, crimp-on lugs.

I. Termination of conductors to equipment with bolted connections:

1. Use compression type lugs:
2. Compression lugs for cables 250 kcmil and larger shall have at least 2 clamping elements of compression indents, and provision for at least 2 bolts for joining to apparatus terminals.
3. Crimping hand tools used for securing conductors in compression type connectors or terminal lugs shall be made for purpose and conductor sizes involved.
4. Crimping tools shall be ratchet-type preventing tool from opening until crimp action is completed.
5. Tools shall be product approved by connector manufacturer.

J. Insulating tapes and compounds for terminations and splices shall be UL-listed for intended use, location, and voltage by manufacturer.

K. Metal-clad cable, NEC Type MC, may not be substituted in place of cable and conduit unless specified otherwise, or unless approved in writing.

3.2 FIELD QUALITY CONTROL

A. Inspect wire and cable for physical damage and proper connections.

B. Perform continuity test on power and equipment branch circuit conductors.

C. Verify phasing for circuits to three-phase loads.

D. Test for insulation resistance in accordance with Section 26 08 00 Commissioning of Electrical Systems.

1. Test after splices and terminations are complete. Do not connect equipment to the cable system during tests.
2. Acceptance Criteria for 600V wire and cable: 10,000,000 ohms
3. Test Failure: In case insulation resistance values are unacceptable, correct deficiency and retest. If the test fails again, replace the entire wire or cable segment.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 — GENERAL

1.1 SECTION INCLUDES:

A. Grounding of Electrical Systems and Equipment.

1. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.2 RELATED SECTIONS AND REFERENCES:

A. Section 26 05 19 - Low Voltage Electrical Power Conductors and Cables.

1.3 SUBMITTALS

A. Submit "Letter of Conformance" in accordance with Section 01 33 00 indicating specified items selected for use in Project with the following supporting data:

1. Product Data: For the following:
   a. Ground rods.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. Comply with UL 467.

B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers:

1. Grounding Conductors, Cables, Connectors, and Rods:
   a. Chance/Hubbell (573-682-5521)
   b. Copperweld Corp. (931-433-7177)
   c. Thomas & Betts, Electrical (800-816-7809)
   d. Approved equals.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 26 05 19 - "Low-Voltage Electrical Power Conductors and Cables."

B. Material: Aluminum, copper-clad aluminum, and copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

E. Grounding Electrode Conductors: Stranded cable.

F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

G. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B3.
2. Assembly of Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.

H. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

I. Ground Conductor and Conductor Protector for Wood Poles: As follows:

1. No. 4 AWG minimum, soft-drawn copper conductor.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.

J. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

K. Equipment Ground Conductor (Green) shall be included with all circuit conductors. In addition, provide a neutral conductor where applicable.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

A. Ground Rods: copper-clad steel. Size: 120" long by 3/4" in diameter.

B. UFER: 25-feet of bare copper conductor installed in the footing or foundation wall. Connect copper to structural support steel.

C. Metal Water Pipes: Where metal water piping is used, provide grounding electrode conductor to metal water piping. Use UL listed connection devices as required.

PART 3 — EXECUTION

3.1 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

C. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

E. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

F. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: If metal water pipe is installed, provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: If metal water piping is used, use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

F. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Non-contact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A .

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

B. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.6 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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. Perform tests, by the fall-of-potential method according to IEEE 81.
3. Provide drawings locating each 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.
    a. Equipment Rated 500 kVA and Less: 10 ohms.
    b. Manhole Grounds: 10 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner representative promptly and include recommendations to reduce ground resistance.

END OF SECTION

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SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Hangers and supports for electrical equipment and systems.

B. Construction requirements for concrete bases.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.3 RELATED SECTIONS

A. Section 26 05 33 - Raceway and Boxes for Electrical Installations.

B. Section 27 00 00 - Communications

1.4 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.5 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 (5) times the applied force.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For the following:

1. Steel slotted support systems.

C. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include product data for components.
2. Steel slotted channel systems. Include product data for components.
3. Equipment supports.

D. Welding certificates.

1.7 QUALITY ASSURANCE

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

B. Comply with NFPA 70.1.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07.

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. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4. 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 and malleable-iron 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 A36, 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.
   a. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
      (1) Hilti Inc.
      (2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      (3) MKT Fastening, LLC.
      (4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one (1) of

the following:
(1) Cooper B-Line, Inc.; a division of Cooper Industries.
(2) Empire Tool and Manufacturing Co., Inc.
(3) Hilti Inc.
(4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
(5) MKT Fastening, LLC.

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 A325.
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 Division 05 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 and RMC as required by NFPA 70. Minimum rod size shall be 1/4-inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted 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 single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

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.

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 Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
3. To Existing Concrete: Expansion anchor fasteners.
4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete four (4) inches thick or

greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than four (4) inches thick.

5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
6. To Light Steel: Sheet metal screws.
7. 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. Comply with installation requirements in Division 05 for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches 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 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 10 Concrete Placement.

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.

B. Touchup: Comply with requirements in Division 09 painting sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

SECTION 26 05 33
RACEWAY AND BOXES

PART 1 — GENERAL

1.1 SECTION INCLUDES:

A. Conduit and Tubing:

1. Rigid galvanized steel (RGS).
2. PVS schedule 40 conduit (PVC).
3. PVC coated rigid galvanized steel conduit.
4. Flexible metal, liquid-tight conduit.

B. Fittings:

1. Rigid galvanized steel conduit.
2. PVC conduit and tubing.
3. PVC coated rigid galvanized steel conduit.
4. Flexible metal, liquid-tight conduit.
5. Flexible coupling, hazardous areas.
6. Watertight entrance seal device.

C. Outlet and Device Boxes:

1. Cast metal.
2. Case aluminum.
3. PVC coated cast metal.
4. Non-metallic.

D. Junction and Pull Boxes:

1. Outlet box uses as junction or pull box.
2. Conduit bodies uses as junction boxes.
3. Large sheet steel box.
4. Large cast metal box, hazardous location
5. Large stainless steel box
6. Large steel box.
7. Concrete box, non-traffic areas.
8. Concrete box, traffic areas.

E. Terminal Junction Box.

F. Metal Wireways.

G. Non-metallic wireways.

H. Precast manholes and handholes.

I. Conduit and tubing accessories.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): HB, Standard Specifications for Highway Bridges, Sixteenth Edition.
2. ASTM International (ASTM):
   a. A123/123M, Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
   b. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel

Steel Plate, Sheet, and Strip.
c. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
d. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
e. D149, Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.

3. Electronic Industry Alliance (EIA) and Telecommunications Industry Association (TIA): 569, Commercial Building Standard for Telecommunications Pathways and Spaces.
4. National Electrical Contractor's Association, Inc. (NECA):
   a. 101, Standard for Installing Steel Conduit (Rigid, IMC, EMT).
   b. 102, Standard for Installing Aluminum Conduits.
   c. 105, Recommended Practice for Installing Metal Cable Trays.
   d. 111, Standard for Installing Nonmetallic Raceway (RNC, ENT, LFNC).
5. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. C80.1, Specification for Rigid Steel Conduit, Zinc Coated.
   c. C80.3, Specification for Electrical Metallic Tubing, Zinc Coated.
   d. C80.5, Specification for Rigid Aluminum Conduit.
   e. C80.6, Intermediate Metal Conduit (IMC) - Zinc Coated.
   f. RN 1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   g. TC 2, Electrical Polyvinyl Chloride (PVC) Plastic Tubing and Conduit.
   h. TC 3, Polyvinyl-Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
   i. TC 6, PVC Plastic Utilities Duct for Underground Installation.
   j. TC 14, Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
   k. VE 1, Metallic Cable Tray Systems.
6. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
7. Underwriters Laboratories Inc. (UL):
   a. 1, Standard for Flexible Metal Conduit.
   b. 5, Standard for Surface Metal Raceways and Fittings
   c. 6, Standard for Electrical Rigid Metal Conduit - Steel.
   d. 6A, Standard for Electrical Rigid Metal Conduit - Aluminum, Bronze, and Stainless.
   e. 50, Standard for Enclosures for Electrical Equipment.
   f. 360, Standard for Liquid-Tight Flexible Steel Conduit.
   g. 514B, Standard for Conduit, Tubing, and Cable Fittings.
   h. 514C, Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
   i. 651, Standard for Schedule 40 and 80 Rigid PVC Conduit.
   j. 651A, Standard for Type EB and A Rigid PVC Conduit and HDPE Conduit.
   k. 797, Standard for Electrical Metallic Tubing.
   l. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
   m. 1242, Standard for Intermediate Metal Conduit.
   n. 1660, Standard for Liquid-Tight Flexible Nonmetallic Conduit.
   o. 1684, Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.3 SUBMITTALS

A. Action Submittals:

1. Manufacturer's Literature:
   a. Rigid galvanized steel conduit.
   b. PVC Schedule 40 conduit.
   c. PVC-coated rigid galvanized steel conduit, submittal to include copy of manufacturer's warranty.
   d. Flexible metal, liquid-tight conduit.
   e. Conduit fittings.
   f. Wireways.
   g. Device boxes for use in hazardous areas.
   h. Junction and pull boxes used at or below grade.
   i. Large junction and pull boxes.
   j. Terminal junction boxes.
2. Precast Manholes and Handholes:

a. Dimensional drawings and descriptive literature.
b. Traffic loading calculations.
c. Accessory information.

3. Equipment and machinery proposed for bending metal conduit.
4. Method for bending PVC conduit less than 30 degrees.

B. Informational Submittals: Manufacturer's certification of training for PVC-coated rigid steel conduit installer.

1.4 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

B. PVC-Coated, Rigid Steel Conduit Installer: Certified by conduit manufacturer as having received minimum 2 hours of training on installation procedures.

PART 2 — PRODUCTS

2.1 CONDUIT AND TUBING

A. Rigid Galvanized Steel Conduit (RGS):

1. Meet requirements of NEMA C80.1 and UL 6.
2. Material: Hot-dip galvanized, with chroimated protective layer.

B. PVC Schedule 40 Conduit:

1. Meet requirements of NEMA TC 2 and UL 651.
2. UL listed for concrete encasement, underground direct burial, concealed or direct sunlight exposure, and 90 degrees C insulated conductors.

C. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of NEMA RN 1.
2. Material:
   a. Meet requirements of NEMA C80.1 and UL 6.
   b. Exterior Finish: PVC coating, 40 mils nominal thickness, bond to metal shall have tensile strength greater than PVC.
   c. Interior finish: Urethane coating, 2 mils nominal thickness.
3. Threads: Hot-dipped galvanized and factory coated with urethane.
4. Bendable without damage to either interior or exterior coating.

D. Flexible Metal, Liquid-Tight Conduit:

1. UL 360 listed for 105 degrees C insulated conductors.
2. Material: Galvanized steel, with an extruded PVC jacket.

E. Electrical Non-Metallic Tubing

1. UL listed for poured-in-place concrete.
2. Manufacturer and Products:
   a. Kraloy Kwikon Series
   b. Approved equal

F. Electrical Metallic Tubing (EMT)

1. Material: Hot-dipped galvanized, high-grade steel with continuously welded seam.
2. External protective coating: Metallic zinc applied by hot-dip galvanizing or electro-galvanizing. Coating shall not flake or crack when conduit is bent.
3. Internal coating: Baked enamel or similar compound resulting in smooth surface.

2.2 FITTINGS

A. Rigid Galvanized Steel Conduit:

1. General:
   a. Meet requirements of UL 514B.
   b. Type: Threaded, galvanized. Set screw and threadless compression fittings not permitted.
2. Bushing:
   a. Material: Malleable iron with integral insulated throat, rated for 150 degrees C.
   b. Manufacturers and Products:
      (1) Appleton; Series BU-I.
      (2) O-Z/Gedney; Type HB.
3. Grounding Bushing:
   a. Material: Malleable iron with integral insulated throat rated for150 degrees C, with solderless lugs.
   b. Manufacturers and Products:
      (1) Appleton; Series GIB.
      (2) O-Z/Gedney; Type HBLG.
4. Conduit Hub:
   a. Material: Malleable iron with insulated throat with bonding screw.
   b. UL listed for use in wet locations.
   c. Manufacturers and Products:
      (1) Appleton, Series HUB-B.
      (2) O-Z/Gedney; Series CH.
      (3) Meyers; ST Series.
5. Conduit Bodies:
   a. Sized as required by NFPA 70.
   b. Manufacturers and Products (For Normal Conditions):
      (1) Appleton; Form 35 threaded unilets.
      (2) Crouse-Hinds; Form 7 or 8 threaded condulets.
      (3) Killark; Series 0 electrolets.
      (4) Thomas & Betts; Form 7 or 8.
   c. Manufacturers (For Hazardous Locations):
      (1) Appleton.
      (2) Crouse-Hinds.
      (3) Killark.
6. Couplings: As supplied by conduit manufacturer.
7. Unions:
   a. Concrete tight, hot-dip galvanized malleable iron.
   b. Manufacturers and Products:
      (1) Appleton; Series SCC Bolt-On Coupling or Series EC Three-Piece Union.
      (2) O-Z/Gedney; Type SSP split coupling or Type 4 Series, three-piece coupling.
8. Conduit Sealing Fitting Manufacturers and Products:
   a. Appleton; Type EYF, EYM, or ESU.
   b. Crouse-Hinds; Type EYS or EZS.
   c. Killark; Type EY or EYS.
9. Drain Seal Manufacturers and Products:
   a. Appleton; Type SF.
   b. Crouse-Hinds; Type EYD or EZD.
10. Drain/Breather Fitting Manufacturers and Products:
    a. Appleton; Type ECDB.
    b. Crouse-Hinds; ECD.
11. Expansion Fitting Manufacturers and Products:

a. Deflection/Expansion Movement:
(1) Appleton; Type DF.
(2) Crouse-Hinds; Type XD.
b. Expansion Movement Only:
(1) Appleton; Type XJ.
(2) Crouse-Hinds; Type XJ.
(3) Thomas & Betts; XJG-TP.

12. Cable Sealing Fittings:
a. To form watertight nonslip cord or cable connection to conduit.
b. For Conductors with OD of 1/2 inch or Less: Neoprene bushing at connector entry.
c. Manufacturers and Products:
(1) Appleton; CG-S.
(2) Crouse-Hinds; CGBS.

B. PVC Conduit and Tubing:

1. Meet requirements of NEMA TC-3.
2. Type: PVC, slip-on.

C. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of UL 514B.
2. Fittings: Rigid galvanized steel type, PVC coated by conduit manufacturer.
3. Conduit Bodies: Cast metal hot-dipped galvanized or urethane finish. Cover shall be of same material as conduit body. PVC coated by conduit manufacturer.
4. Finish: 40-mil PVC exterior, 2-mil urethane interior.
5. Overlapping pressure-sealing sleeves.
6. Conduit Hangers, Attachments, and Accessories: PVC-coated.
7. Manufacturers:
a. Robroy Industries.
b. Ocal.
c. Pennacote.
8. Expansion Fitting Manufacturer and Product: Ocal; OCAL-BLUE XJG.

D. Flexible Metal, Liquid-Tight Conduit:

1. Metal insulated throat connectors with integral nylon or plastic bushing rated for 105 degrees C.
2. Insulated throat and sealing 0-rings.
3. Manufacturers and Products:
a. Thomas & Betts; Series 5331.
b. O-Z/Gedney; Series 4Q.

E. Non-Metallic Tubing:

1. UL listed for cast-in-place concrete
2. Kraloy Kwikon series
3. Or approved equal.

F. Electrical Metallic Tubing:

1. Fittings: Rust-resistant steel compression type.
2. Connectors shall have insulated insert in throat.
3. Die-cast aluminum material, and indent or set screw type, are not acceptable.
4. Conduit bodies: Malleable iron for use with compression type fittings. Set screw type not acceptable.

G. Watertight Entrance Seal Device:

1. New Construction:
a. Material: Oversized sleeve, malleable iron body with sealing ring, pressure ring, grommet seal, and pressure clamp.

b. Manufacturer and Product: O-Z/Gedney; Type FSK or WSK, as required.

2. Cored-Hole Application:
   a. Material: Assembled dual pressure disks, neoprene sealing ring,and membrane clamp.
   b. Manufacturer and Product: O-Z/Gedney; Series CSM.

2.3 OUTLET AND DEVICE BOXES

A. Cast Metal:

1. Box: Malleable iron or cast ferrous metal.
2. Cover: Gasketed, weatherproof, malleable iron, or cast ferrous metal,with stainless steel screws.
3. Hubs: Threaded.
4. Lugs: Cast Mounting.Manufacturers and Products, Nonhazardous Locations:
   a. Crouse-Hinds; Type FS or FD.
   b. Appleton; Type FS or FD.
5. Manufacturers and Products, Hazardous Locations:
   a. Crouse-Hinds; Type GUA or EAJ.
   b. Appleton; Type GR.

B. Cast Aluminum:

1. Material:
   a. Box: Cast, copper-free aluminum.
   b. Cover: Gasketed, weatherproof, cast copper-free aluminum withstainless steel screws.
2. Hubs: Threaded.
3. Lugs: Cast mounting.
4. Manufacturers and Products, Nonhazardous Locations:
   a. Crouse-Hinds; Type FS-SA or FD-SA.
   b. Appleton; Type FS or FD.

C. PVC-Coated Cast Metal:

1. Type: One-piece.
2. Material: Malleable iron, cast ferrous metal, or cast aluminum.
3. Coating:
   a. Exterior Surfaces: 40-mil PVC.
   b. Interior Surfaces: 2-mil urethane.
4. Manufacturers:
   a. Robroy Industries.
   b. Ocal.

D. Nonmetallic:

1. Box: PVC.
2. Cover: PVC, weatherproof, with stainless steel screws.
3. Manufacturer and Product:
   a. Carlon; Type FS or FD, with Type E98 or E96 covers.

2.4 JUNCTION AND PULL BOXES

A. Outlet Box Used as Junction or Pull Box: As specified under Article Outlet and Device Boxes.

B. Conduit Bodies Used as Junction Boxes: As specified under Article Fittings.

C. Large Sheet Steel Box:

1. NEMA 250, Type 1.
2. Box: Code-gauge, galvanized steel.
3. Cover: Full access, screw type.

4. Machine Screws: Corrosion-resistant.

D. Large Cast Metal Box:

1. NEMA 250, Type 4.
2. Box: Cast malleable iron, or ferrous metal, electrogalvanized finished, with drilled and tapped conduit entrances and exterior mounting lugs.
3. Cover: Hinged with clamps.
4. Gasket: Neoprene.
5. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
6. Manufacturers and Products, Surface Mounted Nonhinged Type:
   a. Crouse-Hinds; Series W.
   b. O-Z/Gedney; Series Y.
7. Manufacturer and Product, Surface Mounted, Hinged Type: O-Z/Gedney; Series YW.
8. Manufacturers and Products, Recessed Type:
   a. Crouse-Hinds; Type WJBF.
   b. O-Z/Gedney; Series YR.

E. Large Steel Box:
1. NEMA 250 Type 12.
2. Box: 12-gauge steel, with white enamel painted interior and gray primed exterior, over phosphated surfaces. Provide gray finish as approved by Engineer.
3. Cover: Hinged with clamps.
4. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
5. Manufacturers:
   a. Hoffman Engineering Co.
   b. Robroy Industries.
   c. Wiegman.

F. Concrete Box, Nontraffic Areas:
1. Box: Reinforced, cast concrete with extension.
2. Cover: Steel diamond plate with locking bolts.
3. Cover Marking: ELECTRICAL, TELEPHONE, or as shown.
4. Size: 10 inches by 17 inches, minimum.
5. Manufacturers and Products:
   a. Utility Vault Co.; Series 36-1017.
   b. Christy, Concrete Products, Inc.; N9.
   c. Strongwell; "PG" Style.

G. Concrete Box, Traffic Areas:
1. Box: Reinforced, cast concrete with extension and bottom slab.
2. Cover: Steel checked plate; H/20 loading with screw down.
3. Cover Marking: ELECTRICAL, TELEPHONE, or as shown.
4. Manufacturers and Products:
   a. Christy, Concrete Products, Inc.; B1017BOX.
   b. Utility Vault Co.; 3030 SB.

2.5 TERMINAL JUNCTION BOX

A. Cover: Hinged, unless otherwise shown.

B. Interior Finish: Paint with white enamel or lacquer.

C. Terminal Blocks:

1. Separate connection point for each conductor entering or leaving box.
2. Spare Terminal Points: 25 percent, minimum.

2.6 METAL WIREWAYS

A. Meet requirements of UL 870.

B. Type: Steel-enclosed, lay-in type.

C. Cover: Hinged with friction latch.

D. Rating: Outdoor raintight.

E. Finish: Rust inhibiting phosphatizing primer and gray baked enamel.

F. Hardware: Plated to prevent corrosion; screws installed toward the inside protected by spring nuts or otherwise guarded to prevent wire insulation damage.

G. Knockouts: Without knockouts, unless otherwise indicated.

H. Manufacturers:

1. Circle AW.
2. Hoffman.
3. Square D.

2.7 NONMETALLIC WIREWAY

A. Rating: Outdoor, corrosion resistant, raintight, NEMA Type 12 and Type 3R.

B. Type: Fiberglass-enclosed, with removable cover.

C. Captivated, corrosion resistant cover screws.

D. Oil-resistant gaskets.

E. Meet UL cold impact test to minus 35 degrees C.

F. Manufacturer: Hoffman.

2.8 ACCESSORIES

A. Duct Bank Spacers:

1. Type: Nomnetallic, interlocking, for multiple conduit sizes.
2. Suitable for all types of conduit.
3. Manufacturers:
   a. Underground Device, Inc.
   b. Carlon.

B. Identification Devices:

1. Raceway Tags:
   a. Material: Permanent, nylon or polyethylene.
   b. Shape: Round.
   c. Raceway Designation: Pressure stamped, embossed, or engraved.
   d. Tags relying on adhesives or taped-on markers not permitted.
2. Warning Tape:
   a. Material: Polyethylene, 4-mil gauge with detectable strip.
   b. Color: Red.
   c. Width: Minimum 6 inches.
   d. Designation: Warning on tape that electric circuit is located below tape.
   e. Identifying Letters: Minimum 1-inch high permanent black lettering imprinted continuously over entire length.
   f. Manufacturers and Products:
      (1) Panduit; Type HTDU.
      (2) Reef Industries; Terra Tape.

C. Heat Shrinkable Tubing:

1. Material: Heat-shrinkable, cross-linked polyolefin.
2. Semi-flexible with meltable adhesive inner liner.
3. Color: Black.
4. Manufacturer: Raychem.

D. Wraparound Duct Band:

1. Material: Heat-shrinkable, cross-linked polyolefin, precoated with hot-melt adhesive.
2. 50 mm width (minimum).
3. Manufacturer and Product: Raychem; Type TWDB.

PART 3 — EXECUTION

3.1 GENERAL

A. Conduit and Tubing sizes shown are based on the use of copper conductors.

B. All installed Work shall comply with NECA Installation Standards.

C. Crushed or deformed raceways not permitted.

D. Maintain raceway entirely free of obstructions and moisture.

E. Immediately after installation, plug or cap raceway ends with watertight and dust-tight seals until time for pulling in conductors.

F. Aluminum Conduit: Do not install.

G. Sealing Fittings: Provide drain seal in vertical raceways where condensate may collect above sealing fitting.

H. Avoid moisture traps where possible. When unavoidable in exposed conduit runs, provide junction box and drain fitting at conduit low point.

I. Group raceways installed in same area.

J. Proximity to Heated Piping: Install raceways minimum 12 inches from parallel runs.

K. Follow structural surface contours when installing exposed raceways. Avoid obstruction of passageways.

L. Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes.

M. Block Walls: Do not install raceways in same horizontal course or vertical cell with reinforcing steel.

N. Install watertight fittings in outdoor, underground, or wet locations.

O. Paint threads and cut ends, before assembly of fittings, galvanized conduit, PVC-coated galvanized conduit, or IMC installed in exposed or damp locations with zinc-rich paint or liquid galvanizing compound.

P. Metal conduit shall be reamed, burrs removed, and cleaned before installation of conductors, wires, or cables.

Q. Do not install raceways in concrete equipment pads, foundations, or beams.

R. Horizontal raceways installed under floor slabs shall lie completely under slab, with no part embedded within slab.

S. Install concealed, embedded, and buried raceways so that they emerge at right angles to surface and have no curved portion exposed.

T. Install conduits for fiber optic cables, telephone cables, and data cables in strict conformance with the requirements of EIA/TIA 596-A.

3.2 INSTALLATION IN CAST-IN-PLACE STRUCTURAL CONCRETE

A. Minimum Cover: 2 inches, including all fittings.

B. Conduit placement shall not require changes in reinforcing steel location or configuration.

C. Provide nonmetallic support during placement of concrete to ensure raceways remain in position.

D. Conduit larger than 1 inch shall not be embedded in concrete slabs, walls, foundations, columns, or beams unless approved by Engineer.

E. Slabs and Walls:

1. Trade size of conduit not to exceed one-fourth of the slab or wall thickness.
2. Install within middle two-fourths of slab or wall.
3. Separate conduit less than 2-inch trade size by a minimum ten times conduit trade size, center-to-center, unless otherwise shown.
4. Separate conduit 2-inch and greater trade size by a minimum eight times conduit trade size, center-to-center, unless otherwise shown.
5. Cross conduit at an angle greater than 45 degrees, with minimum separation of 1 inch.
6. Separate conduit by a minimum six times the outside dimension of expansion/deflection fittings at expansion joints.
7. Conduit shall not be installed below the maximum water surface elevation in walls of water holding structures.

F. Columns and Beams:

1. Trade size of conduit not to exceed one-fourth of beam thickness.
2. Conduit cross-sectional area not to exceed 4 percent of beam or column cross section.

3.3 CONDUIT APPLICATION

A. Diameter:

1. Interior: 3/4-inch Minimum.
2. Exterior: 1-inch Minimum.

B. Exterior, Exposed:

1. Rigid galvanized steel.
2. PVC-coated rigid galvanized steel.

C. Interior:

1. Exposed:
   a. Rigid galvanized steel.
   b. PVC-coated rigid galvanized steel.
2. Concealed:
   a. Above ceiling
      (1) Electrical Metallic Tubing

D. Interior & Exterior Penetrations Through Concrete:

1. PVC-coated rigid galvanized steel.

E. Aboveground, Embedded in Concrete Walls, Ceilings, or Floors:

1. Listed non-metallic tubing.
2. Rigid galvanized steel.

F. Direct Earth Burial:

1. PVC-coated rigid galvanized steel.
2. PVC conduit.

G. Under Slabs-On-Grade:

1. PVC-coated rigid galvanized steel.
2. PVC conduit

H. Corrosive Areas (Chlorine Room): PVC-Schedule 40 PVC.

3.4 CONNECTIONS

A. For motors, wall or ceiling mounted fans and unit heaters, dry type transformers, electrically operated valves, instrumentation, and other equipment where flexible connection is required to minimize vibration:

1. Conduit Size 4 Inches or Less: Flexible, liquid-tight conduit.
2. Conduit Size Over 4 Inches: Nonflexible.
3. Wet or Corrosive Areas: Flexible, nomnetallic or flexible metal liquid-tight.
4. Dry Areas: Flexible, metallic liquid-tight.
5. Length: 18-inch minimum, 60-inch maximum, sufficient to allow movement or adjustment of equipment.

B. Lighting Fixtures in Dry Areas: Flexible steel, nonliquid-tight conduit.

C. Outdoor Areas, Process Areas Exposed to Moisture, and Areas Required to be Oiltight and Dust-Tight: Flexible metal, liquid-tight conduit.

D. Transition From Underground or Concrete Embedded to Exposed: PVC-coated rigid steel conduit.

E. Under Equipment Mounting Pads: PVC-coated rigid steel conduit.

3.5 PENETRATIONS

A. Make at right angles, unless otherwise shown.

B. Notching or penetration of structural members, including footings and beams, not permitted.

C. Fire-Rated Walls, Floors, or Ceilings: Firestop openings around penetrations to maintain fire-resistance rating using fire penetration seal as specified in Section 07 92 00, Joint Sealants. as specified in Section 07 84 00, Firestopping.

D. Apply heat shrinkable tubing or single layer of wraparound duct band to metallic conduit protruding through concrete floor slabs to a point 2 inches above and 2 inches below concrete surface.

E. Concrete Walls, Floors, or Ceilings (Aboveground): Provide nonshrink grout dry-pack, or use watertight seal device.

F. Entering Structures:

1. General: Seal raceway at the first box or outlet with oakum or expandable plastic compound to prevent the entrance of gases or liquids from one area to another.
2. Concrete Roof or Membrane Waterproofed Wall or Floor:
   a. Provide a watertight seal.
   b. Without Concrete Encasement: Install watertight entrance seal device on each

side.
c. With Concrete Encasement: Install watertight entrance seal device on the accessible side.
d. Securely anchor malleable iron body of watertight entrance sealdevice into construction with one or more integral flanges.
e. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.

3. Heating, Ventilating, and Air Conditioning Equipment:
a. Penetrate equipment in area established by manufacturer.
b. Terminate conduit with flexible metal conduit at junction box or condulet attached to exterior surface of equipment prior to penetrating equipment.
c. Seal penetration with Type 5 sealant, as specified in Section 07 92 00, Joint Sealants.

4. Corrosive-Sensitive Areas:
a. Seal all conduit passing through room walls.
b. Seal conduit entering equipment panel boards and field panels containing electronic equipment.
c. Seal penetration with Type 5 sealant, as specified in Section 07 92 00, Joint Sealants.

5. Existing or Precast Wall (Underground): Core drill wall and install a watertight entrance seal device.

6. Nonwaterproofed Wall or Floor (Underground, without Concrete Encasement):
a. Provide Schedule 40 galvanized pipe sleeve, or watertightentrance seal device.
b. Fill space between raceway and sleeve with expandable plastic compound or oakum and lead joint, on each side.

7. Manholes and Handholes:
a. Metallic Raceways: Provide insulated grounding bushings.
b. Nonmetallic Raceways: Provide bell ends flush with wall.
c. Install such that raceways enter as near as possible to one end of wall, unless otherwise shown.

3.6 SUPPORT

A. Support from structural members only, at intervals not exceeding NFPA 70 requirements, and in any case not exceeding 10 feet. Do not support from piping, pipe supports, or other raceways.

B. Multiple Adjacent Raceways: Provide ceiling trapeze.

C. Application/Type of Conduit Strap:

1. Rigid Steel Conduit: Zinc coated steel, pregalvanized steel or malleable iron.
2. PVC-Coated Rigid Steel Conduit: PVC-coated metal.
3. Nonmetallic Conduit: Nonmetallic or PVC-coated metal.

D. Provide and attach wall brackets, strap hangers, or ceiling trapeze as follows:

1. Wood: Wood screws.
2. Hollow Masonry Units: Toggle bolts.
3. Concrete or Brick: Expansion shields, or threaded studs driven in by powder charge, with lock washers and nuts.
4. Steelwork: Machine screws.
5. Location/Type of Hardware:
a. Dry, Noncorrosive Areas: Galvanized.
b. Wet, Noncorrosive Areas: Stainless steel.
c. Corrosive Areas: Stainless steel.
6. Nails or wooden plugs inserted in concrete or masonry for attaching raceway not permitted. Do not weld raceways or pipe straps to steel structures. Do not use wire in lieu of straps or hangers.

3.7 BENDS

A. Install concealed raceways with a minimum of bends in the shortest practical distance.

B. Make bends and offsets of longest practical radius. Bends in conduits and ducts being installed for fiber optic cables shall be not less than 20 times cable diameter, 15 inches, minimum.

C. Install with symmetrical bends or cast metal fittings.

D. Avoid field-made bends and offsets, but where necessary, make with acceptable hickey or bending machine. Do not heat metal raceways to facilitate bending.

E. Make bends in parallel or banked runs from same center or centerline with same radius so that bends are parallel.

F. Factory elbows may be installed in parallel or banked raceways if there is change in plane of run, and raceways are same size.

G. PVC Conduit:
1. Bends 30 Degrees and Larger: Provide factory-made elbows.
2. 90-Degree Bends: Provide rigid steel elbows, PVC-coated where direct buried.
3. Use manufacturer's recommended method for forming smaller bends.

H. Flexible Conduit: Do not make bends that exceed allowable conductor bending radius of cable to be installed or that significantly restricts conduit flexibility.

3.8 EXPANSION/DEFLECTION FITTINGS

A. Provide on all raceways at all structural expansion joints, and in long tangential runs.

B. Provide expansion/deflection joints for 50 degrees F maximum temperature variation.

C. Install in accordance with manufacturer's instructions.

3.9 PVC CONDUIT

A. Solvent Welding:

1. Provide manufacturer recommended solvent; apply to all joints.
2. Install such that joint is watertight.

B. Adapters:

1. PVC to Metallic Fittings: PVC terminal type.
2. PVC to Rigid Metal Conduit or IMC: PVC female adapter.

C. Belled-End Conduit: Bevel the unbelled end of the joint prior to joining.

3.10 PVC-COATED RIGID STEEL CONDUIT

A. Install in accordance with manufacturer's instructions.

B. Tools and equipment used in the cutting, bending, threading and installation of PVC-coated rigid steel conduit shall be designed to limit damage to the PVC coating.

C. Provide PVC boot to cover all exposed threading.

3.11 WIREWAYS

A. Install in accordance with manufacturer's instructions.

B. Locate with cover on accessible vertical face of wireway, unless otherwise shown.

C. Applications:

1. Metal wireway in indoor dry locations.
2. Nonmetallic wireway in indoor wet, outdoor, and corrosive locations.

3.12 TERMINATION AT ENCLOSURES

A. Cast Metal Enclosure: Provide manufacturer's premolded insulating sleeve inside metallic conduit terminating in threaded hubs.

B. Nonmetallic, Cabinets, and Enclosures:

1. Terminate conduit in threaded conduit hubs, maintaining enclosure integrity.
2. Metallic Conduit: Provide ground terminal for connection to maintain continuity of ground system.

C. Sheet Metal Boxes, Cabinets, and Enclosures:

1. General:
   a. Install insulated bushing on ends of conduit where grounding is not required.
   b. Provide insulated throat when conduit terminates in sheet metal boxes having threaded hubs.
   c. Utilize sealing locknuts or threaded hubs on sides and bottom of NEMA 3R and NEMA 12 enclosures.
   d. Terminate conduits at threaded hubs at the tops of NEMA 3R and NEMA 12 boxes and enclosures.
   e. Terminate conduits at threaded conduit hubs at NEMA 4 and NEMA 4X boxes and enclosures.
2. Rigid Galvanized Conduit:
   a. Provide one lock nut each on inside and outside of enclosure.
   b. Install grounding bushing at source enclosure.
   c. Provide bonding jumper from grounding bushing to equipment ground bus or ground pad.
3. Flexible Metal Conduit: Provide two screw type, insulated, malleable iron connectors.
4. Flexible, Nonmetallic Conduit: Provide nonmetallic, liquid-tight strain relief connectors.
5. PVC-Coated Rigid Galvanized Steel Conduit: Provide PVC-coated, liquid-tight, metallic connector.
6. PVC Schedule 40 Conduit: Provide PVC terminal adapter with lock nut, except where threaded hubs required above.

D. Motor Control Center, Switchboard, Switchgear, and Free-Standing Enclosures:
1. Terminate metal conduit entering bottom with grounding bushing; provide a grounding jumper extending to equipment ground bus or grounding pad.
2. Terminate PVC conduit entering bottom with bell end fittings.

3.13 UNDERGROUND RACEWAYS

A. Grade: Maintain minimum grade of 4 inches in 100 feet, either from one manhole, handhole, or pull box to the next, or from a high point between them, depending on surface contour.

B. Cover: Maintain minimum 2-foot cover above conduit unless otherwise shown.

C. Make routing changes as necessary to avoid obstructions or conflicts.

D. Couplings: In multiple conduit runs, stagger so couplings in adjacent runs are not in same transverse line.

E. Union type fittings not permitted.

F. Spacers:

1. Provide preformed, nonmetallic spacers, designed for such purpose, to secure and separate parallel conduit runs in a trench.
2. Install at intervals not greater than that specified in NFPA 70 for support of the type conduit

used, but in no case greater than 10 feet.

G. Support conduit so as to prevent bending or displacement during backfilling.

H. Installation with Other Piping Systems:

1. Crossings: Maintain minimum 12-inch vertical separation.
2. Parallel Runs: Maintain minimum 12-inch separation.
3. Installation over valves or couplings not permitted.

I. Provide expansion fittings that allow minimum of 4 inches of movement in vertical conduit runs from underground where exposed conduit will be fastened to or will enter building or structure.

J. Provide deflectional/expansion fittings in conduit runs that exit building or structure belowgrade. Conduit from building wall to fitting shall be PVC-coated rigid steel.

K. Backfill:

1. As specified in Section 31 23 24, Trench Backfill. Controlled low strength fill is an acceptable bedding and pipe zone material and backfill material to within 12 inches of the surface.
2. Do not backfill until inspected by Engineer.

3.14 OUTLET AND DEVICE BOXES

A. Install suitable for conditions encountered at each outlet or device in wiring or raceway system, sized to meet NFPA 70 requirements.

B. Size:

1. Depth: Minimum 2 inches, unless otherwise required by structural conditions. Box extensions not permitted.
   a. Hollow Masonry Construction: Install with sufficient depth such that conduit knockouts or hubs are in masonry void space.
2. Ceiling Outlet: Minimum 4-inch octagonal sheet steel device box, unless otherwise required for installed fixture.
3. Switch and Receptacle: Minimum 2-inch by 4-inch sheet steel device box.

C. Locations:

1. Drawing locations are approximate.
2. To avoid interference with mechanical equipment or structural features, relocate outlets as directed by Engineer.
3. Light Switch: Install on lock side of doors.
4. Light Fixture: Install in symmetrical pattern according to room layout, unless otherwise shown.
5. Install cast/threaded boxes in exposed locations. Sheet steel boxes in concealed locations.

D. Mounting Height:

1. General:
   a. Dimensions given to centerline of box.
   b. Where specified heights do not suit building construction or finish, adjust up or down to avoid interference. Do not straddle CMU block or other construction joints.
2. Light Switch: 48 inches above floor.
3. Thermostat: 54 inches above floor.
4. Convenience Receptacle:
   a. General Interior Areas: 36 inches above floor.
   b. Outdoor, All Areas: 18 inches above finished grade.
5. Switch, Motor Starting: 48 inches above floor, unless otherwise indicated on Drawings.

E. Install plumb and level.

F. Flush Mounted:

1. Install with concealed conduit.
2. Install proper type extension rings or plaster covers to make edges of boxes flush with finished surface.
3. Holes in surrounding surface shall be no larger than required to receive box.

G. Support boxes independently of conduit by attachment to building structure or structural member.

H. Install bar hangers in frame construction or fasten boxes directly as follows:

1. Wood: Wood screws.
2. Concrete or Brick: Bolts and expansion shields.
3. Hollow Masonry Units: Toggle bolts.
4. Steelwork: Machine screws.

I. Threaded studs driven in by powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.

J. Provide plaster rings where necessary.

K. Boxes embedded in concrete or masonry need not be additionally supported.

L. Install galvanized mounting hardware in industrial areas.

M. Install separate junction boxes for flush or recessed lighting fixtures where required by fixture terminal temperature.

N. Boxes Supporting Fixtures: Provide means of attachment with adequate strength to support fixture.

O. Open no more knockouts in sheet steel device boxes than are required; seal unused openings.

3.15 JUNCTION AND PULL BOXES

A. Install where shown and where necessary to terminate, tap-off, or redirect multiple conduit runs.

B. Install pull boxes where necessary in raceway system to facilitate conductor installation.

C. Install in conduit runs at least every 150 feet or after the equivalent of three right-angle bends.

D. Use outlet boxes as junction and pull boxes wherever possible and allowed by applicable codes.

E. Use conduit bodies as junction and pull boxes where no splices are required and their use is allowed by applicable codes.

F. Installed boxes shall be accessible.

G. Do not install on finished surfaces.

H. Install plumb and level.

I. Support boxes independently of conduit by attachment to building structure or structural member.

J. Install bar hangers in frame construction or fasten boxes directly as follows:

1. Wood: Wood screws.
2. Concrete or Brick: Bolts and expansion shields.
3. Hollow Masonry Units: Toggle bolts.
4. Steelwork: Machine screws.

K. Threaded studs driven in by powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.

L. Boxes embedded in concrete or masonry need not be additionally supported.

M. At or below grade:

1. Install boxes for below grade conduit flush with finished grade in locations outside of paved areas, roadways, or walkways.
2. If adjacent structure is available, box may be mounted on structure surface just above finished grade in accessible but unobtrusive location.
3. Obtain Engineer's written acceptance prior to installation in paved areas, roadways, or walkways.
4. Use boxes and covers suitable to support anticipated weights.

N. Flush Mounted:

1. Install with concealed conduit.
2. Holes in surrounding surface shall be no larger than required to receive box.
3. Make edges of boxes flush with final surface.

O. Mounting Hardware:

1. Noncorrosive Dry Areas: Galvanized.
2. Noncorrosive Wet Areas: Stainless steel.
3. Corrosive Areas: Stainless steel.
4. Install Drain/breather fittings in NEMA 250 Type 4 and Type 4X enclosures.

3.16 EMPTY RACEWAYS

A. Provide permanent, removable cap over each end.

B. Provide PVC plug with pull tab for underground raceways with end bells.

C. Provide nylon pull cord.

D. Identify, as specified in Article Identification Devices, with waterproof tags attached to pull cord at each end, and at intermediate pull point.

E. Install flush with floor in finished traffic areas not adjacent to walls. Stub up a minimum of 6-inches above floor in non-traffic areas or adjacent to walls.

3.17 IDENTIFICATION DEVICES

A. Raceway Tags:

1. Identify origin and destination.
2. Install at each terminus, near midpoint, and at minimum intervals of every 50 feet of exposed Raceway, whether in ceiling space or surface mounted.
3. Provide nylon strap for attachment.

B. Warning Tape: Install approximately 18 inches above underground or concrete-encased raceways. Align parallel to, and within 12 inches of, centerline of runs.

3.18 PROTECTION OF INSTALLED WORK

A. Protect products from effects of moisture, corrosion, and physical damage during construction.

B. Provide and maintain manufactured watertight and dust-tight seals over all conduit openings during construction.

C. Touch up painted conduit threads after assembly to cover nicks or scars.

D. Touch up coating damage to PVC-coated conduit with patching compound approved by manufacturer. Compound shall be kept refrigerated according to manufacturers' instructions until time of use.

END OF SECTION

SECTION 26 05 43
UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART1 — GENERAL

1.1 SECTION INCLUDES:

A. Specifications for underground electrical conduits, ductbanks, and underground utility structures.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):1.ASTM C33 Specification for Concrete Aggregates

1.3 SUBMITTALS

A. Refer to Section 01 33 00, Submittal Procedures, for submittal requirements and procedures.

B. Product Data. Submit the following:

1. Complete materials list of items proposed to be provided under this Section.
2. Manufacturers' specifications and other data required to demonstrate compliance with these Specifications.
3. Catalog cuts for the following products:
   a. Raceways.

1.4 QUALITY ASSURANCE

A. Qualification of Manufacturers:

1. Select manufacturers of the products specified for work under this Section who are in the business of manufacturing similar products and are able to provide a history of successful production of the specified products.
2. Inspection: Ensure completed facilities are approved by the Resident Engineer before installation of cable and equipment. Perform corrective work at no additional cost to Sound Transit.

PART 2 — PRODUCTS

2.1 RACEWAYS

A. Conduit and duct: In accordance with Section 26 05 33, Raceways and Boxes for Electrical Systems.

2.2 SAND

A. Clean, graded, washed, passing a No. 4 U.S. sieve, and conforming generally to ASTM C33 for fine aggregate.

2.3 WARNING TAPE

A. Heavy gage, yellow, plastic for direct burial, material resistant to corrosive soil, 6-inch minimum width, minimum 4 mils thick.

B. Printed with warning that an electrical circuit is located beneath the tape.

PART 3 — EXECUTION

3.1 PREPARATION

A. Before beginning construction or installation of a section of underground conduit or ductwork,

verify that the site is in suitable condition for installing conduit or ductwork as indicated.

3.2 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform excavation, bedding, and backfilling for underground conduits and structures in accordance with Section 31 23 24, Trenching and Backfilling, and as indicated.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. This Section includes specifications for providing nameplates, wire and cable markers, power circuit identification and conduit color coding.

1.2 RELATED SECTIONS

A. Section 09 91 00 - Painting and Coating

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Refer to Section 01 33 00, Submittal Procedures, for submittal requirements and procedures.

B. Submit manufacturer's product data for mounting adhesive.

C. Submit schedule for nameplates.

PART 2 — PRODUCTS

2.1 NAMEPLATES

A. Engraved three-layer melamine laminated plastic, not less than 3/32-inch thick, black letters on a white background.

B. Labels: Embossed adhesive tape, with 3/16-inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations and similar.

C. Laminated white-over-black plastic such that face is white with black letters, with 1/8" (3 mm) engraved letters securely fastened with minimum of 2 self-tapping, stainless steel screws.

D. Motor starters, either separately mounted or contained in motor control centers, shall have nameplates identifying related equipment. Where separate control and indicating lights are used, starters shall have engraved or etched legends ("start", "stop", etc.) as shown on Drawings.

E. Provide control stations with nameplates identifying related equipment. Control and indicating lights shall have engraved or etched legends as shown on Drawings.

F. Circuit breakers within main switchboards and distribution switchboards shall be provided with nameplates identifying related equipment being served.

G. Fused and nonfused switches shall have 2 front cover-mounted nameplates.

1. Nameplate containing permanent record indicating switch type, manufacturer's name, catalog number, and appropriate rating for equipment served.
2. Provide additional nameplate to identify associated equipment.

H. Panelboards shall have front cover-mounted nameplates identifying panelboard, matching information shown on Drawings and associated panel schedule. Nameplate shall have at least 4 lines of text consisting of:

1. Line 1: Panel equipment identification number.
2. Line 2: IEEE Voltage Designation.

3. Line 3: Appropriate description from which power is derived, (i.e. fed from HP1 through XFMR-LP1).
4. Line 4: Location of power source, (i.e. PP-1, NW wing).

I. Lighting and auxiliary power transformers shall have front cover-mounted nameplates identifying transformer, matching information shown on Drawings. Nameplate shall have at least 2 lines of text that consist of:

1. Line 1: Transformer equipment identification number.
2. Line 2: Location of derived power source (i.e. fed from MDB, Elec Rm Basement).

J. Nameplates shall meet requirements of NFPA 70E

2.2 WIRE AND CABLE MARKERS:

A. Non-fading, plastic, printed sleeve labels.

B. Non-fading, plastic, printed cable tag with holes for attachment to cable with plastic cable ties.

C. Mounting Screws: Stainless steel machine screws.

D. Mounting Adhesive: Permanent.

E. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
2. Control Circuits: Control wire number.

2.3 CONDUIT MARKERS:

A. Conduits inside manholes, hand holes, building entrance pull boxes, and junction boxes shall be provided with 19-gage stainless steel identification tags, with 1/2" (13 mm) stamped letters and numbers.

1. Attach conduit Identification tags with stainless steel banding. Tag position shall be readily visible for inspection.
2. Tags shall provide, as minimum:
   a. Circuit origination and destination.
   b. Voltage.
   c. Number of conductors in accordance with phase.
   d. Number of phase conductors.

B. Cables passing through or terminating in manholes, hand holes, and pull boxes shall have 19-gage stainless steel identification tags with stamped lettering that provides circuit identification information.

C. Provide power, control, and instrumentation cables with permanent type identification markers with typed cable numbers and from/to information at each point of termination. Cable numbers and from/to information will be provided for circuits not associated with low-voltage panelboards.

1. Position cable markers to be readily visible for inspection.
2. Cable numbers shall match those as shown on Drawings.
3. Provide wire tags at each termination point for each conductor. Tags shall be permanent, wrap around, heat-shrinkable type with typewritten information.

2.4 SELF-ADHESIVE LABELS

A. Self-adhesive labels shall be 1/4" high with 1/8" high lettering.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Degrease and clean surfaces to receive nameplates.

B. Install nameplates parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws or adhesive. Secure nameplate to inside face of recessed panelboard or cabinet doors in finished locations.

3.2 IDENTIFICATION SCHEDULE

A. Conductors: Provide sleeve wire markers on each conductor in panelboard, gutters, pull boxes, manholes, and at load connection. In gutters, pull boxes, and manholes, if cables are not spliced, a cable tag may be used. Attach tag securely to cable with plastic cable tie.

1. Power and Lighting Circuits: Identify with branch circuit or feeder number.
2. Control Wiring: Identify with control wire number as indicated on the Contract Drawings.

B. Provide nameplates of minimum letter height as scheduled below.

1. Panelboards, Switchboards, Uninterruptible Power Supplies, Motor Control Centers, Lighting Controllers: 3/8 inch, identify equipment designation; 1/4 inch, identify voltage rating and source.
2. Disconnect Switches: 3/8 inch, identify equipment designation; 1/4 inch, identify voltage rating, source, and load served.
3. Individual Circuit Breakers in Panelboards: 1/4 inch; identify circuit.
4. Motor Starters in Motor Control Centers: 1/4 inch; identify circuit and load served, including location.
5. Individual Circuit Breakers, Enclosed Switches, and Motor Starters: 1/4 inch; identify load served.
6. Transformers: 3/8 inch; identify equipment designation. 1/4 inch; identify primary and secondary voltages, primary source, and secondary load and location.
7. Devices: 1/4 inch; identify device.
    a. Control devices.
    b. Pushbutton stations.

C. Contractor shall provide a printed label on each electrical load (device outlet box, light switch, receptacle, instrument, device, etc) indicating the power source panelboard and circuit number. Label shall be black lettering on white background.

3.3 CONDUIT COLOR CODING

A. Coordinate color of paint with Section 09 91 00, Painting, to identify conduit by system.

B. Low-voltage Distribution System: Unpainted or black.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE

A. Major Equipment Suppliers (Wetco, Inc.) will provide startup and commissioning of their supplied equipment. The Contractor shall assist and support the Major Equipment Suppliers in the starting and commissioning as it relates to the electrical and control system of this project.

B. Commissioning is the responsibility of the Contractor (including subcontractors and vendors).

1. The commissioning process requires Division 26 participation to ensure all portions of the work have been completed in a satisfactory and fully operational manner. The contractor is responsible to provide all support required for start-up, testing, and commissioning.
2. This specification section is intended to provide an indication of the tests, which must be performed by the Contractor prior to verification by the Engineer and the Owner.

C. Work of Division 26 includes the following:

1. Start-up and testing of the equipment.
2. Assistance in testing, adjusting and balancing.
3. Operating equipment and systems as required for commissioning tests.
4. Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial commissioning.
5. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process, which fulfill contract and warranty requirements.
6. Providing operation and maintenance information and as-built drawings to the Owner/Engineer for verification, organization and distribution.
7. Providing assistance to the Owner/Engineer to develop and edit system operation descriptions.
8. Provide training for the systems specified in this Division with coordination by the Owner/Engineer.

1.2 RELATED SECTIONS

A. All start-up and testing procedures and documentation requirements specified within Division 26.

1.3 APPLICABLE CODES, STANDARDS ANDREFERENCES

A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.

1. NETA - International Electrical Testing Association
2. NEMA - National Electrical Manufacturer's Association
3. ANSI - American National Standards Institute
4. IEEE - Institute of Electrical and Electronic Engineers
5. NEC - National Electrical Code
6. NFPA - National Fire Protection Association
7. ASTM - American Society for Testing and Materials
8. IPCEA - Insulated Power Cable Engineers Association
9. AEIC - Association of Edison Illuminating Companies
10. OSHA - Occupational Safety and Health Administration
11. NFPA - National Fire Protection Association
    a. ANSI/NFPA 70: National Electrical Code
    b. ANSI/NFPA 70B: Electrical Equipment Maintenance
    c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
    d. ANSI/NFPA 78: Lightning Protection Code
    e. ANSI/NFPA 101: Life Safety Code
    f. NFPA 99: Health Care Facilities

12. State and local codes and ordinances
13. Applicable Independent Testing Associations Specifications

B. All inspections and tests shall utilize the following references:

1. Project design drawings and specifications
2. Shop drawings and submittals
3. Manufacturer's instruction manuals applicable to each particular apparatus.
4. Applicable NETA acceptance testing work scope section per NETA ATS 1999.

1.4 COORDINATION

A. Coordinate the completion of all electrical testing, inspection, and calibration prior to the start of commissioning activities

B. Coordinate factory field-testing and assistance per the requirements of this section

C. The Contractor shall coordinate and cooperate in the following manner:

1. Allow sufficient time before final commissioning dates to complete electrical testing, inspection, and calibration to avoid delays in the commissioning process.
2. During the commissioning activities, provide labor and material to make corrections when required, without undue delay.

1.5 SUBMITTALS

A. The test report shall include the following:

1. Summary of project
2. Description of equipment tested
3. Description of test
4. Test results
5. Conclusions and recommendations
6. Appendix, including appropriate test forms
7. List of test equipment used and calibration date
8. Conditions for future access to secured computer database of all Test Data

B. Furnish three copies of the completed report to the project engineer no later than 30 days after completion of the project, unless directed otherwise.

1.6 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. Operations and Maintenance Manuals shall be in accordance with Conditions of the Contract and Division 01 Specification Sections.

1.7 SCHEDULE

A. Complete and make fully functional all phases of Division 26 work pertinent to the Commissioning Tests, prior to the testing date determined by the Engineer.

1.8 MEETINGS

A. Attend Commissioning Meetings as required by the Contractor and/or the Engineer.

1.9 SAFETY AND PRECAUTIONS

A. Safety practices shall include, but are not limited to, the following requirements:

1. Occupational Safety and Health Act of 1970 - OSHA 29CFR 1910.269
2. National Fire Protection Association - NFPA 70E.
3. Applicable state and local safety operating procedures.

B. All tests shall be performed with apparatus de-energized except where otherwise specified.

C. The engineering service testing group's lead test engineer for the project shall be a designated safety representative and shall be present on the project and supervise testing operations and safety requirements.

D. Power circuits shall have conductors shorted to ground by a hotline grounded device approved for the purpose in accordance with the appropriate test procedures.

E. In all cases, work shall not proceed until the safety representative has determined that it is safe to do so.

F. The engineering service testing group shall have available sufficient protective barriers and warning signs, where necessary, to conduct specified tests safely.

G. The owner's safety procedures shall be reviewed and understood by the engineering service testing group personnel.

PART 2 — PRODUCTS

2.1 EQUIPMENT EVALUATION PREPARATION

A. The electrical contractor shall torque down all accessible bolts; perform continuity checks on all branch and control wiring; and perform rotational tests for all motors prior to and in addition to tests performed by the engineering service testing group, specified herein. Contractor shall remove metal shavings and thoroughly clean and vacuum equipment before testing or energizing.

B. The electrical contractor shall supply a suitable and stable source of test power for testing at each test site. The engineering service testing group shall specify requirements.

C. The electrical contractor shall notify the engineering service testing group when equipment becomes available for electrical tests. Work shall be coordinated to expedite project scheduling.

D. The contractor shall notify the Owner/Engineer prior to commencement of any testing.

E. The electrical contractor shall be responsible for implementing all final settings and adjustments on protective devices and electrical equipment.

F. Any system, material or workmanship which is found defective on the basis of electrical tests shall be reported directly to the Engineer.

G. The contractor shall maintain a written record of all tests and upon completion of the project, assemble and certify a final test report.

2.2 TEST EQUIPMENT

A. Provide test equipment as necessary for star-up and commissioning of the electrical equipment and systems.

B. Electrical Megohmmeter for Insulation Testing:

1. 1000 V dc output voltage suitable for resistance measurement from 500 kilohm to 500,000 megohms. Use a megohmmeter with an internal bleeder resistor for discharge.
2. Approved Manufacturer: Hipotronics or approved equal.

2.3 TEST EQUIPMENT - PROPRIETARY

A. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment.

1. Manufacturer shall demonstrate its use, and assist the Test Engineer in the commissioning process.
2. Proprietary test equipment shall become the property of the Owner upon completion of

commissioning.

B. Identify the proprietary test equipment required in the test procedure submittals and in a separate list of equipment to be included in the Operations and Maintenance Manuals.

PART 3 — EXECUTION

3.1 REQUIREMENTS

A. Work prior to commissioning:

1. Complete all phases of work so the system can be started, tested, adjusted, balanced, and otherwise commissioned.
   a. Division 26 has primary start-up responsibilities for Division 26 equipment with obligations to complete systems, including all sub-systems so they are fully functional.
   b. This includes the complete installation of all equipment, materials, conduit, wire, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.
2. Major Equipment Suppliers will develop commissioning plans specific to the performance of the supplied equipment.
   a. Division 26 is obligated to assist the as required in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation.
   b. If system modifications/clarifications are in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner.
   c. If Contractor-initiated system changes have been made that alter the commissioning process, the Contractor will notify the Owner's Representative for approval.
3. Specific pre-commissioning responsibilities of Division 26 are as follows:
   a. Inspection, calibration and testing of the following equipment:
      (1) Transformers
      (2) Primary switchgear
      (3) Automatic transfer switches
      (4) Emergency power systems
      (5) Electrical distribution systems
      (6) Lighting control systems and lighting level verification
      (7) Normal start-up services required to bring each system into a fully operational state:
   b. These include cleaning, testing, motor rotation check, control sequences of operation, full and part load performance, etc.
   c. Major Equipment Suppliers will not begin the commissioning process until each system is complete, including normal Contractor start-up and the work has been completed.
4. Commissioning is intended to begin upon completion of a system.
   a. Commissioning may proceed prior to the completion of systems, or sub-systems, and will be coordinated with the Electrical Contractor.
   b. Start of commissioning before system completion will not relieve Division 26 from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING

A. Provide skilled technicians to start up all systems within Division 26.

1. These same technicians shall be made available to assist the Major Equipment Suppliers in completing the commissioning program as it relates to each system and their technical specialty.
2. Work schedules, time required for testing, etc., will be requested and coordinated by the Major Equipment Suppliers.
3. Division 26 will ensure that the qualified technician(s) are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustment, and/or problem resolutions.

B. System problems and discrepancies may require additional technician time, redesign and/or reconstruction of systems and system components. The additional technician time shall be made available for the subsequent commissioning periods until the required system performance is obtained.

C. The Owner and Engineer reserve the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Major Equipment Suppliers to get the job done.

3.3 WORK TO RESOLVE DEFICIENCIES

A. In some systems, mis-adjustments, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems.

1. This work will be completed under the direction of the Engineer with input from the Contractor, and/or the equipment supplier.
2. Whereas all members will have input and the opportunity to discuss the work and resolve problems, the Owner will have final jurisdiction on the necessary work to be done to achieve performance.

B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process.

1. Experimentation to render system performance will be permitted.
2. If the Commissioning Authority deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, notify the Owner indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities.
3. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem.
4. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall, and during peak turbidity conditions in the raw water.

1. Initial commissioning will be done as soon as contract work is completed, regardless of season.
2. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.

B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance.

1. Heating equipment will be tested during winter design extremes.
2. Cooling equipment will be tested during summer design extremes, with a fully occupied building.
3. Filtration equipment will be tested during peak turbidity levels in the raw water. Each Contractor and supplier will be responsible to participate in the peak season test of the systems required to demonstrate performance, as scheduled by the Major Equipment Supplier, with three day (minimum) advance notification.

C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use.

1. All equipment and systems effected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance.
2. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

3.5 RECOMMISSIONING

A. After the initial and peak season commissioning is completed, there may be additional work required to serve new or revised loads. This work is not part of the contract.

3.6 TRAINING

A. Participate in the training of the Owner's staff on each system and related components Training, in part, may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids.

B. Training may be conducted jointly by the Major Equipment Supplier's representative, the design engineers, the Contractor, and the equipment vendors. The Major Equipment Suppliers will be responsible for highlighting system peculiarities specific to this project.

3.7 SYSTEMS DOCUMENTATION

A. In addition to the requirements of Division 1, update contract documents to incorporate field changes and revisions to system designs to account for actual constructed configurations.

1. All drawings shall be red-lined on two sets.
2. Division 26 as-built drawings shall include architectural floor plans, elevations and details, and the individual mechanical or electrical systems in relation to actual building layout.

B. Maintain as-built red-lines as required by Division 1.
1. Given the size and complexity of this project, red-lining of drawings at completion of construction, based on memory of key personnel, is not satisfactory.
2. Continuous and regular red-lining is considered essential and mandatory.

3.8 SWITCHBOARD ACCEPTANCE TESTING FOR MAIN SERVICE EQUIPMENT

A. Examine the Main switchboard(s), including breakers, and accessories for:

1. Doors, panels, and sections for alignment, dents, scratches, fit, and missing hardware.
2. Shipped loose and shipped short components.
3. Shipping damage.
4. Loose or obviously damaged components.
5. Proper identification.
6. Physical damage from installation.
7. If the unit was placed in temporary storage, verify and record that proper procedures were observed. Remove temporary heater wiring and shipping braces.

B. Inspect

1. Shipping Splits to insure that all bus connections were properly connected and all control wiring splits have been properly terminated.
2. Inspect all grounding connections for cleanliness and alignment.
3. Main Bonding Jumper for proper size and termination (Refer to NEC Article 250, Section 250-102, Equipment Bonding Jumpers).
4. Insulators for evidence of physical damage or contaminated surfaces.
5. Surge Arrester and/or Surge Suppression size, type, installation and connection to determine if they are in accordance with the drawings (Refer to NEC Article 280)
6. Control power & instrument transformers, if applicable.
7. Wiring for damaged insulation, broken leads, tightness of connections, proper crimping, and overall general condition

C. Verify structure, grounding, cables and bus assembly:

1. Anchorage (per local codes, wind and seismic considerations).
2. Required area clearances, correct alignment and cleanliness.
3. Verify the grounding electrode conductor is properly sized (in accordance with NEC Article 250, Table 250-66) and terminated.
4. The proper grounding of instruments, panels and connections (Refer to NEC Article 250, Part J, Sections 250-170 through 250-178).
5. Conductor identification (as applicable).
6. Cable termination tightness.
7. That all cables have been properly installed, routed and supported and are clear of energized

parts.
8. That conduits and conduit bushings are correctly installed.
9. Tightness of accessible bolted electrical connections, especially shipping splits, by calibrated torque-wrench method in accordance with manufacturers published data.

D. Verify Control & Instrumentation:

1. That all VT and CT ratios properly correspond to drawings and that polarity is correct.
2. That shorting screws and bars are removed from CT's and terminal blocks as required.
3. That primary and secondary fuse ratings or circuit breakers match drawings.
4. Meter scaling and type match drawings.

E. Set Meter, Relay, & Breaker Trip settings.

3.9 CABLE TESTING

A. General

1. Insulation System - To insure integrity of the cable insulation system after shipping, site storage, and pulling through conduit an insulation resistance test will reveal insulation deformities and moisture in the cable that otherwise might cause an untimely premature cable failure possibly damaging equipment or personnel. Perform the following on all customer power cables to and from main switchboard. This would include cables from utility transformer to MSB and cables from MSB to all secondary switchboards or distribution panels.
2. Visually inspect visible portion of cables for observable defects.

B. Low-Voltage Cables:

1. Insure all solid-state devices are disconnected from the system prior to meggering. Typically but not all-inclusive would be Meters, trip units with voltage sensing, and TVSS units.
2. Isolate cables by opening breakers. Meggering thru equipment like motors or transformers will produce erroneous readings.
3. Perform insulation-resistance tests on each line and load cable, phase-to-phase, phase-to-ground, phase-to-neutral and neutral-to-ground in each conduit. Megger at 1000 Vdc for 600 volt cable and 500 Vdc for 300 volt cable for one minute.
4. Insulation resistance shall be above 100 ohms and preferably above one megohm.
5. Insure cable termination connections are tight after testing.

3.10 RESTORATION OF EQUIPMENT AND REPORTS

A. Before energizing:

1. Remove and account for all test equipment, jumper wires, and tools used during testing.
2. Remove and account for safety grounds and tools.
3. Replace all barriers and covers, close all doors, and secure all latches.
4. Remove safety locks and tags.
5. Insure all adjustable meters, relays and trip devices are properly set in accordance with the coordination study.
6. Apply testing label to equipment.

B. Note corrective actions taken, deficiencies, recommendations and any general comments.

C. Finish recording data on test forms, completely filling in the blanks.

D. Turn in 3 copies of report to engineer for approval.

3.11 MISCELLANEOUS SUPPORT

A. Division 26 shall remove and replace covers of electrical equipment, open access panels, etc., to permit Contractor, Engineer and Owner's representatives to observe equipment and controllers provided.

B. Furnish ladders, flashlights, tools and equipment as necessary.

END OF SECTION

SECTION 26 22 13
LOW-VOLTAGE GENERAL PURPOSE TRANSFORMERS

PART I — GENERAL

1.1 SECTION INCLUDES:

A. Dry-Type two-winding transformers.

1.2 REFERENCES:

A. National Electrical Manufacturers Association (NEMA):

1. NEMA ST 20 Dry Type Transformers for General Applications
2. NEMA TP 1 Guide for Determining Energy Efficiency for Distribution Transformers

1.3 SUBMITTALS

A. General: Refer to Section 01 33 00, Submittal Procedures, for submittal requirements and procedures.

B. Product Data: Submit manufacturer's product data of manufactured materials and equipment including the following.

1. Outline and support point dimensions of enclosures and accessories
2. Unit weights
3. Voltage, kVA and impedance ratings and characteristics
4. Loss data, efficiency at 25, 50, 75 and 100 percent rated load
5. Sound level
6. Tap configuration
7. Insulation system type and rated temperature rise.

C. Operation and Maintenance Data: Submit in accordance with Section 01 78 23, Operation and Maintenance Data, including the requirements identified above for submittal information.

D. Test Reports: Submit test reports of factory and field tests performed, verifying that performance of equipment meets specification requirements.

1.4 DELIVERY, STORAGE AND HANDLING

A. Ship each unit securely wrapped, packaged, and labeled for safe handling of shipment and to avoid damage or distortion.

B. Store transformers in secure, warm and dry storage facility.

C. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

PART 2 — PRODUCTS

2.1 DRY TYPE TWO-WINDING TRANSFORMERS

A. Dry Type Transformers: NEMA ST 20 and TP 1; factory-assembled, air cooled dry type transformers; ratings as shown on Contract Drawings.

B. Insulation system and average winding temperature rise for rated kVA as follows:

1. 1 to 15 kVA: Class 220 insulation, 115 degrees C rise.
2. 16 to 500 kVA: Class 220 insulation, 115 degrees C rise.
3. 501 to 2000 kVA: Class 220 insulation, 80 degrees C rise.

C. Load Ratings and Transformer Cooling: Load ratings, unless noted otherwise, are assumed to be AA (air convection cooling). For transformers larger than 500 kVA, provide mounting hardware and internal thermostats appropriate for future installation of external fans. Provisions shall be capable of increasing the transformer full-load rating by50 percent.

D. Winding Taps

1. Transformers Less than 15 kVA: Two 5 percent, full-capacity taps below rated voltage on primary winding.
2. Transformers 15 kVA and larger: NEMA ST 20.

E. Sound Levels: NEMA ST 20

F. Basic Impulse Level.

1. Low-voltage Dry-Type Transformers: 10 kV.

G. Ground core and coil assembly to enclosure by means of a visible, flexible copper grounding strap.

H. Mounting: Transformers 75 kVA and less shall be suitable for wall, floor, or trapeze mounting; transformers larger than 75 kVA shall be suitable for floor or trapeze mounting.

I. Coil Conductors: Continuous windings with terminations brazed or welded.

J. Enclosure: NEMA ST 20; Type 1, drip-proof.

K. Isolate core and coil from enclosure using vibration-absorbing mounts.

L. Nameplate: Include transformer connection data.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Set transformers plumb and level.

B. Use flexible conduit, 2-foot minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the structure.

D. Provide restraints for vertical and horizontal seismic motion in accordance with the seismic requirements in Section 26 05 00, Common Work Results for Electrical.

3.2 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Distribution panelboards.

B. Lighting branch-circuit panelboards.

1.2 REFERENCES:

A. National Electrical Manufacturers Association (NEMA):

1. PB-1-2006 Panelboards
2. AB-1-2002 Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures

B. National Fire Protection Association (NFPA):

1. 70-2005 National Electrical Code (NEC)
2. 70E-2004 Standard for Electrical Life Safety in the Workplace

C. Underwriters Laboratories, Inc. (UL):

1. 50-2003 Enclosures for Electrical Equipment
2. 67-2003 Panel boards
3. 489-2006 Molded Case Circuit Breakers and Circuit Breaker Enclosures

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. Section 09 91 00, Painting: Identification and painting of panelboards.

C. Section 26 05 00, Common Work Results for Electrical Systems: General electrical requirements and items that are common to more than one Section of Division 26.

D. Section 26 05 33, Raceway and Boxes for Electrical Systems: Conduits and outlet boxes.

E. Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables: Cables and wiring.

F. Section 26 05 26, Grounding and Bonding for Electrical Systems: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

G. Section 26 24 19.70, Integrated Transient Voltage Surge Suppressors (TVSS/SPDS) for Low Voltage Motor Control Centers.

1.4 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.5 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."

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittal Procedures.

B. 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.

C. 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 bus configuration, current, and voltage ratings.
3. Short-circuit current rating of panelboards and overcurrent protective devices.
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Include selectable ranges for each type of overcurrent protective device.

D. Qualification Data: For qualified testing agency.

E. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 00. 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.

F. 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.

G. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

H. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23, 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 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. 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.

D. 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.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.8 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 NECA 407.

1.9 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 minus 23 degrees F to plus 104 degrees F.
   b. Altitude: Not exceeding 6200 feet.

B. 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 Architect, Construction Manager, and Owner no fewer than two (2) days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's and/or Owner's written permission.
3. Comply with NFPA 70E.

1.10 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 form work requirements are specified in Division 03.

1.11 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.

1. Warranty Period: Five (5) years from date of Substantial Completion.

1.12 EXTRA MATERIALS

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 (2) spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two (2) spares for each panelboard.

PART 2 — PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48.

B. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.
   a. Outdoor Locations: NEMA 250, Type 3R
   b. 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. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:
   a. Panels and Trim: Steel and galvanized 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.
7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top and bottom.

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. Neutral Bus: Neutral bus rated 100 percent of phase bus.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one (1) 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:

1. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of allowable upstream and branch devices, listed

and labeled for series-connected short-circuit rating by UL.
2. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two (2) latches, keyed alike.

D. Mains: As Noted On Drawings.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. 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.

G. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: As Noted On Drawings.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Automatic trip-free with 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. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Breakers: Single pole configurations as required for sleeping area circuits. Refer to drawings for circuit assignments.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Minimum interrupting rating as indicated by not less than:
      (1) 120/208 Volt Panelboard: 10,000 amperes symmetrical.
      (2) 120/240 Volt Panelboard: 10,000 amperes symmetrical.
      (3) 277/480 Volt Panelboard: 14,000 amperes symmetrical.
   c. Arc quenchers and phase barriers for each pole.
   d. Quick-make, quick-break operating mechanisms.
   e. Operating handle which indicates ON, TRIPPED and OFF positions.
   f. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
   g. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   h. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   i. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
9. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

2.5 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.

B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 — EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

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 NECA 407.

B. Installation shall be in accordance with the Manufacturer's instructions, the NEC, as shown on the drawings, and as specified.

C. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 03 30 00.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch 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.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

E. Comply with mounting and anchoring requirements specified in Section 26 05 29.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. 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.

H. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of cabinets with designated space.

I. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

J. Install filler plates in unused spaces.

K. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

L. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53.

B. Create a directory to indicate installed circuit loads after balancing panelboard 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 26 05 53.

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53.

E. Provide ARC flash identification per NFPA 70E.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. 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.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 13
ELECTRICITY METERING

PART 1 — GENERAL

1.1 SECTION INCLUDES:

A. Section includes equipment for electricity metering by utility company.

1.2 RELATED DOCUMENTS

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

1.3 DEFINITIONS

A. KY Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay opening and closing in response to the rotation of the disk in the meter.

B. PC: Personal computer.

1.4 SUBMITTALS

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

B. Shop Drawings: For electricity-metering equipment.

1. Dimensioned plans and sections or elevation layouts.
2. Wiring Diagrams: For power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.

C. Field quality-control reports.

D. Operation and Maintenance Data. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Application and operating software documentation.
2. Software licenses.
3. Software service agreement.
4. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy Submittal.

1.5 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, store, and handle modular meter center according to NECA 400.

1.7 PROJECT CONDITIONS

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 Architect, Construction Manager and Owner no fewer than two days in advance of

proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Architect's, Construction Manager's and Owner's written permission.

1.8 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

1. Comply with requirements of utilities providing electrical power services.
2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 — PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

B. Meter Sockets: Comply with requirements of electrical-power utility company.

C. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install modular meter center according to NECA 400 switchboard installation requirements.

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
2. Equipment Identification Labels: Adhesive film labels with clear protective overlay. For residential meters, provide an additional card holder suitable for printed, weather-resistant card with occupant's name.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
2. Turn off circuits supplied by metered feeder and secure them in off condition.
3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at

test-load connection. Record test results.

C. Electricity metering will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Switches

1. General Purpose switches.
2. Motor Rated switches

B. Receptacles

1. General purpose receptacles.
2. Ground fault circuit interrupter receptacles.
3. Special Purpose receptacles.
4. Corrosion resistant receptacles.

C. Device Plates

1. Plastic.
2. Metal.
3. Cast metal.
4. Weatherproof.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM): A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. Federal Specifications (FS):
   a. W-C-596, General Specification for Connector, Electrical, Power.
   b. W-S-896F/GEN, Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification).
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. WD 1, General Requirements for Wiring Devices.
4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
5. Underwriters Laboratories Inc. (UL):
   a. 498, Standard for Attachment Plugs and Receptacles.
   b. 508, Standard for Safety for Industrial Control Equipment.
   c. 943, Standard for Ground-Fault Circuit-Interrupters.
   d. 1449, Standard for Transient Voltage Surge Suppressors.

1.3 SUBMITTALS

A. Action Submittals: Manufacturer's product data for wiring devices.

PART 2 — PRODUCTS

2.1 SWITCHES

A. Switch, General Purpose:

1. NEMA WD 1 and FS W-S-896F/GEN.
2. Totally enclosed, ac type, with quiet tumbler switches and screw terminals.
3. Rivetless one-piece brass or copper alloy contact arm with silver alloy contacts.
4. Capable of controlling 100 percent tungsten filament and fluorescent lamp loads.
5. Rating: 20 amps, 120/277 volts.
6. Color: White.

7. Automatic grounding clip and integral grounding terminal on mounting strap.
8. Manufacturers and Products, Industrial Grade:
    a. Arrow Hart; 2221 Series.
    b. Bryant; 4901 Series.
    c. Hubbell; 1222Series.
    d. Leviton; 1221 Series.

B. Switch, Motor Rated:

1. Type: Two-pole or three-pole, manual motor starting/disconnect switch without overload protection.
2. Enclosure/Mounting and Rating:
    a. General Purpose:
        (1) Totally enclosed snap-action switch. Quick-make, slow-break design with silver alloy contacts. UL 508 listed.
        (2) General Purpose Rating: 30 amperes, 600V ac.
        (3) Minimum Motor Ratings:
            (a) 2 hp for 120V ac, single-phase, two-pole.
            (b) 3 hp for 240V ac, single-phase, two-pole.
            (c) 15 hp for 480V ac, three-phase, three-pole.
        (4) Screw-type terminals.
3. Manufacturers:
    a. General Purpose:
        (1) Bryant.
        (2) Hubbell.
    b. Explosion-Proof: Eaton, Type B101.

2.2 RECEPTACLES

A. Receptacle, General Purpose:

1. NEMA WD 1 and FS W-C-596.
2. Duplex, two-pole, three-wire grounding type with screw type wire terminals.
3. Impact resistant nylon cover and body.
4. One-piece mounting strap with integral ground contact (rivetless construction).
5. Contact Arrangement: Contact to be made on two sides of each inserted blade without detent.
6. Rating: 125 volts, NEMA WD 1, Configuration 5-20R, 20 amps.
7. Size: For 2-inch by 4-inch outlet boxes.
8. Industrial Grade:
    a. Color: White
    b. Manufacturers and Products:
        (1) Arrow Hart; 5362 Series.
        (2) Bryant; 5362 Series.
        (3) Hubbell; 5362 Series.
        (4) Leviton; 5362 Series.

B. Receptacle, Ground Fault Circuit Interrupter:

1. Meet requirements of general-purpose receptacles.
2. Listed Class A to UL 943, tripping at 5 mA.
3. Color: White.
4. Standard Model: NEMA WD 1, with screw terminals and provisions for testing.
5. Feed-Through Model: NEMA WD 1, with feed-through screw terminals and provisions for testing.
6. Manufacturers:
    a. Bryant.
    b. Hubbell.
    c. Arrow Hart.
    d. Leviton.

C. Receptacle, Corrosion-Resistant (Chlorine Room only).

1. Meet requirements of general-purpose receptacles.

2. Nickel coated metal parts.
3. Color: White.
4. Manufacturer and Product:
   a. Hubbell; 52CM62/53CM62
   b. Leviton; 52CM-62/53CM-62.

D. Receptacle, Special-Purpose:
1. Rating and number of poles as indicated or required for anticipated purpose.
2. One matching plug with cord-grip features for each special-purpose receptacle.

2.3 DEVICE PLATES

A. General: Sectional type plates not permitted.

B. Plastic:

1. Material: Specification grade, 0.10-inch minimum thickness, noncombustible, thermosetting.
2. Color: To match associated wiring device.
3. Mounting Screw: Oval-head metal, color matched to plate.

C. Metal:

1. Material: Specification grade, one-piece, 0.040-inch nominal thickness stainless steel.
2. Finish: ASTM A167, Type 302/304, satin.
3. Mounting Screw: Oval-head, finish matched to plate.

D. Cast Metal:

1. Material: Malleable ferrous metal or copper-free aluminum, with gaskets.
2. Screw: Oval-head stainless steel.

E. Weatherproof:

1. Receptacles, Weatherproof Type 1:
   a. Gasketed, cast-aluminum, with individual cap over each receptacle opening.
   b. Mounting Screw and Cap Spring: Stainless steel.
   c. Manufacturers and Products:
      (1) Crouse-Hinds; Type WLRD-1.
      (2) Appleton; Type FSK-WRD.
2. Receptacles, Weatherproof Type 2:
   a. UL listed for WET location while in use.
   b. Polycarbonate cover.
   c. Locking type.
   d. Manufacturers and Products: TayMac; Type Multi-Mac.
3. Switches:
   a. Gasketed, cast-metal or cast-aluminum, incorporating external operator for internal switch.
   b. Mounting Screw: Stainless steel.
   c. Manufacturers and Products:
      (1) Crouse-Hinds; DS-181 or DS-185.2
      (2) Appleton; FSK-1VTS or FSK-1VS.

PART 3 — EXECUTION

3.1 SWITCHES

A. Switch, General Purpose:

1. Mounting Height: See Section 26 05 33, Raceway and Boxes.
2. Install with switch operation in vertical position.
3. Install single-pole, two-way switches so toggle is in up position when switch is on.

B. Switch, Motor Rated:

1. Mounting Height: See Section 26 05 33, Raceway and Boxes.
2. Install with switch operation in vertical position so toggle is in up position when ON.
3. Install within sight of motor when used as a disconnect switch.

3.2 RECEPTACLES

A. Duplex Receptacles:

1. Install with grounding slot down, except where horizontal mounting is shown, in which case install with neutral slot up.
2. Ground receptacles to boxes with grounding wire only.
3. Weatherproof Receptacles:
   a. Install in cast metal box.
   b. Install such that hinge for protective cover is above receptacle opening.
4. Ground Fault Interrupter: Install feed-through model at locations where ground fault protection is specified for "downstream" conventional receptacles.
5. Special-Purpose Receptacles: Install in accordance with manufacturer's instructions.

3.3 DEVICE PLATES

A. Securely fasten to wiring device; ensure a tight fit to box.

B. Flush Mounted: Install with all four edges in continuous contact with finished wall surfaces without use of mats or similar materials. Plaster fillings will not be acceptable.

C. Surface Mounted: Plate shall not extend beyond sides of box, unless plates have no sharp corners or edges.

D. Install with alignment tolerance to box of 1/16 inch.

E. Engrave with designated titles.

F. Types (Unless Otherwise Shown):

1. Exterior:
   a. Switch: Weatherproof.
   b. Receptacle in DAMP location: Weatherproof Type 1.
   c. Receptacle in WET location: Weatherproof Type 2.

G. Interior:

1. Flush Mounted Boxes: Metal.
2. Surface Mounted, Metal Boxes:
   a. General Purpose Areas: Sheet Steel.
   b. Other Areas: Cast.
3. Surface Mounted, Aluminum Boxes:
   a. General Purpose Areas: Stamped.
   b. Other Areas: Cast.
4. Surface Mounted, Sheet Steel Boxes: Raised sheet steel.
5. Surface Mounted, Nonmetalic Boxes: Manufacturer’s standard.
6. Receptacle shown as Weatherproof on Drawings: Weatherproof Type 1.

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following:

1. Cartridge fuses rated 600V and less for use in switches.
2. Spare-fuse cabinets.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.3 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 1 include the following:
   a. Let-through current curves for fuses with current-limiting characteristics.
   b. Time-current curves, coordination charts and tables, and related data.
   c. Ambient temperature adjustment information.

C. Closeout: Submittals listed above, updated to record status.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

E. Comply with the following standards:

1. ANSI C97.1 - Low Voltage Cartridge Fuses 600 Volts or Less
2. ANSI/UL 198C - High Interrupting Capacity Limiting Class L Fuses
3. ANSI/UL 198E - Class R Fuses
4. ANSI/UL 198G - Fuses for Supplementary Overcurrent Protection
5. ANSI/UL 512 - Fuseholders

1.5 DESIGN REQUIREMENTS

A. Select fuses to provide appropriate levels of short circuit and overcurrent protection for components such as wire, cable, bus structures, and other equipment. Design system to ensure that component damage is within acceptable levels during a fault.

B. Select fuses to coordinate with time-current characteristics of other overcurrent protective elements, such as other fuses, circuit breakers, and protective relays. Design system to ensure that device closest

to fault operates.

1.6 FUSE PERFORMANCE REQUIREMENTS

A. Motor Load Feeder Switches: Class RK1 (time delay).

1.7 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg. F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Quantity equal to ten percent of each fuse type and size, but no fewer than six of each type and size.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussman, Inc.
2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

B. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 — EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures and elevation to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Intermixing of fuse type and manufacturers within the same series-connected circuit is prohibited.

B. Fuse types (e.g. KRP-C & FRS) of the same manufacturer within the same series connected circuit is permitted and encouraged.

C. Motor Branch Circuits:

1. Standard motor circuits Class RK1, time delay.
2. Motor circuits for adjustable speed drives Class J, fast acting.

D. Branch Circuits: Class RK1, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is not up-side-down and readable without removing fuse.

B. Fuse Blocks: Install fuses in fuse blocks rated for the respective fuse class.

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION

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SECTION 26 29 13.16
REDUCED-VOLTAGE MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish and install solid state starter as shown on the drawings and as specified herein, including all required appurtenances. The solid state starter shall be microprocessor controlled, suitable for use with three phase induction motors rated 600 VAC or less. The starter shall provide a closed loop current ramp for smooth and stepless motor acceleration and deceleration.

1.2 QUALITY ASSURANCE

A. The solid state starter shall be the product of a manufacturer who has produced solid state starters of the same type and size for a minimum of 10 years consecutive. When requested by the Engineer, a Users List, complete with telephone numbers and contact persons shall be furnished for verification.

B. For safety, reliability, and continuity of warranty, any modifications, alterations, etc. required to conform to the requirements of this specification shall be performed by the Starter Manufacturer only. Distributor modifications, third party packaging, etc. of a Manufacturer's standard product are specifically disallowed

C. The solid state starter shall be designed, manufactured and tested to conform, where applicable, to the following industry standards and specifications:

1. NEC
2. UL
3. CSA
4. NEMA ICS2
5. EEMAC
6. OSHA
7. IEEE

D. Environmental Requirements:

1. Temperature: 0 - 50-deg C (32° F to 140° F Min.)
2. Relative Humidity: up to 95%, non-condensing
3. Input Power: 480V AC, 3 Phase, +/- 10% 50-60 Hz, +/- 3 Hz.
4. Meet Uniform Building Code on non-building structures, section 2338 for zone 1, 2, 3, and 4 requirements.

1.3 SUBMITTALS

A. Submittals shall be furnished in accordance with Specification Section 01 33 00 - Submittal Procedures.

B. Provide the following:

1. Elementary wiring and interconnection diagrams in accordance with NEMA ICS standards.
2. Size, type, and rating of all system components
3. Enclosure frontal elevation and dimension drawings.
4. Internal component layout diagrams.
5. Available conduit entry and exit locations.
6. Manufacturer's product data sheets.

1.4 DELIVERY, STORAGE AND HANDLING

A. Handling and shipment of the equipment shall be in such a manner to prevent internal component damage, breakage, and denting and scoring of the enclosure finish.

B. Equipment shall be stored indoors in a clean, dry environment. Energize space heaters if furnished.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Benshaw, Inc.

B. Motortronics.

C. Or Engineer approved equal meeting the detailed requirements of this specification

2.2 EQUIPMENT DESIGN CRITERIA

A. Size:40 HP

B. Minimum Overload Rating: 500% of Starter FLA for 30 sec., 125% cont.

C. PIV Ratings:1800V Minimum

D. Rated Short Circuit Amps:42KAIC

E. Insulation Test:2500VAC Minimum

F. Overall Efficiency w/o Bypass: Average 99.7%

G. Overall Efficiency w/Bypass: 99.94%

H. SCR Firing Technique :Hard Drive with "picket fence"

I. Transient Voltage Protection: dV/dT circuits or SIOV/ phase

J. Under voltage Protection: 80% Pickup; 60% Dropout

K. Control Input: Dry contact, 2 wire.

L. Starts Per Hour: Minimum of 5

M. Min Time Between Restarts: Not more than 2 minutes

N. Audible Noise: Not to exceed 60dbA @ 1 meter at any time

2.3 ENCLOSURE CONSTRUCTION

A. Construct to comply with NEMA Part ICS 2.

B. Basic structure shall be welded type construction utilizing minimum 14 GA sheet metal.

1. Doors shall be minimum 14 GA sheet metal, pan type with flanges formed to provide sturdy, rigid structure.
2. Door latches and hinges capable of holding door closed during maximum fault condition.
3. Provide defeatable door interlocks to prevent doors from being opened with power applied
4. Provide removable lifting provisions on floormount enclosures.

5. Each structure shall be provided with removal lifting provisions.

C. The starters and any required accessories or auxiliary items shall fit within the space shown on the Plans

D. Finish:

1. Metal parts to be given thorough rust resistant treatment.
2. Primer shall be S-W recoatable epoxy primer B-67 Series
3. Finish shall be S-W high solid polyurethane polate T plus F63 series
4. Color shall be ANSI 61

E. Complete with internal power and control wires including terminations for external connections. Phase sequencing shall have proper identification and control wires shall have suitable markings at terminations.

2.4 MAIN AND BYPASS CONTACTORS

A. Inline (main) contactor and a bypass contactor shall be provided.

1. Full NEMA rated (IEC rated contactors cannot be accepted)
2. Current rating: manufacturer standard for horsepower rating .
3. Voltage rating: Up to 600 VAC.
4. The main, bypass, and capacitor contactors shall be sequenced by the starter manufacturer for proper operation of the solid state starter.
5. The bypass contactor shall bypass the SCR's after starting and while the starter is in the run (full voltage) mode.

2.5 CONSTRUCTION

A. Enclosure Construction:

1. The starter cabinet shall contain the following:
   a. NEMA rated inline and bypass contactors.
   b. Low voltage control devices.
   c. Auxiliary metering and control devices as specified herein or as shown on the Contract Drawings
   d. Power factor correction capacitor rated for 95% Power Factor.
   e. Contactor to apply power factor correction capacitor after RVSS bypass contactor is closed.

B. Power Fuses:

1. Current limiting type rated 42KAIC symmetrical at max. 600V.
2. Fuse size shall be manufacturer's standard.
3. Fuses shall be vertically mounted in the front of the enclosure for ease of inspection and removal without special tools.
4. Provide blown fuse indication.
5. Power fuse holders shall be part of starter assembly.

C. SCR Stacks:

1. Arranged horizontally for proper heat management.
2. Heat sinks sized for specified Starts Per Hour without requiring auxiliary cabinet cooling fans.

2.6 CONTROL DEVICES

A. Control Power Transformer

1. Provide an appropriately rated internal 480V-120VAC step-down transformer.

2. Supply two fuses on primary and one fuse on secondary side with one leg grounded.

B. Control Wiring: minimum 16 GA stranded, rated for 600 V.

C. Terminal Strips: Rated for 600 V, suitable for contractor termination of up to 10 GA wire.

D. Push buttons, pilot lights, and control relays, heavy duty, rated to 600 V.

2.7 SOLID STATE STARTER LOGIC CONTROL

A. Provide a door mounted Display & User Interface Module with the following functions:

1. Backlit LCD- 2 Lines, 16 Characters
2. Tactile Feedback Buttons
3. Pass Code Protection
4. Battery Backup of Starter Parameters & Diagnostics
5. Built in Start/Stop Pushbuttons
6. Status Indication via LCD Display and LED's
7. Scrolling Menu/Parameters
8. Discrete Enter Command Button
9. Meter Mode Display
10. Selectable Meter Mode Scroll Rate
11. Main Display Hot Key

B. Provide a Windows based software package with the Solid State Starters included under this contract for use on an Owner furnished IBM compatible PC. The software shall be utilized to program and monitor the starter parameters listed in paras. C-G without exception. The software shall include the following features and functions:

1. Connect to Starters via RS232 or RS485 port
2. Display up to six (6) starters at a time as screen Icons
3. Provide realtime starter basic parameter feedback
4. Provide realtime Start and Stop capabilities
5. Provide realtime current trending chart display for each starter
6. Provide capability for full Starter parameter programming
7. Provide an Event Recorder Display8.Provide a Fault Recorder Display
8. Provide a comparison of Setup parameters to Last Start conditions
9. Comm speed of up to 9600 baud

C. Programmable Motor Control Functions.

1. Motor Starting/Running
   a. Programmable Current Ramp
   b. Ramp to Limit
   c. Dual Ramps
   d. Full Voltage Start
   e. Initial Current Limit (50-400%)
   f. Motor Service Factor (1.0, 1.15, or 1.25)
   g. Start Ramp Time (0-120 Sec.)
   h. Power Outage Ride Through
   i. Dual Kick Start (0.1-10 Seconds)
   j. Programmable 1-1200 Amps
   k. Maximum Current (200-600%)
2. Motor Stopping
   a. Fully Programmable "S" Curve Pump Decel
   b. Soft Stop
   c. Fail Soft on Motor Overload
   d. Auxiliary Motor Feeder Control
3. Interlocking/Logic
   a. Restart Block-Backspin Timer

b. Overload Lockout
c. General Fault Digital Relay Output
d. Assignable Digital Relay Outputs (2)
e. Frequency Tracking
f. Up to Speed Indication/Contact
g. Preassigned Digital Inputs (7)
h. User Selectable # of Auto Restarts
i. User Selectable Fault Priority
j. Fully Programmable 4 output Relay Cards

4. Maintenance
   a. Emergency Restart After Fault Lockout
   b. Selectable CT Ratios
   c. Current Limited Jog
   d. Event Recorder

D. Programmable Motor Protection Functions

1. Motor/Machine Faults
   a. Electronic Overload
   b. Selectable Overload Curves, Class 10/20/30
   c. Overload Reset
   d. Overload Warning
   e. Acceleration Time
   f. Instantaneous Overcurrent
   g. Mechanical Jam/Electronic Shearpin (Selectable Trip or Warning)
   h. Motor Thermal Capacity Protection
   i. Undercurrent Alarm (Selectable Trip or Warning)
   j. Time Between Restarts
   k. Trip Reset Protection
   l. Machine Ground Fault Protection (Selectable Trip or Warning)
2. Electrical System Faults
   a. Undercurrent Protection
   b. Current Unbalance (10-40%)
   c. Overfrequency Protection
   d. Overload Alarm
   e. Undervoltage Protection (10-30%)
   f. Generator Set Frequency Tracking
   g. Overvoltage Protection (10-30%)
   h. Restart After Non-critical Fault
   i. Phase Reversal Protection
   j. Ground Overcurrent Protection
   k. Underfrequency Protection

E. Diagnostics Functions

1. Alpha/Numeric Fault Display
2. Starter Status Indication
3. Revolving 99 Most Recent Events
4. Pre-Start: Pending Fault Indication
5. Start/Stop Recorder
6. Pre-Start: Phase Rotation Indication
7. Date & Time Stamped Events
8. Control Board Built in Self Tests
9. Motor Thermal % Capacity Display
10. Shorted SCR Detection
11. Closed Loop Motor Stall Detection
12. LED Indication SCR Status
13. Open Loop Motor Stall Detection
14. Full Screen Meter Mode

F. Metering Functions

1. Meter Displays:
    a. Scrolling Current I.% Overload
    b. Elapsed Time Meter
    c. Average Current, Current: L1, L2 & L3
    d. Percent Current Imbalance
    e. Ground Fault Current
    f. Elapsed HourX100 Meter
    g. Kilowatts, kilowatt Hours, Megawatt Hours
    h. Scrolling Voltage
    i. Voltage: Average, L1, L2 & L3
    j. KVAR
    k. KVA
    l. Starts Counter
    m. Line Frequency (60Hz)
2. Programmable Relay Outputs
    a. Programmable Relay Outputs
    b. Overload
    c. Ground Fault
    d. Overload Lock
    e. Shear Pin Trip
    f. Overload Warn
    g. Under Current Trip
    h. Run
    i. Brake Mode
    j. Up To Speed
    k. Starter Ready
    l. Shorted SCR
    m. Shunt Trip

PART 3 EXECUTION

3.1 TESTING.

A. All incoming material shall be inspected and/or tested for conformance to quality assurance specifications.

B. Power semiconductors shall be fully tested for proper electrical characteristics, including dv/dt and di/dt.

C. All subassemblies shall be inspected and/or tested for conformance to quality assurance specifications.

D. Each completed unit shall be functionally tested prior to shipment to assure conformance to the specifications.

3.2 STARTUP & TRAINING

A. Bid price shall include 1 - day site visit, consisting of startup and training. Services shall include startup of equipment and field training for owner's personnel. Startup and training shall be provided by factory direct personnel only. The use of agents, manufacturer's representatives, associated integrators or manufacturer's distributors for startup and training shall not be permitted.

3.3 WARRANTY

A. Starters furnished herein shall include a three (3) year manufacturer's warranty (from date put in service) on all solid state power sections and P.C.solid state control cards with one (1) year manufacturer's warranty (from date put in service) on other equipment of each system.

3.4 SPARE PARTS

A. A complete set of Spare Parts shall be provided at no extra cost to the Owner. Spare parts shall include, but not be limited to:

1. One each of each type of Printed Circuit Board.
2. One of each type and size of control fuse.
3. Three of each type and size of power fuse.
4. One complete spare Power Cell of each type and size used.

END OF SECTION

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. This section includes requirements for individually mounted and enclosed fused and non-fused disconnect switches, fuses, and circuit breakers for disconnecting and protecting services, feeders, branch circuits, and utilization equipment.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.3 REFERENCES

A. The latest edition of the following standards and codes, standard publications of professional organizations, and the local authorities having jurisdiction are the minimum requirements for this work.

1. American National Standards Institute (ANSI)
2. Institute of Electrical and Electronic Engineers (IEEE)
3. National Electrical Manufacturer's Association (NEMA)
4. National Fire Protection Association (NFPA)
5. NFPA 70, the National Electrical Code (NEC)
6. Underwriters Laboratories, Inc. (UL)
7. State, city, and local authorities

1.4 DEFINITIONS

A. FDS: Fused Disconnect Switch

B. NFDS: Non-fused Disconnect Switch

C. RMS: Root Mean Square

D. SPDT: Single-pole Double-throw

1.5 SUBMITTALS

A. General:

1. Submit each item in this Article according to the Conditions of the Contract and Division 1 Specifications.
2. All exceptions to this specification shall be given in written format referencing the section and paragraph and stating the proposed alternative to the requirement.
3. The information continued in the submittal shall be complete in every respect, as partial submittals shall be cause for rejection.

B. Product data for disconnect switches, circuit breakers, and accessories specified in this section as follows:

1. Descriptive data and ratings for voltage, continuous current, maximum horsepower, and short-circuit rating
2. Dimensional plans, elevations, sections, and details
3. NEMA enclosure type and size.
4. Cable terminal size, number, and material
5. Unit wiring diagrams depicting local and remote devices.
6. Accessories device descriptive bulletins and product data sheets (i.e. shunt trip coil, undervoltage release, ground fault, auxiliary contacts, key interlocks, etc.)

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70, the National Electrical Code.

C. All equipment and materials will be new and unused and shall conform with the current applicable industry standards. Workmanship and neat appearance shall be as important as electrical and mechanical operation. Defective or damaged materials shall be replaced or repaired prior to final acceptance in a manner meeting approval of Architect and/or Engineer and at no additional cost to the Owner.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. Disconnect Switches and Circuit Breakers: Acceptable manufacturers are listed below. All disconnect and circuit breakers shall be of the same manufacturer.

1. Cutler-Hammer
2. General Electric Company
3. Square D Company

B. Fuses: Acceptable manufacturers are listed below. All fuses shall be of the same manufacturer.

1. Cooper Bussman, Inc.
2. Ferraz Shawmut, Inc.
3. Tracor, Inc.; Littelfuse, Inc. Subsidiary

2.2 DISCONNECT SWITCHES

A. Enclosed fusible and non-fusible switches, 1200-amp and smaller, NEMA KS1, heavy duty type with lockable handle, 600-volts, horsepower rated for motors as required. Number of poles and ampacity as noted or required by Code. Short-circuit rating shall be sufficient to withstand the available fault current or let-through current before the fuse melts without damage or change in rating.

B. Fusible switches 30- through 600-amperes shall be furnished with rejection class "R" or "J" type fuse clips and 800 through 1200 amperes shall be furnished with class "L" type fuse clips.

C. Switches shall incorporate a safety cover interlock to prevent opening the cover with the switch in the "ON" position or prevent placing the switch in the "ON" position with the cover open. Provide a "defeater" for authorized personnel.

D. Handles shall have provisions for padlocking and shall clearly indicate the ON and OFF positions. Front cover doors shall be padlockable in the closed position.

2.3 CIRCUIT BREAKERS

A. General:

1. Provide 600-volt enclosed molded case circuit breaker per NEMA AB1 with lockable handle with frame size, trip rating, number of poles, and interrupting rating to meet available fault current. Application listing shall be appropriate for switching fluorescent lighting loads or heating, air conditioning, and refrigerating equipment.
2. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-breaker over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy and arc extinction shall be accomplished by means of arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

3. Thermal-magnetic Circuit Breakers: Frame sizes 400 amp and smaller shall have 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 amp and larger.
4. Molded-case Switch: Molded-case circuit breaker without trip units.

B. Circuit-breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style suitable for number, size, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.4 ENCLOSURE

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Indoor Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install devices in general area of equipment and accessible to maintenance personnel according to manufacturer's written instructions. Secure devices firmly to supporting structure with approved fasteners in a level and plumb manner. Verify voltage and amperage size and enclosure type of devices for each installation. Where practical, devices shall be mounted such that the top of switch is a maximum of 61-0" above finished floor or surface.

B. Connect devices to wiring system and to ground as indicated and instructed by manufacturer. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

C. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse. Install labels indicating fuse replacement information on inside door of each fused switch.

D. Identify each device according to requirements in other sections of these specifications.

3.2 OVERCURRENT PROTECTIVE DEVICES

A. Install fuses where required as a protective device in conformance with equipment manufacturer's specified requirements and in accordance with the requirements of this section.

3.3 EQUIPMENT CONNECTIONS

A. Provide all final power connections for mechanical equipment. All equipment items will be furnished and set by others. Confirm with suppliers all rough-in data, e.g., electrical characteristics, dimensions, locations, type of connection, etc., prior to installation.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
2. Test continuity of each line- and load-side circuit.

B. Testing: After installing and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify

compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit breaker trip ranges.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint and plaster splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 26 50 00
LIGHTING

PART 1 — GENERAL

1.1 SECTION INCLUDES

A. Interior lighting fixtures and accessories.

B. Emergency lighting systems.

1.2 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI C62.41 IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. American Society for Testing and Materials (ASTM):

1. ASTM A123/A123M Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2. ASTM A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
3. ASTM A366/A366M Specification for Steel Sheet, Carbon, Cold-Rolled, Commercial Quality

C. Federal Specifications (FS):

1. TT-P-641 Type II Zinc Dust Primer for Steel or Galvanized Metal Surfaces

D. Illuminating Engineering Society of North America (IES):

1. IES Lighting Handbook, Reference and Application

E. National Fire Protection Association (NFPA):

1. NFPA 101 Code for Safety to Life from Fire in Buildings and Structures

F. Porcelain Enamel Institute (PEI):

1. PEI S-100 Specification for Architectural Porcelain Enamel on Steel for Exterior Use
2. PEI LS-105 Specification for Architectural Porcelain Enamel on Aluminum for Exterior Use

G. Underwriters Laboratories Inc. (UL):

1. UL 94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
2. UL 496 Edison-Base Lampholders
3. UL 508 Industrial Control Equipment
4. UL 542 Fluorsescent Lamp Starters
5. UL 595 Marine-Type Electric Lighting Fixtures
6. UL 773 Plug-In, Locking Type Photocontrols for Use with Area Lighting
7. UL 1029 High-Intensity-Discharge Lamp Ballasts
8. UL 1571 Incandescent Lighting Fixtures
9. UL 1572 High Intensity Discharge Lighting Fixtures
10. UL 8750 The Standard for Safety of Light Emitting Diode (LED) Equipment for use in Lighting Products.

1.3 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

1.4 SUBMITTALS

A. Product Data Luminaire Manual: Submit light fixture manual which provides product data indicating fixture construction, photometric performance, installation, and maintenance requirements. Include the following information and exhibits:

1. The Manual shall be complete with cover, title page, and table of contents. The cover and title page shall identify the document, project, client, contract name, number and date of issuance. The table of contents shall provide at a glance the overall document scope and structure and, as a minimum, a heading for each fixture type with each grouping prefaced by a "general information" report sheet.
2. The Manual shall include drawings and illustrations of sufficient detail to show the following:
   a. Fixture housing, hardware, and finishes;
   b. Lighting controlling elements;
   c. Electrical components, including lampholders, ballast, and provision for conduit entry; and
   d. Support details including foundation. Indicate weight of fixture, complete with lamps.
3. The Manual shall include procedures for installation of the complete lighting unit in its final service location. Provide templates for mounting of light poles. Provide dimensions to locations of openings and parts interfacing with remote systems, such as pole bases, mounting hardware, auxiliary electrical equipment, lighting control equipment, and lamps.
4. The Manual shall include operation and maintenance requirements in accordance with
   a. Materials and components clearly indicated in the parts list;
   b. Re-lamping methods;
   c. Special tools required; and
   d. Frequency of inspection, tightening, or other service recommended for preventative maintenance.
5. The Manual shall include calculations indicating capability of light poles with light fixtures installed to withstand wind load requirements. Proper selection of anchor bolts shall be included in the computation.

B. Test Reports: Submit certified test reports of factory and field tests performed, in accordance with applicable referenced standards and Specification requirements.

C. Samples: Submit one complete light fixture or luminaire for each type required. Each sample requires the Engineer's approval and shall become the property of the District. Approved samples will become the Engineer's control samples.

1.5 GENERAL REQUIREMENTS

A. Determine required quantities of equipment from Drawings.

B. Systems shall be complete and operable including required accessories, fastenings, and supports.

1.6 DELIVERY, HANDLING, AND STORAGE

A. Handle and transport products in a manner that prevents damage.

B. Wrap and package products to avoid damage.

C. Indelibly mark each carton with minimum 1/2 inch high letters containing the following information:

1. Fixture, lamp, or component type.
2. Quantity.
3. Manufacturer's name and product number.

D. Store products in a clean, dry, and secure storage area pending installation.

1.7 JOBSITE CONDITIONS

A. Install new lamps not earlier than 48 hours before the date of final inspection.

B. Install exposed parts of fixtures after construction, painting, and general cleanup in the area have been completed.

C. Inspect surfaces and structures to, and on, which products will be installed before the work of this Section begins, and ensure that these surfaces are capable of supporting the products. Surfaces that will be concealed by products shall be finished before products are installed.

PART 2 — PRODUCTS

2.1 LIGHTING FIXTURES

A. Types: As designated in "Lighting Fixture Schedule" on Drawings.

B. Requirements:

1. Provide lighting fixtures, complete and ready for service, in accordance with UL 1570, UL 1571, and UL 1572. Fixtures shall be of the number, type, material, finish, electrical components, and characteristics, and shall be provided with the necessary hardware and auxiliary equipment, as indicated. Light fixtures provided with provisions for raceways shall be UL-listed for this use. Comply also with applicable requirements and guidelines of the IES Lighting Handbook.
2. Mark fixtures clearly with manufacturer's name and catalog number, voltage, acceptable lamp type, maximum wattage, and label for intended use.
3. Fixtures shall be UL listed for the location and application indicated.

C. Materials:

1. Thicknesses, gages, and tempers of products shall be as indicated, and as recommended by the manufacturer for the specific finish, proper forming operations, and structural requirements.
2. Reflector material shall be prefinished, copper-free aluminum alloy, minimum thickness 0.032 inch, Architectural Type 1 with Class M1 anodic coating providing 83 percent reflectivity.
3. Acrylic for lenses and diffusers shall be manufactured from virgin-acrylic extrusion or injection molding pellets.
4. Glass for lenses shall be of tempered borosilicate pressed or spun glass, minimum 0.13 inch thick.
5. Stainless steel shall be Type 304 conforming to ASTM A167.

D. Finishes:

1. Provide lighting fixtures completely factory-finished in colors to match the Engineer's control samples.
2. Do not start finishing operations until fabrication and forming operations have been completed.
3. Aluminum to be anodized shall be given the Aluminum Association's Architectural Class 1 anodic coating.
    a. Anodize aluminum in accordance with procedures established by alloy manufacturer to achieve color within specified range.
    b. Apply a clear organic protective coating to exposed aluminum surfaces that may experience prolonged contact with caustic material such as concrete and plaster.
4. Minimum cleaning of metal before painting shall be a five-stage phosphatizing system consisting of alkali cleaner, hot water rinse, zinc phosphatizing solution with toner, water rinse at room temperature, and chromic acid rinse for neutralizing.
5. Interior fixtures with surfaces not exceeding 150 degrees F shall be statically charged and painted two coats minimum of acrylic gloss enamel to a minimum total dry film thickness (DFT) of 2.5 mils.
6. Interior fixtures with surfaces exceeding a temperature of 150 degrees F, but not exceeding 300 degrees F, shall be statically charged and painted with silicone-alkyd enamel, two coats minimum to a total DFT of 2.5 mils.
7. Provide fixtures specified to be painted with one coat of epoxy-polyamide at a minimum DFT of 2 mils and one coat of aliphatic urethane to a minimum DFT of 2 mils. Interior reflective surfaces specified to be painted shall be as for interior fixtures.
8. Finish fixtures specified to be porcelain enameled, or painted fixtures with reflectors specified to be porcelain enameled, shall receive porcelain-enamel coating in accordance with the requirements of PEI S-100 or PEI LS-105.
9. Reflective surfaces not specified to be specular shall be gloss white, guaranteed nonyellowing, with a reflectance rating of not less than 88 percent.
10. Provide galvanized coating, where indicated, hot-dip galvanized according to ASTM A123.

Where painting of the galvanized surface is indicated, pre-treat the surface with a spray of zinc chromate-vinyl butyryl wash primer at least 0.05 mil thick; apply an 80 percent zinc dust, 20 percent zinc oxide, alkyd resin primer conforming to FS TT-P- 641; and then apply a single-component, Type II, modified acrylic or polyurethane top coat.

E. Electrical Components

1. Fixture Wiring:
   a. Provide fixture wires of stranded tinned-copper construction, not smaller in wire size than 16 AWG. Provide insulation of silicone rubber type SF-2, 200 degrees C rated. Mark conductor size, temperature rating, voltage, and manufacturer clearly on the insulation of each conductor.
   b. Tape wires at points of abrasion. Do not permit splices within fixtures other than as required to connect lampholders and ballast. Provide wireways and wiring channels with rounded edges or bushed holes wherever conductors pass through. Install insulated bushings at points of entrance and exit of wiring.
2. Fixture Grounding:
   a. Unless otherwise specified, provide the housing of each ballasted lighting fixture with a separate, factory-installed grounding device.
   b. A separate grounding conductor shall be attached to the grounding device on each fixture housing and connected to the ground lug terminal in the hand hole of the light pole.
   c. Provide only GRS conduits and accessories, except in underground or concrete encased duct banks.
   d. Light poles shall be grounded by use of a separate grounding conductor connected at one end to the grounding lug in the hand hole of each pole, and the other end connected to the grounding bus in the lighting distribution panel.

F. Fixture Hardware:

1. Latch and release mechanism, hinges, pins, and other retaining parts of fixtures; screws, bolts, or other assembly and mounting parts shall be manufactured of Type 304 or Type 316 stainless steel. Provide springs of heavy-duty stainless steel. Provide self-retaining type retaining hardware.
2. Light transmitting panels shall be held in the frames in a neat, rattle-free manner that will provide proper tolerance for normal expansion and contraction.
3. Fabricate internal brackets from ASTM A366/A366M sheet steel, zinc-coated after fabrication, or finished extruded aluminum.
4. Gaskets, sealants, and adhesives shall be formed from silicone rubber.
5. Provide bolts, nuts, washers, screws, nails, rivets, and other fastenings necessary for proper installation or assembly of work. When exposed to the atmosphere, items shall be made of 300 series stainless steel. Fastenings within the housing shall be hot-dip galvanized steel. Nuts shall have captive externally-footed lockwashers.
6. Junction boxes suitable for the intended location and wiring requirements shall be provided with four 3/4 inch threaded and plugged conduit entries.

G. Lighting fixtures shall be furnished completely assembled with wiring and mounting devices, and be ready for installation at locations noted. Recessed fixtures in suspended ceilings shall be designed and equipped for installation in type of ceiling in which fixture is to be installed. Fixtures shall be designed to be supported independently of ceiling.

2.2 LIGHT EMITTING DIODE (LED) LIGHTING

The LED Fixture shall consist of a LED Luminaire Assembly, LED Driver and mounting hardware.

A. LED Lighting Fixture

LED Fixture requirements are as described below:

1. The input to the LED Lighting Fixture shall be 120 to 277VAC (±10%), 60HZ or as indicated in the Contract Document.
2. Correlated Color Temperature (CCT) shall be minimum 4000K or as indicated in the Contract Document.

3. Color Rendering Index (CRI) shall be 70.
4. A minimum of 50,000 operating hours before reaching the L70 lumen output degradations point without catastrophic failure, or as indicated in the Contract Document.
5. Conform with UL 8750.
6. Compliance to FCC CFR Section 15.

B. LED Luminaire Assembly

Luminaire Assembly requirements as described below:

1. Definition: Luminaire Assembly is the LED assembly without LED driver.
2. Input voltage shall be 24VDC, 36VDC or as indicated in the Contract Document.
3. CCT, CRI, Minimum life and UL conformity requirements are as defined in above article LED Lighting Fixture.

C. LED Driver

LED Driver requirements are as described below:

1. Must operate input voltage between 120VAC to 277VAC (±10%).
2. Operating frequency must be 60Hz.
3. Must be rated to operate between -40°C to +50°C.
4. Must have a minimum efficiency of 85%.
5. Self protected including short circuit protection.
6. Compliance to FCC CFR Section 15.
7. Driver must have a Power Factor (PF) of • 0.90.

8. Types and ratings: As shown on "Lighting Fixture Schedule" on Drawings.

2.3 FIXTURE MOUNTING HARDWARE

A. Requirements:

1. Provide fixtures with brackets, straps, canopies and stems, poles, and miscellaneous hardware suitable for the mounting method specified. Pendant mounted fixtures shall have seismic resistant swivel mountings.
2. When exposed to public view, fabricate and finish hardware in material matching the fixture body.
3. Canopies, holders, and similar parts shall be drawn or spun in one piece with a minimum 0.026 inch finished thickness.
4. Tubing used for stems shall be seamless drawn with a minimum of 1/16-inch wall thickness of size and length as indicated. Stems shall be provided for pendant- mounted fixtures of length as required for the specified mounting height with swivel hangers or ball aligners.

PART 3 — EXECUTION

3.1 GENERAL REQUIREMENTS

A. Determine locations and arrangement of equipment from Drawings.

B. Locations shown on Drawings are approximate unless dimensioned. Choose precise location to clear obstructions and to provide sufficient space for operation and maintenance.

C. Coordinate timing of installation and location of equipment with other trades.

D. Make permanent lighting system, or selected portions thereof, operable as soon as possible.

E. Install equipment in strict accordance with manufacturer's recommendations.

F. Perform construction in accordance with NEC.

G. Repair factory finishes where they become damaged during construction.

H. Install equipment level and plumb.

3.2 LIGHTING FIXTURES

A. Support lighting fixtures from building framing or floor slabs, and independently of conduit system and suspended ceilings.

B. Coordinate exact locations of lighting fixtures with suspended ceiling layout to achieve uniformity.

C. To minimize equipment breakage, delay installation of lighting fixtures in locations near heavy piping and equipment until such equipment is in place.

D. Replace defective or damaged lighting fixtures and lamps at conclusion of job.

3.3 WALL-MOUNTED EQUIPMENT

A. Concrete or masonry walls: Use expansion anchors and bolts; install collars around mounting bolts, or use other means to provide air space between wall and equipment enclosure.

B. Structural steel mounting: Bolt to steel or brackets attached to steel; provide air space between steel and equipment enclosure.

3.4 LIGHTING CONTROLS

A. Mount photocells facing north or upward and adjust to render insensitive to any artificial lighting units.

B. Install occupancy sensors and ambient light sensor in accordance with manufacturer's installation procedures. Final adjustments of sensors shall be coordinated with Owner for proper settings.

3.5 FIELD QUALITY CONTROL

A. Inspect luminaries, lamps, and associated hardware before and after installation to ensure that they are of the quality and type specified and indicated, and are free of defects and damage.

B. Deliver luminaries and lighting equipment to the project site complete with related items, completely wired and assembled.

C. Whenever practicable, test lighting systems at the same time that the distribution panelboard or switchboard is tested.

D. Replace failed fixtures within 2 years days after final acceptance without additional cost to the District.

E. Test light poles for continuity to the grounding system.

END OF SECTION

SECTION 31 22 00
GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes preparation, excavation and filling, disposal of excess excavated and waste materials, compaction, dust and surface water control, field quality control and protection for grading operations.

1.2 RELATED WORK

A. 03 30 00 Cast In Place Concrete

1.3 REFERENCES

A. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort

B. ASTM D1557 (AASHTO T-180) – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

C. ASTM D2216 – Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock

D. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

E. ASTM D3017 – Standard test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

F. ASTM D3282 – Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

G. ASTM D3740 – Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Observation of Soil and Rock as Used in Engineering Design and Construction.

1.4 SUBMITTALS

A. Qualification data for qualified testing agency, per ASTM D3740.

B. Pre-excavation photos or video: Prior to excavation, photograph existing surfaces along which work may take place in order to determine, after construction is completed, whether any damage to existing improvements occurred prior to construction operations.

C. Submit evidence of materials conformance with applicable requirements as well as these Specifications, including the following:

1. For each non-structural fill product, submit name of supplier, source, CBR value and gradation.
2. For each structural fill material, submit name of supplier, source, CBR value, gradation, maximum laboratory dry density, optimum laboratory moisture content and laboratory compaction curve.
3. Upon Engineer's request, submit a written quality control observations and testing report describing source and field quality control activities performed by Contractor and Supplier.

1.5 QUALITY ASSURANCE

A. Comply with federal, state, and local codes and regulations.

B. Use a laboratory that follows and complies with Section 01 45 00 – Quality Control and ASTM D 3750.

C. All working conditions shall be in accordance with the "Utah Occupational Safety and Health Standard for Construction".

D. Freezing weather:

1. Unless scheduling requirements of these specifications dictate otherwise, construction of fills during freezing weather shall not be done without approval of the Owner.

2. If placement of earth materials during freezing weather is permitted by the Owner, such permission does not relieve the Contractor of the responsibility to perform the work in accordance with these specifications and at no additional cost to the Owner.

1.6 STORAGE AND HANDLING

A. Stockpile excavated material to cause a minimum of inconvenience to public and provide for emergency services as necessary.

B. Provide free access to all existing fire hydrants, water and gas valves and meters.

C. Provide free flow of storm water in all gutters, conduits and natural water courses.

D. Utilize traffic control signs, markers and procedures in product storage and handling activities.

E. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.

F. Promptly remove excess or waste material from site.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Structural Fill:

1. Shall not be lumpy or frozen.

2. Shall be free from large concentrations of alkali, salt, and petroleum products, all roots, sod, limbs, and other vegetative matter, slag, cinders, ashes and rubbish, or other material that in the opinion of the Owner is objectionable or deleterious.

3. Shall be "clean" granular soils graded within the following limits.

Structural Fill Gradation

Sieve Size	*% Passing*
4 inch	100
No. 10	50 max
No. 40	30 max
No. 200	13 max

4. A maximum particle size of 2 inches is required of structural fill placed in confined areas.

5. Moisture conditions at the time of placement shall be such the material used will be compactable to required specs.

6. Shall be approved by the Engineer prior to being used on the site of the work.

7. Stabilizing structural fill: Mixture of clean coarse gravels and cobbles.

B. Non-structural fill:

1. Shall not be lumpy or frozen.
2. Shall be free from large concentrations of alkali, salt, and petroleum products, all roots, sod, limbs, and other vegetative matter, rocks larger than 6 inches in diameter, slag, cinders, ashes and rubbish, or other material that in the opinion of the Owner is objectionable or deleterious.
3. Shall be either cohesive or granular.

PART 3 - EXECUTION

3.1 PREPARATION

A. Within 10 feet of construction limits, observe, photograph, and record condition of concrete slabs, structures, landscaping and other features to remain which might be affected by clearing. Mark with paint any existing cracks on concrete along which work will take place, in order to determine after the construction is completed whether such damage was caused by the operations of the Contractor or had occurred previously. Any concrete showing unmarked cracks upon completion of construction will be evidence of damage by the Contractor's forces, and shall be replaced or repaired to the satisfaction of the Owner of the damaged concrete, at the Con-tractor's own expense.

B. Obtain necessary permits required for grading.

C. Trees, shrubs and lawn, areas to receive planting, rock outcroppings, fences, and other improvements that are not to be removed shall be protected from damage or injury. If damaged or removed, they shall be restored or replaced in as nearly the original condition and location as is reasonably possible.

D. Establish the location and extent of all underground utilities. Notify necessary utility companies to be present if disturbing ground in the vicinity of utilities. Protect active utility systems adjacent to or uncovered by any excavation during site grading. Maintain, re-route or extend as required, existing ditches, pipelines or utility lines to remain which pass through the construction limits. Pay costs for this work, except those covered by the utility companies. Accurately locate and record abandoned and active utility lines re-routed or extended, on Project Record Documents. Call Blue-Stakes for utility location.

E. Maintain benchmarks, monuments and other reference points.

F. Appropriate traffic control devices shall be provided in accordance with federal, state or local regulations to regulate, warn, and guide traffic at the work site.

G. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Sections 01 57 00 – Construction Facilities and Temporary Controls are in place.

H. All work shall be performed so as to insure the least possible interference with the public convenience.

3.2 EXCAVATION AND FILLING

A. Excavate cut areas to proper elevation. When Structural Fill or other material is to be placed upon exposed surface, take care to prevent disturbing of soils. A smooth-lipped bucket, or other equipment which will produce a smooth, undisturbed surface, shall be used to excavate areas which require placement of Structural Fill or other material on undisturbed natural soil subgrade. Excavation equipment with "teeth" shall not be used as this equipment may disturb the subgrade soils.

B. Placement of Structural Fill:

1. Structural Fill shall be used to fill below an area which is to be structurally loaded, or which is to support slab-on-grade or pavement, and shall extend from undisturbed native soil to the proper subgrade elevation. Excavated material which meets the specification requirements, including compaction and moisture provisions, may be used as Structural Fill.
2. Under areas to receive structural fill, topsoil shall be completely removed.
3. Prior to placing the structural fill, the subgrade shall be proof-rolled by passing moderately-loaded rubber tire-mounted construction equipment uniformly over the surface continuously at least twice. If excessively soft, loose or disturbed soils are encountered, they shall be removed as directed by Owner, to a maximum depth of two feet, and replaced with STABILIZING STRUCTURAL FILL, compacted to 90% of the maximum laboratory dry density determined by ASTM D-1557 or AASHTO T-180.
4. Structural fill should be placed in lifts not exceeding 8 inches in loose thickness.

C. Placement of Non-Structural Fill:

1. Non-Structural Fill shall be used to fill all areas which do not require Structural Fill. Excavated material which meets the specified gradation, compaction and moisture requirements may be used as Non-Structural Fill.
2. Prior to placing Non-Structural Fill, the area to receive the fill shall be cleared as specified above.
3. Non-Structural fill should be placed in lifts not exceeding 12 inches in loose thickness.

D. Grading Tolerances:

1. Finish areas to within not more than 0.10' above or below required elevations.
2. Uniformly grade areas within construction limits, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

E. Unauthorized excavation:

1. Unauthorized excavation consists of removal of materials beyond indicated elevations or dimensions without specific direction of the Owner.
2. Correct unauthorized excavation as directed, at no cost to the Owner.

F. All material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.

G. Fills adjacent to structures shall be placed around the structure in lifts of constant elevation until finish grade is achieved.

3.3 DISPOSAL OF EXCESS EXCAVATED AND WASTE MATERIALS

A. Remove waste material, unacceptable excavated material, surface and sub-surface vegetation, trash and debris and dispose of it off Owner's property in accordance with all applicable laws and ordinances.

B. Excess excavated material shall be disposed of at the site shown on the Drawings. When quantity shown has been exceeded, dispose of excess excavated material off Owner's property in accordance with all applicable laws and ordinances.

3.4 COMPACTION REQUIREMENTS

A. Each layer of structural fill shall be compacted to at least 90% of the maximum dry density, as determined by the ASTM D-1557 (AASHTO T-180) method of compaction. Non-structural fill shall be compacted to at least 85% of the maximum dry density, as determined by the ASTM

D-1557 (AASHTO T-180) method of compaction.

B. Where layer of soil material to be compacted must be moisture conditioned before compaction, uniformly apply water to surface of layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operation.

C. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.5 DUST AND SURFACE WATER CONTROL

A. Dust control measures shall be implemented by application of water to all work areas, storage areas, haul and access roads, or other areas affected by work.

B. All work shall be in compliance with the Federal, State, and local air pollution standards, and not cause a hazard or nuisance to personnel and the public in the vicinity of the work.

C. Provide and operate at least 1 mobile tank sprinkling unit during the contract period.

D. Other methods of dust control for haul and access roads may include chemical treatment, light bituminous treatment or other method as approved by the Owner.

E. Surface water shall be controlled to the extent that the areas to receive pavement, walks or slabs are not allowed to become wet from runoff from adjacent areas. Surface water shall be directed away from these areas but not directed toward adjacent property, buildings, or any improvement that may be damaged by water. Surface water shall not be allowed to enter sanitary sewers.]

3.6 FIELD QUALITY CONTROL

A. Allow testing service to observe and approve subgrades and fill layers before further construction work is performed.

B. Testing of compacted fill materials and subgrades will be performed by testing agency employed by the Contractor. If, during progress of work, tests indicate that compacted materials do not meet specified requirements, remove defective work, replace and retest at no cost to Owner.

C. In each compacted fill layer, testing service shall perform at least one field density test for every 2000 sq. ft. of fill area, but in no case less than 3 tests.

3.7 PROTECTION

A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and retted areas to specified tolerances.

C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re shape, and compact to required density prior to further construction.

D. Where settling is measurable or observable in excavated or filled areas during general project warranty period, remove surface (pavement, lawn or other finish), add structural fill material, compact to required specifications, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION

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SECTION 31 23 00
EXCAVATION, BACKFILLING AND COMPACTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes preparation, excavation, backfilling, compaction, dewatering and/or runoff control measures, trench shoring, restoration of existing facilities damaged or displaced as a result of the work of the project, clean up, protection and maintenance.

1.2 RELATED WORK

A. Section 33 11 00 - Water Distribution and Transmission

B. Section 33 31 00 - Sanitary Sewer Systems

C. Section 33 41 00 - Storm Drainage Systems

1.3 REFERENCES

A. The applicable provisions of the latest editions of the References listed below shall govern the Work covered under this Section, unless there is a conflict between said References and the requirements of this Section. In the case of such a conflict, the requirements of this Section shall apply.

B. Utah Occupational Safety and Health Division (UOSHD).

C. American Association of State Highway and Transportation Officials (AASHTO):

D. American Society for Testing and Materials (ASTM)

E. American Public Works Association (APWA)

1.4 SUBMITTALS

A. Submit evidence of materials conformance with applicable requirements as well as these specifications.

1.5 QUALITY ASSURANCE

A. Comply with federal, state, and local codes and regulations as applicable. Permits shall be obtained and paid for by the Contractor.

B. All working conditions shall be in accordance with the "Utah Occupational Safety and Health Division", Safe Practices for Excavation & Trenching Operations, latest edition, or other Laws or Regulations which apply.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Materials suppliers shall provide, upon request, verification of a consistent record of meeting or exceeding materials or performance standards as specified herein.

2.2 FOUNDATION MATERIALS

A. All foundation materials shall be free from alkali, salt, and petroleum products, roots, sod, limbs, and other vegetative matter, slag, cinders, ashes and rubbish, or other material that in the

opinion of the Owner may be objectionable or deleterious.

B. Undisturbed soil foundation material:

1. Shall be natural trench bottom soil unless unable to adequately support pipe or structures.
2. Shall not be lumpy or frozen.

C. Sewer Rock:

1. Shall be hard, durable, broken, angular, crushed stone or high quality mineral or combination thereof.
2. Shall be graded as follows:

Sewer Rock Gradation

Sieve Size	*% Passing*
2"	100
1.5"	90-100
1"	20-55
¾"	0-15
3/8"	0-5

2.3 BEDDING MATERIALS

A. Sand Bedding for Water Pipes:

1. Shall be free from alkali, salt, and petroleum products, roots, sod, limbs, and other vegetative matter, slag, cinders, ashes and rubbish, or other material that in the opinion of the Owner may be objectionable or deleterious.
2. Graded within the following limits:

Sand Bedding Gradation

Sieve Size	*% Passing*
¾"	100
No. 4	80-100
No. 10	30-50
No. 40	10-30
No. 200	0-15

B. Gravel Bedding for Sewer and Storm Drain Pipes:

1. Shall be hard, durable, broken, angular, crushed stone or high quality mineral or combination thereof.
2. Shall be graded as follows:

Gravel Bedding Gradation

Sieve Size	*% Passing*
1-1/2"	100
1"	95-100
½"	25-60
No. 4	0-10
No. 8	0-5

2.4 BACKFILL MATERIALS

A. Granular backfill:

1. Shall be readily compactable and shall be free from alkali, salt, and petroleum

products, roots, sod, limbs, and other vegetative matter, slag, cinders, ashes and rubbish, or other material that in the opinion of the Owner may be objectionable or deleterious.

B. Shall be AASHTO M145 classification A-1-a: non-plastic, well-graded 3" minus material, graded within the following limits:

Granular Backfill Gradation

Sieve Size	*% Passing*
3"	100
No. 10	50 max
No. 40	30 max
No. 200	15 max

1. May be select material from excavation if it will meet all requirements of granular backfill, including compaction requirements as specified for type of surface improvement above trench.

C. Excavated Soil Backfill Material:

1. Shall be free from alkali, salt, and petroleum products, roots, sod, limbs, and other vegetative matter, slag, cinders, ashes and rubbish, or other material that in the opinion of the Owner may be objectionable or deleterious.
2. Shall be select material from excavation, with no particle larger than 4 inches in diameter.
3. Use on-site materials only if specified compaction requirements can be met.

PART 3 - EXECUTION

3.1 EXAMINATION

A. It shall be the Contractor's sole responsibility to locate all (whether or not shown on the Drawings) existing water, sanitary sewer, storm drain, and gas lines, electrical and telephone conduit,other underground utilities with their existing house service connections, and all other underground structures in order that no damage or loss of service will result from interference with existing lines.

B. Review all available drawings, notes, and information on the location of these underground lines and structures in determining the location of the existing facilities.

C. Blue Stakes Location Center shall be contacted 48 hours before any excavation is commenced. Mark and locate all utilities prior to excavation.

D. Mark with paint any existing cracks on concrete along which work will take place, in order to determine after the construction is completed whether such damage was caused by the operations of the Contractor or had occurred previously. Any concrete showing unmarked cracks upon completion of construction will be evidence of damage by the Contractor's forces, and shall be replaced or repaired to the satisfaction of the owner of the damaged concrete, at the Contractor's own expense.

E. All fences removed for excavation shall be returned to their original condition except that damaged portions will be replaced with new fencing at the Contractor's expense.

F. Obtain all required permits.

3.2 METHODS AND PROCEDURES

A. General Requirements

1. All gas, sanitary sewer, storm drain, water and other pipelines, flumes and ditches of metal, wood or concrete, underground electrical conduits and telephone cable, and all walks, curbs, and other improvements encountered in excavating trenches carefully shall be supported, maintained and protected from injury or interruption of service until backfill is complete and settlement has taken place.
2. If any existing facility is damaged or interrupted, promptly after becoming aware thereof and before performing any Work affected thereby except in an emergency, identify the owner of such existing facility, and give written notice thereof to that owner and the Owner. Indemnify the Owner and Engineer from any and all damages resulting from damaged facilities.
3. All damage, injury or loss resulting from lack of adequate sheeting, bracing, and shoring shall be the responsibility of the Contractor; and the Contractor shall effect all necessary repairs or reconstruction resulting from such damage.
4. The trenches shall not be backfilled until the utilities systems as installed conform to the requirements of the Drawings and Specifications. Where, in the opinion of the Owner, damage is likely to result from withdrawing sheeting, the sheeting shall be left in place.
5. Trenches shall be backfilled to the proper surface with material as shown or specified. Trenches improperly backfilled shall be reopened to the depth required for correction, then refilled and compacted as specified, or the condition shall be otherwise corrected as approved.
6. Care shall be exercised so that when backfilling is complete and settlement has taken place, all existing pipes, flumes, ditches, conduits, cables, walks, curbs, and other improvements will be on the same alignment and grade as they were before work commenced.
7. Compaction shall be the responsibility of the Contractor. Select the methods to be used and carefully perform the work of backfilling and compaction so as to prevent damage to new or existing utilities. Any new or existing utilities damaged during the Contractor's work shall be replaced as directed by the Owner.

3.3 INSTALLATION

A. Excavation

1. Excavation for pipe lines, concrete valve boxes, manholes, vaults and appurtenant structures shall include the work of removing all earth, sand, gravel, quicksand, stone, loose rock, solid rock, clay, shale, cement, hardpan, boulders, and all other materials necessary to be moved in excavating the trench for the pipe. Maintainthe excavation by shoring, bracing, and sheeting or well pointing to prevent the sides of the trench from caving in while pipe laying is in progress and remove sheeting from the trench after pipe has been laid.
2. Trench support system shall be suitable for the soil structure, depth of cut, water content of soil, weather conditions, superimposed loads, vibration. Select one of the following methods of ensuring the safety of workers in the trench, as approved by OSHA or its safety inspectors:
    a. Sloping sides of trench to the angle of repose at which the soil will remain safely at rest.
    b. Shoring trench sides by placing sheeting, timber shores, trench jacks, bracing, piles, or other materials to resist pressures surrounding the excavation.
    c. Using a movable trench box built-up of steel plates and a heavy steel frame of sufficient strength to resist the pressures surrounding the excavation.

    Trenches shall be of the necessary width for proper laying of pipe. Care shall be taken not to over-excavate. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe along the entire

length of the barrel of the pipe.

3. Trenches shall be excavated to the depths shown on the Drawings, including any required allowances for the sewer rock foundation, when required, and for other pipe bedding requirements.
4. Minimum cover over the top of the pipe, including any paving, shall be as follows:
    a. Water supply piping: 4 feet minimum from finish grade unless otherwise specified or required by the governing jurisdiction.
    b. Sanitary sewer and storm drain: as indicated on the plans.
5. Grading of trenches shall be performed to avoid interference of water, storm drain and sewer lines with other underground utilities and structures:
    a. Water supply piping: Unless otherwise indicated, trenches shall be graded to avoid high points with the necessity of placing vacuum and relief valves in the water lines.
6. The width of trench, measured at the top of the pipe, shall be as narrow as possible, but not wider than 15 inches on each side of sewer or water pipe.
7. Excavation for manholes, concrete valve boxes, and similar structures shall be sufficient to leave at least 12 inches in the clear between the outer surfaces and the embankment or timber that may be used to hold and protect the banks.
8. Excess materials shall be hauled away from the construction site or otherwise disposed of by the Contractor as approved by the Owner.

B. Backfilling

1. Materials for trench backfill shall be as shown on the Drawings.
2. Pipe bedding:
    a. Consists of preparing an acceptable pipe foundation, excavating the pipe groove in the prepared foundation and backfilling from the foundation to 12 inches above the top of the pipe. All piping shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.
    b. Pipe foundation: Shall consist of natural soil in the bottom of the trench, or a built-up foundation if conditions so warrant. Wherever the trench subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, and where groundwater must be drained, the trench shall be excavated below the bottom of the pipe to such depth as may be necessary, and this additional excavation filled with clean, compacted sewer rock.
    c. Install pipe bedding materials from pipe foundation to 12 inches above top of pipe: Materials shall be deposited and compacted in layers not to exceed 8 inches in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses. Materials used shall be as shown in the Typical Trench Section in the Drawings and as specified in Part 2.
    d. A pipe groove shall be excavated in the pipe foundation to receive the bottom quadrant of the pipe so that the installed pipe will be true to line and grade. Bell holes shall be dug after the trench bottom has been graded. Bell holes shall be excavated so that only the barrel of the pipe bears on the pipe foundation.
3. Each lift shall be evenly spread and moistened or dried by disk harrowing or other

means so that the required density will be produced.

4. Backfill around valves, vaults and appurtenances with granular backfill material.

C. Compaction

1. Backfill Compaction Requirements:
   a. Under pavements, or other surface improvements, the minimum density shall be 96% of laboratory maximum density as determined by ASTM D-1557 (Modified Proctor).
   b. In shoulders and other unimproved areas, the minimum density shall be 90% of laboratory maximum density as determined by ASTM D-1557.
2. Compaction shall be performed in strict accordance with the manufacturer's recommendations for each type of pipe.
3. Mechanical compaction: Shall be accomplished by the use of a sheep-foot roller, pneumatic tire roller, vibrating roller, or other mechanical tampers of a size and type necessary to achieve the required degree of compaction.

D. Dewatering

1. The Contractor shall do all pumping, build all drains and do all the work necessary to keep the trench and pipes free from water during the progress of the work.
2. In wet trenches, a channel shall be kept open along the side of the pipe for conducting the water to a sump hole, from which it shall be pumped out of the trench. No water shall be allowed to enter the pipe.

3.4 PROTECTION

A. Provide barricades and restrict access as appropriate to prevent damage to Work in place.

B. Contractor shall be responsible for protection of Work in place against displacement, damage, or loss until Owner's acceptance. Any work subsequently damaged, lost or displaced shall be repaired or replaced to the Owner's satisfaction at no additional cost to the Owner.

3.5 CLEANING

A. Thoroughly clean, rake, wash, flush or sweep as required to clean adjacent improvements of materials covered as part of this Work prior to submitting for Owner's acceptance.

B. Contractor shall provide all labor, equipment, materials and other items as required to perform clean up as required by the Owner, adjacent property owners and other jurisdictions.

C. Finish grading of areas affected by this Work shall be required as part of clean up.

D. The roadway including shoulders, slopes, ditches, and borrow pits shall be smoothly trimmed, and shaped by machinery, or other satisfactory methods, to the lines, grades and cross-sections, as established, and shall be so maintained until accepted. Any surplus material not suitable for spreading along the road to widen the existing shoulder or raise the grade shall be disposed of as specified above.

3.6 TESTING

A. The Contractor shall employ a testing laboratory to perform field and laboratory density tests. The Contractor shall make such additional tests, at his expense, as deemed necessary by him to assure that the work of compaction is performed properly and determine any adjustments in compacting equipment, thickness of layers, moisture content and compactive effort or other means necessary to obtain the specified minimum relative density. Provide access to the work and all manpower and machinery necessary to aid the testing laboratory personnel in performing field density tests or taking samples for laboratory tests. In general, tests and

samples shall be made as the work proceeds.

B. Testing laboratory is to perform maximum density tests on materials to be compacted from samples submitted by Contractor taken from locations selected by the Owner.

C. Testing laboratory is to perform field density tests of compacted backfill materials. The approximate location of such tests shall be as shown on the drawings or as selected by the Owner. Field density tests shall be taken every 200' along the pipeline alignment as follows:

1. In planted or unimproved areas:
    a. 18" above the top of the pipe
    b. Finished grade
2. In streets, roads, parking lots or other paved areas:
    a. 18" above the top of the pipe
    b. 24" to 36" below the gravel road base
    c. Gravel road base subgrade
    d. Top of gravel road base
    e. Top of bituminous surface course

D. Copies of test results prepared by the testing laboratory shall be transmitted to the Contractor at the same time they are transmitted to the Owner.

E. Successful performance of compaction at the location of the field density test shall not relieve the Contractor of his responsibility to meet the specified density requirements for the complete project.

END OF SECTION

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SECTION 32 05 00
RESTORATION OF EXISTING IMPROVEMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Contractor shall provide all materials, labor, equipment, transportation, and other items required to restore existing improvements dislocated, damaged, or removed as indicated or as required to accomplish Work of other sections of these specifications. All restoration Work shall be in accordance with applicable regulations and as specified herein.

B. Restoration of existing improvements includes, but is not limited to the following:

1. General restoration requirements
2. Restoration or replacement of gravel, asphaltic concrete, or Portland cement concrete pavements, including base course and striping.
3. Portland cement concrete curbs, gutters, sidewalks, and driveways
4. Landscaping improvements
5. Miscellaneous improvements

1.2 RELATED WORK

A. Section 31 23 16 – Excavation, Backfilling and Compaction

1.3 REFERENCES

A. The applicable provisions of the latest editions of the References listed below shall govern the Work covered under this Section, unless there is a conflict between said References and the requirements of this Section. In the case of such a conflict, the requirements of this Section shall apply.

B. Utah Department of Transportation Standard Metric Specifications for Road and Bridge Construction, latest edition including all addenda.

C. American Society for Testing and Materials (ASTM)

D. American Association of State Highway and Transportation Officials (AASHTO)

E. American Concrete Institute (ACI)

F. Concrete Reinforcing Steel Institute (CRSI)

1.4 SUBMITTALS

A. Submit shop drawings, manufacturer's literature, certifications, and other product data in accordance with Section 01 33 00 - Submittals.

B. Required submittals include, but are not limited to:

1. Manufacturer's recommended transportation, unloading, and storage requirements as well as installation guides and instructions for materials provided as part of this Work.
2. Evidence of materials conformance with applicable requirements as well as these specifications.
3. Dimensional information for pipes, valves, fittings, castings, structures and other items provided as part of this Work.

C. Contractor shall maintain accurate construction record drawings for items restored as part of this Work, but covered by subsequent landscaping, paving or as a result of Work of other sections of these specifications. These records shall be submitted to Engineer for approval prior to application for final payment.

1.5 QUALITY ASSURANCE

A. Transportation, handling, storage and installation practices shall be in accordance with manufacturer's recommended practice for materials provided as part of this Work.

B. Use adequate numbers of skilled workmen who are trained and experienced in the type of construction required.

C. The quality of the finished restored improvement, as determined by the Owner, shall be of equal or better quality than was said improvement prior to being damaged or removed.

1.6 DELIVERY, STORAGE AND HANDLING

A. Contractor shall be responsible for proper transportation, unloading, handling, storage, and security of all equipment and materials to be provided as part of this specification in accordance with manufacturer's recommendations.

B. Materials shall be stored in such a manner as to prevent damage or degradation. Any materials damaged prior to installation shall be removed from the project and replaced with new materials at no additional cost. Lost or stolen materials shall be replaced at no additional cost.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers providing materials or equipment as part of this specification shall have a minimum of five years' experience in the design, manufacture, testing and support of such materials.

B. Manufacturers shall provide, upon request, verification of a consistent record of meeting or exceeding materials or performance standards as specified herein.

2.2 MATERIALS - GENERAL

A. Materials shall be as required to complete the restoration of existing improvements, and shall be at least equal to original improvement at the time of damage or removal, as determined by the owner of said improvement, and shall match original construction in finish and dimension.

B. Materials shall be in accordance with requirements of local jurisdiction having authority. Obtain approval of all materials from local jurisdiction having authority prior to ordering.

2.3 BITUMINOUS SURFACE COURSE

A. Asphaltic concrete surface course shall be plant mix in accordance with UDOT, ½" Gradation using PG 64-34 asphaltic cement. Refer to UDOT specifications Section 02741.

B. Compaction requirements are no tests less than 93.5% percent of the density (determined in accordance with ASTM D2041), as determined by ASTM D2170.

2.4 PORTLAND CEMENT CONCRETE

A. Portland cement concrete for curbs, gutters, sidewalks and driveways shall be Class AA(AE) conforming to the requirements of Section 0355, UDOT Standard Specification for Road and Bridge Construction.

2.5 SOD AND VEGETATION

A. All materials shall be from sources approved by the Owner; however, such approval does not relieve the Contractor from responsibilities for growth, maintenance and replacement has specified herein.

B. Topsoil:

1. Topsoil for backfill mixture for tree pits shall be fertile, friable, natural loam, surface soil, reasonably free of clay lumps, brush, weeds, and other litter, and free of rocks, stumps, stones larger than 2-inch in any dimension, and other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from naturally well drained sites where topsoil occurs in a depth of not less than 4 inch.
2. Do not obtain from bogs or marshes.

C. Manure:

1. Well dried, rotted, unleached, pulverized cattle manure reasonably free from refuse and harmful materials.

D. Mulch:

1. Fine grind bark mulch.

E. Tree staking and guying:

1. Steel T post stakes 8 feet long and steel ground stakes 18 inches long.
2. All T post stakes shall be primed and painted a dark green color.
3. Provide wire ties and guys of 2 strand, twisted, pliable, galvanized iron wire not lighter than 12 gauge.
4. Provide new 2 ply garden hose not less than 5/8 inch diameter in size, cut to required lengths to protect tree trunks from damage by wires.

F. Sod:

1. Strongly rooted blend of Kentucky Blue Grass sod, not less than 2 years old and free of weeds and undesirable native grasses.
2. Provide only sod capable of growth and development when planted (viable, not dormant).
3. Recommended Kentucky Blue Grass mixture is 50 parts Baron, 25 parts Glade and 25 parts Touchdown, or approved equal.

G. Commercial fertilizer:

1. Agriform 20 10 5, 21 gram fertilizer tablets for trees and shrubs. Provide three tablets per tree.
2. Ammonium sulfate fertilizer in pellet form for lawn areas at 40 actual pounds of nitrogen per acre.

H. Trees:

1. Trees shall be not less than indicated sizes, balled and burlapped or container grown, unless otherwise indicated, specified or required by Owner of tree removed.

I. Shrubs:

1. Shall be as removed, minimum 5 gallon can.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that Work covered under other sections of these specifications is complete to the point that Work covered under this section may properly commence without hindering or damaging Work of other trades. Do not proceed with construction until unsatisfactory conditions have been corrected.

B. Verify that Work performed under other sections of these specifications has been adequately observed, tested and accepted prior to covering up that Work as part of the Work specified under this section.

C. Carefully examine restoration areas, verifying dimensions, materials and other restoration requirements with Engineer and Owner prior to beginning Work covered under this section.

3.2 METHODS AND PROCEDURES

A. General Requirements

1. Contractor shall obtain all permits necessary for the restoration of existing surface improvements.
2. Contractor shall protect all public and private property adjacent to the work. Exercise due caution to avoid damage to such property.
3. All improvements damaged or removed shall be restored in accordance with local jurisdiction having authority. In case of conflict between these specifications and local authority specifications, the local authority shall govern.
4. Repair or replace all existing surface improvements, which were damaged or removed as a result of operations of Work under this contract. Restoration shall be of at least equal quality and identical in dimension to original improvement unless specifically specified otherwise.

3.3 INSTALLATION

A. Gravel Surfaced Areas

1. Where trenches are excavated through gravel surfaced areas such as roads and driveways and other areas, the gravel surface shall be restored by placing untreated base course material upon a prepared subgrade.
2. Subgrade preparation shall conform to the following:
    a. Subgrade shall be proof-rolled by passing moderately-loaded rubber tire-mounted construction equipment uniformly over the surface continuously at least twice, or by other means acceptable to Engineer. If excessively soft, loose or disturbed soils are encountered, they shall be removed as directed by Owner, to a maximum depth of two feet, and replaced with stabilizing structural fill, compacted to 96% of the maximum laboratory dry density determined by ASTM D-1557 or AASHTO T-180.
    b. Place structural fill in lifts not exceeding 8 inches in loose thickness.
3. Base Course
    a. Thickness of untreated base course surface shall be 6 inches or shall match existing, whichever is greater.
    b. Base course shall be compacted to no less than 96% maximum Modified Proctor Density, as determined by ASTM D1557 (AASHTO T-180). Moisture content shall be maintained to within 1.5% of optimum throughout placing and compaction operations.

B. Asphaltic Concrete Surfaced Areas

1. Where trenches are excavated through asphaltic concrete surfaced areas such as roads, driveways or parking areas, the surface shall be restored by preparing the subgrade, placing base course, placing tack and prime coats, and placing the asphaltic concrete surface course(s).
2. Subgrade preparation shall conform to applicable parts of Section 02056, UDOT Standard Specifications for Road and Bridge Construction:
    a. Average of field density determinations shall be 96 percent of the maximum dry density, with no determination lower than 92 percent.
    b. The maximum dry densities shall be determined in accordance with the following:
        (i) A-1 Soils: AASHTO Designation T-180, Method D.
        (ii) All other Soils: AASHTO Designation T-99, Method D.
3. Thickness of base course shall be 6 inches, shall match existing, or shall be as required by local authority having jurisdiction, whichever is greater.
4. Placing and compaction of untreated base course shall conform to applicable parts of Section 02721, UDOT Standard Specifications for Road and Bridge Construction, excluding pay factor allowances.
5. Tack Coat
    a. Tack coat shall be applied at the rate of 0.05 to 0.15 gal/SY. A hand sprayer or brush shall be used to apply tack coat to vertical faces of previously constructed bituminous pavement (over 1/2 hour hence) prior to placing an adjacent or parallel pass, curbs, gutters, slab edges, and all structures to be in actual contact with the bituminous pavement. Tack coat shall also be applied uniformly at the same rate to the horizontal top surface of each lift of bituminous pavement prior to placing the next lift of bituminous pavement to promote a bond between the two courses of pavement. None of the material shall penetrate into the pavement and for this reason the application should be limited.
    b. Prior to applying the material, the surface to be treated shall be swept or flushed free of dust or other foreign material.
    c. Protect all surfaces not required to receive tack coat from any inadvertent application.
    d. The temperature range of the tack coat at the time of application shall be such that the viscosity will be between 50 and 100 centistokes as determined in accordance with ASTM Designation D2170.
    e. Under no circumstances shall traffic be permitted to travel over the tacked surface. If detours cannot be provided, restrict operation to a width that will permit at least one way traffic over the remaining portion of the roadbed. If one way traffic is provided, the traffic shall be controlled in accordance with governing authority.
    f. After application of tack coat, sufficient time shall be given to allow for complete separation of asphalt and water before paving operations begin. The tack coat shall be applied on only as many surfaces as will be paved against in the same day.
6. Mixing, placing, spreading and compaction of bituminous surface course shall conform to applicable parts of Section 02741, UDOT Standard Specifications for Road and Bridge Construction, excluding pay factor allowances.

C. Concrete Curbs, Gutter, Sidewalks and Driveways

1. Shall be removed and replaced to the next joint or scoring lining beyond the actually damaged or broken sections; or in the event that joints or scoring lines do not exist or are three or more feet from the removed or damaged section, the damaged portions shall be removed by saw cutting full-depth.
2. All new concrete shall match, as nearly as possible, the appearance of adjacent concrete improvements. Where necessary, lampblack or other pigments shall be added to the new concrete to obtain the desired results.
3. Concrete forms shall be true to line and of sufficient strength to ensure against bulging or displacement.
4. Contraction and expansion joints shall match original construction in placement and size, unless otherwise required by local jurisdiction having authority.
5. Reinforcement shall be replaced as in original construction, unless otherwise required by local jurisdiction having authority, and shall be installed in accordance with applicable CRSI and ACI Standards.
6. Finishing and curing shall be in accordance with local jurisdiction having authority.

D. Vegetated Areas

1. Prior to placing sod or other final vegetative cover, examine and repair the subgrade as necessary to assure a smooth and even surface which will match grade and contours of surrounding undisturbed ground. Finish grade construction areas to match grade prior to construction activities. Assure that a positive slope away from all building walls is maintained for at least 10 feet to prevent runoff from approaching walls.
2. Prepare soil under areas to receive vegetation by placing topsoil to a depth equal to surrounding conditions or to 6 inches, whichever is greater. Disk or till 3 cubic yards manure per 1000 square feet of surface area to a depth of 8 inches.
3. Roll and rake areas receiving vegetation to smooth, even surface, free of ridges, with loose, uniformly fine texture.
4. Allow for final vegetation thickness when preparing subgrade.
5. Restore raked areas to specified condition if eroded or otherwise disturbed after fine grading and prior to placing vegetative cover.
6. Remove stones over 1 1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter.
7. Limit preparation to areas that will be planted promptly after preparation.
8. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before sodding. Do not create a muddy soil condition.

E. Trees and shrubs:

1. Layout individual tree locations.
2. Secure approval of Engineer and Owner prior to planting.
3. Excavate tree and shrub pits with vertical sides. Dispose of subsoil removed from landscape excavations. Do not mix with backfill. If tree or shrub is to be planted on excavation area, remove all impervious fill from tree and shrub pit down to pervious material.
4. Place three Agriform fertilizer tablets evenly around the perimeter of, and immediately adjacent to the root ball at a depth which is between the middle and the bottom of the root ball.
5. When excavation is approximately 2/3 full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final

layer of backfill.

6. Stake or guy trees immediately after planting. Stakes and guys should be evenly distributed around tree. All stakes must be driven so as not to disturb the root ball.

F. Sprinkling Systems:

1. Restore all sprinkling systems and fences disturbed, removed, or damaged by construction operations in a condition at least equal to that prior to construction.

G. Sodding:

1. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.

2. Secure sod on slopes with U-shaped wire clips as required to prevent slippage. Immediately after planting, sod shall be thoroughly watered with a fine spray. Watering shall occur as frequently as needed to keep sod constantly moist for a period of 14 days after planting. Two weeks after planting, apply ammonium sulfate in pellet form at 40 actual pounds of nitrogen per acre. Water thoroughly immediately after fertilizing.

H. Miscellaneous Restoration Items

1. All other improvements interrupted or removed to permit the construction specified herein shall be restored. Miscellaneous improvements to be restored shall include, but shall not be limited to, the following:

a. Culverts

b. Fences

c. Utilities

3.4 PROTECTION

A. Provide barricades and restrict access as appropriate to prevent damage to Work in place.

B. Contractor shall be responsible for protection of Work in place against displacement, damage, loss or theft until Owner's acceptance. Any Work installed and subsequently damaged, lost or displaced shall be repaired or replaced to the Owner's satisfaction at no additional cost.

C. Planting Maintenance:

1. Begin maintenance immediately after planting, and continue until observation and acceptance, in no case less than 30 days from the time of completion of Work.

2. Maintain trees by pruning, cultivation and weeding as required for healthy growth. Restore planting saucers.

3. Tighten and repair stake and guy supports and reset trees to proper grades or vertical position as required. Spray as required to keep trees free of insects and disease.

4. Maintain lawns for not less than 30 days and longer as required to establish an acceptable lawn. To be acceptable, lawn must be past second mowing with no bare spots. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

3.5 CLEANING

A. Thoroughly clean, rake, wash and/or flush all restoration Work prior to submitting for Owner's

acceptance.

END OF SECTION

SECTION 32 11 23
BASE COURSE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes subgrade preparation, placement, grading and compaction of base and sub-base course materials, and dust and surface water control.

1.2 RELATED WORK

A. Section 31 23 00 - Excavating, Backfilling and Compaction

B. Section 32 12 16 - Asphaltic Concrete Paving

1.3 REFERENCES

A. American Society for Testing Materials (ASTM).

B. American Association of Safety and Highway Transportation Officials (AASHTO)

1.4 SUBMITTALS

A. Name of supplier and aggregate source.

B. Target gradation curve.

1.5 QUALITY ASSURANCE

A. Use a laboratory that follows and complies with ASTM D3740 and Section 01 45 00 – Quality Control.

PART 2 - PRODUCTS

2.1 BASE COURSE MATERIAL

A. Road Base for Concrete Sidewalks, Concrete Curb and Gutter, and Waterways and Pavement Preparation shall be:

1. Unwashed, hard, durable, angular pit run gravel or crushed natural stone.
2. Shall be free from shale, silt, clay, loam, friable or soluble materials.
3. Shall be free from noticeable concentrations of alkali, salt, and petroleum products, all roots, sod, limbs, and other vegetative matter, slag, cinders, ashes and rubbish, or other material that, in the opinion of the Engineer, is objectionable or deleterious.

B. Gradation Requirements

1 Inch Gradation

Sieve Size	*% Passing*
1"	100
½"	79-91
No. 4	49-61
No. 16	27-35
No. 200	7-11

OR

¾ Inch Gradation

Sieve Size	*% Passing*
3/4"	100
3/8"	78-92
No. 4	55-67
No. 16	28-38
No. 200	7-11

PART 3 - EXECUTION

3.1 PREPARATION OF SUBGRADE

A. Prior to placing base course materials, the subgrade shall be scarified to a depth of not less than 6", moistened or dried to optimum moisture content, and compacted to at least 95% maximum Modified Proctor Density as determined in accordance with ASTM D1557 (AASHTO T-180), and shall be within 2% of optimum moisture content.

B. The subgrade shall then be proof rolled in the presence of the Engineer by passing loaded rubber-tired construction equipment uniformly over the surface at a constant rate. At least two (2) passes shall be made over all subgrade areas.

C. If excessively soft, loose, or disturbed soils are encountered, they shall be removed as directed by the Engineer to a maximum depth of two feet (2') and replaced and recompacted to 95% maximum Modified Proctor Density using approved subgrade stabilizing material.

D. Ensure subgrade is to required lines and elevations.

3.2 PLACEMENT OF BASE COURSE

A. Protect against "pumping" moisture to surface by limiting travel on exposed subgrade. Where it is determined by the Owner that construction vehicle traffic (other than proof rolling) has caused subgrade instability, remove disturbed soils and replace with sand backfill at no additional cost to the Owner.

B. Apply water soluble herbicide for nonselective control of annual and perennial weeds in strict accordance with manufacturer's instructions and all laws and regulations.

C. Place base course material on the prepared and accepted subgrade. The material shall be back-dumped and spread in a uniform lift thickness.

D. Handle and spread materials in a manner that will prevent segregation of sizes. When vibrating or other acceptable types of compaction equipment are used, the entire course may be placed in one layer, provided the ability of the equipment to achieve specified compaction to the full layer depth is demonstrated. In no case shall compacted lift thickness be greater than 8".

E. When base course is constructed in more than one layer, the previously placed layer shall be cleaned of loose and foreign matter. Upper layer of base course shall not be less than 1-1/2", nor shall fine materials be added to reach final grade.

F. Overstressing the subgrade soil and base course shall be avoided by utilizing equipment in spreading and dumping that exerts only moderate pressures on the soil. Avoid excessive travel on lower base course lifts. Severe rutting, cracking or yielding is an indication of overstressing the soil. Any ruts or cracks which develop in the base course during spreading or compacting shall be repaired as directed at no additional cost to Owner.

G. Base course shall be compacted to no less than 95% maximum Modified Proctor Density, as determined by ASTM D1557 (AASHTO T-180). Moisture content shall be maintained to within 1.5% of optimum throughout placing and compaction operations.

1. Compaction shall always be commenced along the edge of the area to be

compacted and the roller shall gradually advance toward the center of the area to be compacted.

2. Compaction equipment shall be operated along lines parallel or concentric with the centerline of the road being constructed, and no material variation therefrom will be permitted.

H. Base course shall be substantially true to line and grade as indicated on the drawings. The surface shall be within 1/2" of required grade. Completed thickness of base course shall be within 1/2" of indicated thickness, with average thickness not less than that indicated.

I. The top surface of compacted base course shall be finished by blading or rolled with equipment designed for that purpose.

J. Temporary Graded Surface

1. When allowed by the local jurisdiction having authority, where trenches are excavated in paved traffic lanes, the surface course may be temporarily replaced by a surface consisting of base course material. The base course shall be removed and replaced with pavement as soon as conditions permit, or as required by local jurisdiction having authority.

2. The surface shall be maintained to provide for a smooth flow of traffic without holes, bumps, etc., until final acceptance of the work.

3.3 DUST AND SURFACE WATER CONTROL

A. Dust control measures shall be implemented by application of water to all work areas, storage areas, haul and access roads, or other areas affected by work.

B. All work shall be in compliance with the Federal, State and local air pollution standards, and not cause a hazard or nuisance to personnel and the public in the vicinity of the work.

C. Provide and operate at least one (1) mobile tank sprinkling unit during the contract period.

D. Other methods of dust control for haul and access roads may include chemical treatment, light bituminous treatment or other method as approved by the Owner.

E. Surface water shall be controlled to the extent that the areas to receive pavement, walks or slabs are not allowed to become wet from runoff from adjacent areas. Surface water shall be directed away from these areas but not directed toward adjacent property, buildings, or any improvement that may be damaged by water. Surface water shall not be allowed to enter sanitary sewers.

3.4 FIELD QUALITY CONTROL

A. Contractor shall employ a qualified testing agency to perform the following tests:

Item	*Type*	*Frequency*
Base course aggregate sampling	ASTM D75	Each day or 1 test/500 sq. yd., or as required
Atterberg limits	ASTM D2419, D423, and D424	As required
Sieve analysis	ASTM C136	As required
Bearing ratio	ASTM D1883	As required
Maximum density	ASTM D1557, Method D	As required

In-place density	ASTM D2167, D2922 and D3017	As required

B. If tests indicate that sub-base and/or base course do not meet specified requirements, remove defective work, replace and retest at no cost to Owner.

END OF SECTION

SECTION 33 11 00
WATER DISTRIBUTION AND TRANSMISSION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes water system transmission or distribution piping, valves, fittings and accessories, hydrants, thrust blocking, corrosion protection, installation, protection, cleaning, and hydrostatic and leakage testing for potable waters systems.

1.2 RELATED WORK

A. Section 31 23 00 Excavation, Backfilling and Compaction.
   1. Excavation of trenches, pipe bedding and backfill, compaction of backfill

B. Section 33 13 00 - Disinfection of Water Distribution Systems

C. Section 03 10 00 - Cast-in-Place Concrete
   1. Thrust blocks, vaults and other structures associated with water systems.

1.3 REFERENCES

A. The applicable provisions of the latest editions of the References listed below shall govern the Work covered under this section, unless there is a conflict between said References and the requirements of this Section. In the case of such a conflict, the requirements of this section shall apply.

B. American Water Works Association (AWWA)

C. American Society for Testing and Materials (ASTM)

D. American National Standards Institute (ANSI)

E. American Association of State Highway and Transportation Officials (AASHTO)
   1. Standard Specifications for Highway Bridges

F. Ductile Iron Pipe Research Association (DIPRA)

G. Uni-Bell PVC Pipe Association

H. American Public works Association (APWA)

1.4 SUBMITTALS

A. Submit shop drawings, manufacturer's literature, certifications, and other product data in accordance with Section 01 33 00 - Submittals.

B. Required submittals include, but are not limited to:
   1. Evidence of materials conformance with these specifications.
   2. Manufacturer's recommended transportation, unloading and storage requirements. Manufacturer's installation guides and instructions.
   3. Dimensional information for pipe, valves, fittings, castings, and structures.

C. Contractor shall maintain accurate construction record drawings of all as-built valve, fitting, and line locations, manhole locations, pipe lengths, and other relevant data and shall submit these records to the Owner for approval prior to application for final completion in

accordance with Section 01 78 50 – Closeout Procedures.

1.5 QUALITY ASSURANCE

A. Transportation, handling, storage and installation practices shall be in accordance with manufacturer's recommended practice for materials provided as part of this Work.

B. Contractor's personnel shall be experienced in the installation of materials provided as part of the Work, and shall comply with manufacturer's recommended practices during handling, placement and installation of such materials.

C. Pipe, valve and appurtenant materials and Workmanship shall be in accordance with ANSI/NSF 61 and AWWA Standards as applicable.

1.6 DELIVERY, STORAGE AND HANDLING

A. Contractor shall be responsible for proper transportation, unloading, handling, storage and security of all equipment and materials to be provided as part of this specification in accordance with manufacturer's recommendations.

B. Materials shall be stored in such a manner as to prevent damage or degradation. Any materials damaged prior to installation shall be removed from the project and replaced with new materials at no additional cost. Lost or stolen materials shall be replaced at no additional cost.

C. Load and unload pipe, fittings, specials, valves and accessories by lifting with hoists or skidding so as to avoid shock or damage. Do not skid or roll pipe on skidways against pipe already on the ground.

D. Each length of pipe shall be unloaded opposite or near the place where it is to be laid in the trench.

E. Polyvinyl Chloride (PVC) piping, fittings, and materials shall be protected during storage from ultraviolet and ozone degradation. Noticeably faded materials shall not be installed and shall be promptly removed from project site.

F. At times when pipe laying is not in progress, the open end(s) of pipe in the trench shall be closed by a watertight plug.

1.7 PERFORMANCE REQUIREMENTS

A. Depth of Cover

1. Minimum cover shall be 3-½' from top of pipe to ground surface. Maximum shall be 6' unless the drawings indicate otherwise.

B. Layout

1. Comply with Utah Administrative Rules R309-550. As a minimum, locate potable water pipe at least 18 inches vertical and 10 feet horizontal edge to edge between water and sewer lines. Place water lines above sewer line.
2. Where potable water pipe crosses under gravity-flow sewer lines, fully encase sewer pipe in concrete for a distance at least 10 feet each size of the crossing.
    a. Do not locate any joint in the water line within 36 inches of the crossing.
3. Encase water line if it is within 24 inches of a sewer force main or a sewer inverted syphon.
4. Encase sewer main joints in concrete if joints are horizontally closer than 36 inches to the water line.
5. Do not put potable water lines in the same trench with sewer lines, storm drains or

electrical wires.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND FABRICATION

A. Manufacturers providing materials or equipment as part of this specification shall have a minimum of five (5) years in the design, manufacture, and testing of such materials.

B. Manufacturers shall provide, upon request, verification of a consistent record of meeting or exceeding materials or performance standards as specified herein.

2.2 POTABLE WATER SYSTEM PIPING

A. Water system piping shall be of the size, type, and class indicated on the drawings and as specified herein.

B. Tracer Wire.

1. Any non-metallic pipe, regardless of size or installation, shall have a 14 gauge insulated copper tracer wire installed within 6" directly above the top of the pipe.
2. Wire is to be spliced in at all connections to other mains, and connections must be covered or coated with corrosion protection using gel caps or mastic pad.
3. When a new main ends, such as at a dead end or where it connects to an old main that does not have a tracer wire, the locating wire shall be properly grounded either by connecting directly onto the metal pipe or by connecting onto a grounding rod. This connection shall also be covered or coating with corrosion protection as previously stated.

C. Ductile Iron Pipe and Fittings

1. Ductile iron pipe shall be designed and manufactured in accordance with the following requirements:
   a. AWWA/ANSI C150/A21.50 - American National Standard for the Thickness Design of Ductile Iron Pipe.
   b. AWWA/ANSI C151/A21.51 - American National Standard for Ductile Iron Pipe, Centrifugally Cast, for Water and Other Liquids.
2. Ductile iron fittings shall comply with the requirements of the following:
   a. AWWA/ANSI C110/A21.10 - American National Standard for Ductile Iron and Grey Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.
   b. AWWA/ANSI C153/A21.53 - American National Standard for Ductile Iron Compact Fittings, 3 in. through 24 in. and 54 in. through 64 in. for Water Service.
3. Ductile iron pipe and fittings shall be cement mortar lined and shall have a bituminous seal coat in accordance with the requirements of AWWA/ANSI C104/A21.4 - American National Standard for Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
4. Joints and gaskets shall be in accordance with AWWA/ANSI C111/A21.11 American National Standard for Rubber Gasketed Joints for Ductile Iron Pressure Pipe and Fittings.
5. Flanged pipe shall be in accordance with AWWA/ANSI C115/A21.15 - American National Standard for Flanged Ductile Iron Pipe with Ductile Iron or Grey Iron Threaded Flanges.

D. Polyvinyl Chloride Pipe

1. PVC pipe shall be manufactured from virgin Class 12454A or 12454B materials as

defined by ASTM D1784 .

2. PVC pipe and fittings shall be designed and manufactured in accordance with the following requirements:
    a. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution.
    b. AWWA C905 - Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 in. Through 36 in.
    c. AWWA C907 - Polyvinyl Chloride (PVC) Pressure Fittings for Water - 4 in. Through 8 in.

E. Prefabricated Steel Loops
1. Steel water loops shall be fabricated using steel pipe A53 Grade B ERW.
2. Steel pipe fittings shall conform to ASTM A234.
3. All welding shall be full penetration butt welds per ASTM C200
4. Lining and Coating Specifications;
    a. All fabricated steel pipe shall be sandblasted to "near white" (SSPC-SP10). Each section of pipe and or fittings shall be primed by the spraying method with Tnemec Series FC-20 Pota Pox (fast cure) Epoxy - Polyamide 20-1255 beige primer. This shall be 7 mils wet and 4 mils after drying. The minimum drying time shall be 3 hours at 77° F or 12 hours at 50° F before intermediate coats are applied. Proper curing will not occur under 35° F.
    b. Intermediate and topcoat shall be Tnemec Series FC-20 Pota Pox (Fast Cure) epoxy Polyamide 20-AA83 Tank White applied by the spraying method. Each coat shall be 9.0 mils wet and 5.0 mils dry per coat. The minimum dry time shall be 3 hours at 77° F. or 12 hours at 50° F. before finish coat is applied. Proper curing will not occur under 35° F.
    c. Total Dry Film Thickness shall be 14.0 mils (minimum).
    d. All welded joints or other repairs shall be made in the same manner as listed above.
    e. All underground loops, spools, and fabricated piping shall be double tape wrapped after the above coatings, with Polyken 934-35 Pipe Wrap or equal
    f. All Tnemec products listed above are listed by the State of Utah, Board of Health, NSF and conforms to AWWA 1DO1 Inside System No. 1.

2.3 CORROSION PROTECTION

A. Bolts: Apply 2 coats of Coal for Mastic (Kopper 50 or equal) to all exposed surfaces of bolts and to all bolt threads after installation of piping, fittings, valves, and couplings.

B. Fittings, valves, and specialties shall be tape wrapped with Polyken 930 filler tape for filling voids and with Polyken 930 tape to cover.

C. Polyethylene encasement, if required, shall conform to AWWA/ANSI C105/A21.5 - American National Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.

D. Buried ductile iron mechanical joints shall be covered in grease and 8 mil vinyl wrap plastic.

2.4 VALVES

A. Gate valves:
1. Shall be iron body fully bronze mounted, double disc parallel seat, or resilient seat non-

rising bronze stem with mechanical joint ends, except as otherwise specified or shown on the Drawings.

2. Gate valves shall conform to the following requirements:
    a. AWWA C509 - Resilient Seated Gate Valves for Water Supply Service.
3. All valves shall be provided with a 2" square operating nut for key operation from ground surface and open to the left, unless hand wheels are indicated.
4. Valve body and gates shall be rated to a design working pressure of 200 psig for valves up to 12", and 150 psig for valves of 16" or greater. All valves shall be factory tested to twice the rated working pressure.
5. Gate valves for potable water service shall be epoxy lined in accordance with AWWA/ANSI C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
6. Gate valves shall be similar and equivalent to that produced by the following manufacturers:
    a. Mueller Series 2300
    b. Clow Cat. Model No. 2639
    c. American Darling Series 2500

B. Tapping valves and sleeves:

1. Tapping valves shall have large diameter seat rings to permit entry of tapping machine cutters. Inlet shall be flanged. Outlet shall suit branch piping and shall include the required flange for tapping machine adapter connection. Tapping valves shall conform to the applicable requirements for gate valves as specified herein.
2. Tapping sleeves shall be suitable for assembly around the existing main. Body shall be high strength ribbed construction. End gaskets shall be sized to suit the existing main.
3. Tapping valves and sleeves shall be similar and equivalent to those produced by the following manufacturers:
    a. Mueller cast iron split tapping sleeve
    b. JCM model 414 custom fabricated mechanical joint steel tapping sleeve

C. Butterfly Valves

1. Butterfly valves shall conform to the requirements of AWWA/ANSI C504 - Rubber Seated Butterfly Valves.
2. Butterfly valves for potable water service shall be epoxy lined in accordance with AWWA/ANSI C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
3. Butterfly valves shall comply with the following requirements:
    a. Valve bodies shall be ductile iron conforming to ASTM A126, Class B.
    b. Discs shall be streamlined and shall have a continuous 360E seating surface of 18-8 stainless steel.
    c. Shafts shall be 18-8 stainless steel of stub construction with at least 1-1/2 shaft diameter engagement into the disc and shall be fastened to the disc with upset pins.
    d. Seats shall be Buna-N material and shall be bonded to the valve body. Seats shall provide tight shutoff
    e. Mueller Lineseal III Series
    f. Clow Style 4500

D. Check Valves

1. Check valves shall conform to the requirements of AWWA/ANSI C508 - Swing Check Valves for Waterworks Service - 2 in. through 24 in. NPS.
2. Check valves for potable water service shall be epoxy lined in accordance with AWWA/ANSI C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
3. Check valves shall be weighted swing arm type unless otherwise noted, similar and equivalent to those produced by the following manufacturers:
    a. Mueller Cat. No. A-2600 Series
    b. Clow Cat. No. F-5300 Series

E. Air Relief/Vacuum Valves

1. Air relief/vacuum valves shall conform to the requirements of AWWA/ANSI C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
2. Air and Vacuum Valves shall vent air from lines being filled and shall allow entry of air upon draining of lines. Design of valves shall be such that velocity of air passing through the valve will not blow float shut at design volumes.
    a. Valve body shall be cast iron conforming to ASTM A126, Class B.
    b. Float, and guide rod shall be stainless steel conforming to ASTM A240 and A582, respectively.
    c. Valves shall be designed to withstand hydrostatic pressures of 300 psig.
    d. Valve seat shall be BUNA-N Rubber.
    e. Valve inlet shall be ANSI Class 125 or Class 250 flanged, or NPT as indicated.
    f. Valve shall be of the size indicated and shall include vent piping of the size, type and configuration indicated.
    g. Air and Vacuum Valves shall be similar and equivalent to Crispin AL Series as manufactured by Multiplex Manufacturing Co.
3. Air Relief Valves shall vent air from high points in lines under pressure.
    a. Valve body shall be cast iron conforming to ASTM A126, Class B.
    b. Float, float lever and operating linkages shall be stainless steel conforming to ASTM A240 or A582, bronze conforming to ASTM B62, or brass conforming to ASTM B16.
    c. Valves shall be designed to withstand hydrostatic pressures of 300 psig.
    d. Valve seat shall be PVC or stainless steel conforming to ASTM A276.
    e. Valve inlet shall be ANSI Class 125 or Class 250 flanged, or NPT as indicated.
    f. Valve shall be of the size indicated and shall include vent piping of the size, type and configuration indicated.
    g. Pressure Air Relief Valves shall be similar and equivalent to Crispin P Series as manufactured by Multiplex Manufacturing Co.
4. Combination or Universal Air Relief Valves shall allow air to be vented from lines being filled, shall allow entry of air when lines are being drained, and shall allow venting of air from lines under pressure. Valve shall be a single unit (universal type) or dual unit (combination type) assembly as indicated.
    a. Universal Air Relief Valves shall be similar and equivalent to Crispin UL Series as manufactured by Multiplex Manufacturing Co.
    b. Combination Air Relief Valves shall consist of an Air and Vacuum Valve and a

Pressure Air Release Valve and shall be similar and equivalent to Crispin C Series as manufactured by Multiplex Manufacturing Co.

F. Pressure Reducing Valves (PRV)

1. Pressure reducing valves shall be hydraulically operated, pilot controlled diaphragm operated, globe pattern regulating valves with the following function features.
    a. Reduce variable inlet pressure to constant downstream pressure regardless of flow rate.
    b. Include pressure sustaining feature to maintain inlet pressure above a predetermined minimum.
    c. Rate of opening/closing adjustment.
2. PRV unit shall consist of valve body, pilot controls, related piping and all other items required to provide a complete, operational installation. PRV unit shall be constructed of the following materials:
    a. Valve body and cover shall be of ductile iron meeting the requirements of ASTM A536.
    b. Trim shall be bronze meeting the requirements of ASTM B62.
    c. Stem, nut and spring shall be of Type 304 stainless steel.
    d. Disk shall be Buna-N rubber.
    e. Diaphragm shall be of nylon reinforced Buna-N rubber.
    f. Pilot assemblies shall consist of bronze (ASTM B62) pilot control, Type 303 stainless steel trim, and Buna-N synthetic rubber parts. Control assembly shall be provided with a strainer.
    g. Control valves and piping shall be of bronze, copper, stainless steel or other non-corrosive metals.
3. Working pressure shall be 150 psi at maximum water temperature of 180° F.
4. Valve size, inlet/outlet pressures, and screwed/flanged designation shall be as indicated on the drawings.
5. Pressure reducing valves shall be similar and equivalent to the following:
    a. CLA-VAL Model 92-01

2.5 VALVE BOXES

A. Shall be suitable for HS-20 (AASHTO) traffic loading.

B. Shall be furnished and installed over each line valve and over each auxiliary hydrant valve. All buried valves shall be installed complete with two-piece, cast iron, screw type, 5-1/4 inch shaft valve box.

2.6 HYDRANTS

A. Hydrants shall be dry barrel type, of cast or ductile iron construction, with bronze glands, bushings, stems, stem nuts, valve seats, and nozzles.

B. Hydrants shall conform to the requirements of AWWA/ANSI C502 - Dry Barrel Fire Hydrants.
    1. Hydrant rated working pressure shall be 200 psig.

C. Hydrant features shall conform to the following requirements:
    1. Main valve opening shall be a minimum of 5-1/4".
    2. Pumper and hose nozzles shall be threaded in accordance with National Standard

hose coupling thread specifications.

a. Provide one (1) pumper nozzle, 4-1/2" nom. ID., 7.5 threads per inch

b. Provide two (2) hose nozzles, 2-1/2" nom. ID., 6 threads per inch.

3. Operating nut shall be National Standard, 1-1/2" pentagon, opening counter-clockwise.

4. Hydrants shall be warranted for ten (10) years against defects in materials and workmanship and shall be similar and equivalent to those produced by the following manufacturers:

a. Mueller Super Centurion Series

D. Hydrant appearance and paint scheme shall be in accordance with the requirements of the local jurisdiction.

2.7 INDICATOR POSTS

A. UL 789, FM Approved, vertical type, cast iron body with operating wrench, extension rod, and adjustable cast iron barrel of length required for depth of bury of valve.

1. Mueller A-20806 for 4" - 14"

2. Mueller A-20807 for 16" - 24"

B. Supervisory Switches: SPDT designed to signal valve in other than full open position.

2.8 MECHANICAL JOINT SLEEVES / COUPLINGS

A. AC pipe transition coupling to DI or PVC

1. PowerSeal, PowerMax Coupling

2. Viking-Johnson MaxiFit Coupling

B. Mechanical Joint Long Sleeve

1. Tyler, MJ "Long" Sleeve

2.9 MECHANICAL JOINT RESTRAINTS

A. EBAA IRON Megalugs® Series 1100 mechanical joint restraint for ductile iron pipe, 3" - 12".

B. EBAA IRON Megalug® Series 2000PV for restraining plain end PVC pipe at mechanical fittings and appurtenances, 3" - 36".

C. Sigma One-Lok™

D. Stargrip

2.10 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 200 psi.

2.11 REPAIR CLAMPS

A. Clamps shall provide a gasketed seal around the full circumference of the pipe. Bolts shall be high strength carbon steel.

B. Gasket dimensions shall suit existing and new pipe, as required.

C. Quality standard: Mueller series 540 (150 psig).

2.12 BOLTS

A. Bolts shall be stainless steel, conforming to ASTM A193 B8 and the nut shall be Grade 8. Install with an anti-seize lubricant. Do not use an impact wrench. Torque in accordance with the pipe manufacturer's criteria so as to not crush the pipe. Grease and wrap as specified.

B. Steel studs shall conform to ASTM A 193 B7 and the nut shall conform to ASTM A194 2H. The studs and nuts shall be treated with trivalent blue type 2 zinc coating. Grease and wrap as specified.

2.13 WATER MANHOLES

A. Water manholes shall consist of concrete base, riser and cone sections as well as iron ring and cover.

B. Manhole sections shall be manufactured in accordance with ASTM C478 and shall be designed to withstand AASHTO H20 loadings.

C. Manholes shall be watertight, both in floor and full height of walls. Joints shall be made water tight by the use of Kent-Seal or approved equivalent. Manhole grade rings shall be set in a full bed of mortar.

D. Manhole frames and covers shall be of domestic manufacture, suitable for AASHTO H20 loadings, manufactured of ductile or grey cast iron.

1. The bearing surface between frame and cover shall be machined to prevent rocking or uneven bearing.
2. Cover shall bear the lettering "WATER".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that Work covered under other sections of these specifications is complete to the point that Work covered under this section may properly commence without hindering or damaging Work of other trades. Do not proceed with construction until unsatisfactory conditions have been corrected.

B. Carefully examine all pipe fittings, valves and other appurtenances for damage and other defects immediately before installation.

C. Mark and hold defective materials for inspection by Owner, who may prescribe corrective repairs or reject the materials.

D. Prior to installation, observe valves for direction of opening, freedom of operation, tightness of pressure resisting bolts, cleanliness of valve ports and seating surfaces, handling damage and cracks. Hold defective valves for inspection by Owner.

E. Verify installation or connection requirements prior to construction by potholing as necessary.

3.2 METHODS AND PROCEDURES

A. General

1. Prior to pipe installation, prepare trench in accordance with the plans and Section 31 23 00 - Excavation, Backfilling and Compaction.
2. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the Work. All pipe, fittings, and valves shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or

equipment, in such a manner as to prevent damage to materials, protective coatings and linings. Under no circumstances shall water system materials be dropped or dumped into the trench.

3. Manufacturers' Installation Manual recommendations for handling and laying pipe, fittings and related materials shall be strictly adhered to. In no case shall these materials be dropped or dumped during transport, unloading, or handling.

3.3 INSTALLATION

A. Water Pipe Installation

1. Water pipe installation shall be in accordance with the applicable requirements of the following documents:
    a. AWWA/ANSI C600 - Installation of Ductile Iron Water Mains and their Appurtenances.
    b. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
    c. AWWA/ANSI C105/A21.5 - Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
    d. DIPRA - The Guide for the Installation of Ductile Iron Pipe
    e. UNI-B-3-92 - Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch).
2. All lumps, blisters, and excess coating shall be removed from the bell and spigot ends of each pipe, and the outside of the spigot and the inside of the bell shall be wiped clean and dry so as to be free from dirt, sand, grit, or any foreign material before the pipe is laid. Bevel and file spigot of pipe to prevent gasket damage during joint assembly.
3. The water pipe shall be laid and maintained to lines and grades established by the Drawings and Specifications with fittings and valves at the required locations unless otherwise approved by Owner.
4. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of Owner to provide clearance as required by federal, state, or local regulations or as deemed necessary by Owner to prevent future damage or contamination of either structure.
5. Lay all water lines on a continuous grade to avoid high points except as shown on the Drawings.
6. Prevent foreign material from entering the pipe while it is being placed in the trench. During laying operations, no soil, debris, tools, clothing, or other materials shall be placed in, or allowed to enter the pipe.
7. Assemble joints in accordance with manufacturer's recommendations.
8. The pipe shall be brought to correct line and grade, and shall be secured in place with approved backfill material in accordance with Section 31 23 00 Excavation, Backfilling and Compaction.
9. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long-radius curves are permitted, the amount of deflection allowed shall not exceed that recommended by pipe manufacturer.
10. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Owner. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.

11. Where necessary, cut pipe perpendicular to the pipe centerline. Grind cut ends and rough edges smooth. For push on joint connections, the cut end shall be beveled.
12. Fire hydrants shall be set plumb at proper finish grade as indicated on the drawings (see typical hydrant detail).

B. Valve Installation

1. Locate valves as shown on drawings.
2. Orient valve operating stems in a manner that will allow proper operation.
3. A valve box shall be provided for every valve that has no gearing or operating mechanism or in which the gearing or operating mechanism is fully protected with a gear case. The valve box shall not transmit shock or stress to the valve and shall be centered over the operating nut of the valve. Set box cover at grade shown on Drawings.
4. In no case shall valves be used to bring misaligned pipe into alignment during installation. Support pipe in such a manner as to prevent stress on the valve.

C. Thrust Block Installation

1. Provide thrust blocks at reducers, valves, tees, hydrants, plugs and caps, and at bends deflecting 11-1/4 degrees or more.
2. Place thrust block between solid ground and the component to be shored; the area of bearing on the pipe and on the ground in each instance shall be that shown on Drawings. Unless otherwise shown or directed, locate block so as to contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair.
3. Concrete for thrust blocks shall have a compressive strength of not less than 2500 psi at 28 days. Concrete mixes shall be provided in accordance with Section 03 10 00 –Cast-In-Place Concrete of these specifications.

3.4 PROTECTION

A. Provide barricades and restrict access as appropriate to prevent damage to Work in place.

B. Contractor shall be responsible for protection of Work in place against displacement, damage, loss, or theft until Owner's acceptance. Any Work installed and subsequently damaged, lost, or displaced shall be repaired or replaced to the Owner's satisfaction at no additional cost.

3.5 CLEANING

A. Thoroughly clean all pipe lengths or units of all debris immediately after laying.

B. Thoroughly clean by flushing and remove all debris from water mains and appurtenances. Observe and verify lines are clean prior to submitting facilities for Owner's acceptance.

3.6 TESTING

A. Temporary connections for pressure testing shall be made by Contractor at his expense and removed by Contractor after satisfactory completion of the testing Work.

B. Testing procedures shall as a minimum be in accordance with the most recent update of the following specifications and regulations.

1. AWWA C600 - Pressure and Leak Testing

C. Hydrostatic Pressure Test:

1. After completion of the installation of the system, or any reasonable length thereof, after backfilling and after thorough flushing of the portion to be tested, pressure tests shall be made. The system to be tested shall be subjected to a hydrostatic pressure of

200 pounds per square inch, unless otherwise noted on the Drawings, for a period of not less than 2 hours duration.

2. The portion to be tested shall be filled with water slowly and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. The Contractor shall make the temporary connection for pressure testing.
3. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation stops at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged by the Contractor.
4. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the Owner.

D. Leakage Test:

1. A leakage test shall be conducted concurrently with the pressure test.
2. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
3. No leakage shall be allowed.
4. All visible leaks, other than a minor amount of sweating, shall require immediate stoppage of the test and tightening of the joints so that, when pressure is again put on the system, there will be no leakage.

END OF SECTION

SECTION 33 13 00
DISINFECTION OF WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes flushing of water distribution system and supply lines, chlorine disinfection and final flushing.

1.2 RELATED WORK

A. Section 33 11 00 - Water Distribution and Transmission

1. Construction and installation of water distribution and transmission piping, hydrostatic testing, cleaning and flushing requirements.

1.3 REFERENCES

A. The applicable provisions of the latest editions of the References listed below shall govern the Work covered under this Section.

B. American Water Works Association (AWWA)

C. "Standard Methods for the Examination of Water and Wastewater", American Public Health Association, AWWA, and Water Pollution Control Federation

D. Rules governing public drinking water systems as found in R309 of the Utah Administrative Code.

1.4 SUBMITTALS

A. Submit manufacturer's literature, certifications, and other product data in accordance with Section 01 33 00 - Submittals.

B. Submittals required prior to testing include but are not limited to the following:

1. Evidence of materials conformance with these specifications
2. Proposed methods and equipment to be used for disinfection.

C. Submittals required after testing as a condition for final acceptance include but are not limited to the following:

1. Results of chlorine residual tests.
2. Results of bacteriologic quality tests.

1.5 QUALITY ASSURANCE

A. All disinfection and testing procedures shall be in accordance with applicable Federal, State, and local standards.

1.6 DELIVERY AND HANDLING

A. Contractor shall be responsible for proper transportation, unloading, handling, storage and security of all equipment and materials provided as part of this specification in accordance with manufacturer's recommendations.

B. Materials shall be stored in such a manner as to prevent damage or degradation. Any materials damaged or degraded prior to installation shall be removed from the project and replaced with new materials at no additional cost. Lost or stolen materials shall be replaced at

no additional cost.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers providing materials as part of this specification shall have a minimum of five (5) years' experience in the manufacture and testing of such materials.

B. Manufacturers shall provide, upon request, verification of a consistent record of meeting or exceeding materials or performance standards as specified herein.

2.2 CHLORINE

A. Tablets shall conform to AWWA B300 - Standard for Hypochlorite's.

B. Liquid shall conform to AWWA B301 - Standard for Liquid Chlorine.

C. Store in a cool, dark, and dry environment to minimize deterioration.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine water facilities to verify they have been properly cleaned, flushed, and hydrostatically tested, as appropriate prior to performing disinfection Work. Verify that other Work will not contaminate or disturb disinfected facilities.

B. Notify Owner at least 72 hours prior to any flushing and disinfecting.

3.2 METHODS AND PROCEDURES

A. General

1. Disinfection procedures shall as a minimum be in accordance with the following specifications and regulations.
    a. AWWA C651 - Disinfecting Water Mains
    b. AWWA C652 - Disinfection of Water Storage Facilities

B. Prevention of Contamination

1. Pipe and appurtenances shall be kept clean and dry and shall be delivered as closely as possible to the time of installation. Pipe shall be positioned so as to minimize the entrance of foreign material into the pipe before laying.
2. As pipe is lowered into trench, verify that all foreign materials are removed before joining to proceeding pipe. All openings in the pipeline shall be closed with watertight plugs whenever pipe laying operations are stopped, including but not limited to rest breaks and lunch periods. Rodent-proof plugs may be used with the concurrence of the Owner where it is determined that watertight plugs are not practical and where thorough cleaning will be performed by flushing or other means.
3. Complete assembly of pipe joints shall be completed for all pipe in the trench prior to any work stoppage.
4. Water shall be removed from the trench before removal of any trench plugs.
5. Gaskets shall be handled in such a manner that avoids contamination. Lubricants used for installation or sealing of gaskets shall be approved for use in potable water systems. All lubricants shall be delivered to the project site in closed containers and shall be maintained in a sanitary condition.

6. If dirt enters the pipe during laying operations, and the Owner determines that the dirt will not be adequately removed by flushing, the interior of the pipe shall be swabbed with a 1 percent hypochlorite solution. Cleaning with the use of a pig, swab, or "go-devil" shall only be undertaken when the Owner has determined that such operation will not force mud or debris into pipe-joint spaces.
7. If it is not possible to keep pipe and fittings dry during construction, every effort shall be made to assure that any of the water that may enter the pipe-joint spaces contains an available chlorine concentration of approximately 25mg/l. This shall be accomplished by adding calcium hypochlorite granules or tablets to each length of pipe before it is lowered into a wet trench, or by treating the trench water with hypochlorite tablets.
8. If the trench is flooded during construction and the water main is filled with flood water, the main shall be cleared of the flood water by draining and flushing with potable water until the main is thoroughly cleaned. The section exposed to the flood water shall then be filled with a chlorinated potable water that will maintain a minimum 25 mg/l free chlorine residual for 24 hours. The chlorinate water may then be drained and flushed from the main. After construction of the main is completed, the line shall be disinfected using the continuous-feed or slug method.

C. Preliminary Flushing of Water Distribution and Supply System

1. Flush mains in accordance with Section 33 11 00 - Water Distribution and Transmission.
2. The flushing velocity shall not be less than 2.5 feet per second.
3. Water discharged from the flushing operation shall be conducted to approved natural drainage channels, storm sewers, or other locations in accordance with applicable laws, ordinances and regulations.
4. No flushing water shall be discharged into a sanitary sewer.

D. Chlorination of Water Distribution and Supply System

1. A 1 percent chlorine solution shall be prepared.
2. The chlorine solution shall be applied to the water line with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strength as to withstand safely the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the hypochlorite solution is applied to the main.
3. Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly laid pipeline. The water shall receive a dose of the chlorine solution, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 mg/l available chlorine.
4. The ratio of application of the hypochlorite solution to water to maintain a 50 mg/l (50 ppm) chlorine concentration is as follows:
    a. Application Ratio: 1 gal. of 1 percent chlorine solution to 200 gal water.
5. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water.
6. Chlorine application shall not cease until the entire line is filled with the chlorine solution.
7. The chlorinated water shall be retained in the line for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24 hour period, the treated water shall contain no less than 25 mg/l chlorine throughout the length of the main.

E. Final Flushing of Water Distribution and Supply System

1. After the applicable retention period, the chlorinated disinfection water shall be flushed from the line.
2. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the line. The line shall be flushed until the residual chlorine concentration is less than 1 mg/l.
3. The discharge of highly chlorinated disinfection water to the environment is not allowed. The Contractor shall follow methods for de-chlorinating the disinfection water as found in AWWA C651.

F. Bacteriological Sampling and Testing

1. Sampling and testing shall be conducted in accordance with AWWA Manual M12 - Simplified Procedures for Water Examination.
2. Samples for bacteriologic analysis shall be collected in sterile bottles treated with sodium thiosulfate. No hose or fire hydrant shall be used in collection of samples.
3. After final flushing, and before the water line is placed in service, a sample shall be collected from the water line at 1000 foot intervals, evenly spaced along the line, and tested for coliform organisms in accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater". The testing shall be by either the multiple tube fermentation technique or the membrane filter technique. Two samples shall be taken, from each location, at least 24 hours apart.
4. All samples shall be taken from a sampling tap.
5. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained.
6. When the samples are satisfactory, the water line may be placed in service upon receiving notification from the Owner to do so.

3.3 PROTECTION

A. Contractor shall be responsible for maintaining disinfected facilities from contamination until acceptance by the Owner. Should facilities be contaminated prior to acceptance, Contractor shall re-disinfect and retest in accordance with 3.2 of these specification at no additional cost.

3.4 CLEANING

A. Refer to 3.2 of these specifications

3.5 TESTING

A. Refer to 3.2 of these specifications

END OF SECTION

SECTION 33 41 00
STORM DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes:

1. Storm drain piping;
2. Cast-in-place and pre-cast concrete drainage structures including headwalls, catch basins, manholes and end sections;
3. Grates, solid covers, frames and manhole steps.

1.2 RELATED WORK

A. Section 01 33 00 – Submittals: For manufacturer's specifications for all products.

B. Section 03 10 00 – Cast-In-Place Concrete

C. Section 31 23 00 – Excavating, Backfilling and Compaction

1.3 REFERENCES

A. "Manual of Standard Practices", Concrete Reinforcing Steel Institute (CRSI)

B. American Society for Testing and Materials (ASTM):

1. A48, Gray Iron Gastings
2. A123, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
3. A536, Ductile Iron Castings
4. A615, Deformed and Plain Billet Steel Bars for Concrete Reinforcement
5. A746, Ductile Iron Gravity Sewer Pipe
6. C14, Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe
7. C76, Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
8. C150, Portland Cement
9. C443, Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
10. C478, Precast Reinforced Concrete Manhole Section
11. C857, Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
12. C858, Underground Precast Concrete Utility Structures
13. C891, Installation of Underground Precast Concrete Utility Structures
14. C923, Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals
15. C969, Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
16. C1103, Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

17. D3034, Type PSM Polyvinyl Chloride Sewer Pipe and Fittings
18. D3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
19. F477, Elastomeric Seals (Gaskets) For Joining Plastic Pipe
20. F1417, Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air
21. F2648, 2 to 60 inch Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications

C. American Welding Society

1. D1.1, Structural Welding Code

1.4 SUBMITTALS

A. Submit manufacturer's specifications for all products.

B. Provide video inspection log as a computerized data report with a map of the system inspected with appropriate identification labels as referenced in the video.

1.5 DEFINITIONS

A. Catch Basin/Drop Inlet – A structure accepting drainage from gutters or medians or other channels and discharging the water through a conduit.

B. End section – A structure commonly made of steel or concrete that is attached to one or both ends of a culvert or a pipe to retain the embankment, improve appearance, provide anchorage, improve discharge, and limit scour at the opening

C. Headwall – A structure commonly made of concrete, placed at the end of culvert inlet or outlet or storm drain outlet, to anchor the pipe, to retain the highway embankment near the pipe end, and to protect the pipe ends from bank erosion and channel bed scour.

D. Inlet – A grated surface connection to a closed conduit such as a storm drain. A structure at the upstream end of a cross culvert. The upstream end of any structure through which water may flow.

E. Manhole (access hole) – A circular structure for access and joining pipes.

1.6 DELIVERY AND HANDLING

A. Load and unload pipe, fittings, and accessories in such a manner as to avoid shock or damage

1.7 QUALITY ASSURANCE

A. Workmanship and methods employed in the handling, transportation, storage, bedding, and laying of pipe, fittings, associated structures and accessories shall conform to the appropriate manufacturers' recommendations and/or ASTM recommendations.

B. All products shall be inspected by Contractor, prior to installation, for damage. No damaged products will be used, including damage to pipe or coatings.

C. Pipe Alignment and Grade

1. For design grades ≤ 1%:
    a. Do not allow grade of pipe to vary more than ¼ inch in 10 feet and not more than ½ inch total variance from true grade at any location.
2. For design grades > 1%:

a. Do not allow grade of pipe to vary more than ½ inch in 10 feet and not more than1 inch total variance from true grade at any location. These tolerances shall be acceptable provided that such variation does not result in a level or reserve sloping invert.

3. 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 ¼ inch maximum.

D. Pipe Distortions

1. Do not allow ovaling or distortions greater than 5% of the nominal pipe diameter. Maximum reduction of internal diameter in any plane shall be 5%.

E. Pipe Infiltration

1. Maximum allowable infiltration is 50 gallons per inch diameter per mile per 24 hours.

F. Concrete Drainage Structures

1. Repair or replace any structure that has the following:

a. Fractures or cracks passing through the wall except for a single end crack that does not exceed the thickness of the precast unit.

b. Defects showing improper proportioning, mixing, or molding.

c. Honeycombing and open texture.

d. Damaged or cracked ends that prevent joining manhole or inlets grade rings and sections.

e. Any continuous crack with a surface width of 0.01 inch or more that extends more than 12 inches anywhere on the wall.

f. Limit cracks or fractures for grade rings or similar structures. Refer to ASTM C478.

g. Verity the structures and pipe connections appear watertight.

h. Furnish pre-cast structures that are plumb and square within ⅛ inch per foot so that precast adjoining elements fit.

i. Mark pre-cast structures with date of casting and supplier identification.

1.8 INSPECTION AND TESTING

A. A video test is required for storm drain pipe. When video test shows non-compliance with the criteria in this section, the Engineer may require a mandrel and/or joint test.

B. Repair or replace damaged or improperly installed pipes and joints at the direction of the Engineer.

C. Pipe Video Test

1. Run water through gravity system prior to video inspection.

2. Conduct test at least 30 days after backfill and prior to installation of pavements.

3. Inspect, measure and record host pipe conditions using digital video recording equipment in MPEG 1 format with 352x240/320x240x30 fps resolution and audio bit rate of 256 Kbps.

4. Identify the date, pipe reach, slope, upstream and downstream manhole numbers, and manhole to manhole footage.

5. Provide video inspection log as a computerized data report with a map of the system inspected with appropriate identification labels as referenced in the video.

D. Pipe Mandrel Test

1. Test all pipes that show signs of pipe deformation.
2. Test pipe by hand pulling a fabricated mandrel through the pipe.
3. Provide and use mandrels to verify that the installed pipes meet the requirements of this specification.
4. Provide the following:
    a. A mandrel acceptable to the Engineer.
    b. A mandrel with an effective diameter equal to 95 percent of the nominal inside diameter
    c. A proving-ring to verify mandrel size
    d. A mandrel with a minimum of nine equally spaced runners (40 degree angles)
5. Submit engineering analysis certifying the structural and hydraulic integrity of the pipe, signed and sealed by a professional engineer licensed in the State of Utah, for all pipes that fail the mandrel test and that do not exceed 10 percent deflections for the pipe acceptance.
6. Remove and replace all pipes that exceed 10 percent deflections.
7. Recommend an alternate method of measurement if mandrel testing would cause damage to internal pipe coating.

E. Pipe Joint Test

1. Test all pipes that have joints showing visible gaps, defects, or any other problem according to one of the following methods:
2. Air Test
    a. Concrete pipe – Test according to ASTM C1103.
    b. Plastic pipe – Test according to ASTM F1417 and manufacturer's recommendations.
3. Exfiltration Test
    a. Test all pipe material types according to ASTM F2487 and ASTM C969.
    b. Maintain head for one hour.
    c. Do not exceed leakage values as given in the table below:

Nominal Pipe Diameter (inches)	Maximum Leakage Allowed (Gallons/hr/100 ft)
18	4.5
24	6.0
30	7.5
36	9.0
42	10.5
48	12.0

    d. Locate source or sources of leakage and repair damaged storm drain that does not pass the test.

PART 2 - PRODUCTS

2.1 STORM DRAIN PIPE

A. Concrete Pipe

1. For 12" diameter and larger:

a. RCP (reinforced concrete pipe) shall meet the requirements of ASTM C76, Class III, with push-on gasket joints conforming to ASTM C443. Cement for the pipe shall be Portland Cement Type V, conforming to ASTM C150.

2. For diameters smaller than 12":

a. Concrete pipe shall meet the requirements of ASTM C14, Class III, with push-on gasket joints conforming to ASTM C443. Cement for the pipe shall be Portland Cement, Type V, complying to ASTM C150.

B. PVC Pipe

1. For diameters smaller than 15"

a. PVC (polyvinyl chloride) shall meet the requirements of ASTM D3034 for SDR 35. The pipe shall have integral wall bell and spigot joints conforming to ASTM D3212, with a solid cross-section rubber ring, factory assembled, securely locked in place to prevent displacement during assembly.

C. Corrugated Wall HDPE Pipe

1. ASTM F2648 with smooth waterway for coupling joints.
2. Fittings shall be blow molded or rotational molded per ASTM D3350.
3. Joints shall be bell and spigot with ASTM F477 joints (elastomeric gasket).

2.2 NUTS AND BOLTS

A. Carbon steel machine heavy hex heads, Class 2 fit, ASTM A307; Grade B, threads, ASME B1.1.

2.3 PIPE JOINTS

A. Furnish pipes with joints that can sustain 5 psi minimum pressure for all storm drains.

B. Comply with manufacturer's recommendations for connecting pipes together and for connecting pipes to concrete headwalls, catch basins, and similar structures.

2.4 CONCRETE DRAINAGE STRUCTURES

A. Concrete, forms and reinforcement shall be as specified in Section 03 10 00 – Cast-In-Place Concrete.

B. Rings, lids and grates shall be as specified on the Drawings.

2.5 GRATES, SOLID COVERS, FRAMES, AND MANHOLE STEPS

A. Grates, solid covers, frames and manhole steps shall be of the type, material and dimensions as indicated on the Drawings.

B. Structural Steel

1. Hot-dip galvanize structural steel after fabrication. Refer to ASTM A123.

C. Cast Grey Iron – Refer to ASTM A48.

D. Ductile Iron – Refer to ASTM A536.

E. Precast Grade Ring – Refer to ASTM C478.

PART 3 - EXECUTION

3.1 PREPARATION

A. When connections are to be made to any existing pipe, conduit, or other improvement, the actual elevation or position of which cannot be determined without excavation, the Contractor shall excavate for and expose the existing improvement before laying any pipe or conduit.

B. Verify fit and function with field conditions before manufacturing or constructing any structure.

3.2 PIPE INSTALLATION

A. Bedding:

1. Bedding shall be prepared in accordance with Section 31 23 00 - Excavation, Backfilling and Compaction and as shown on the Drawings.

2. Lay all pipes on a firm bed, true to the line and grade, and abutt the end and shoulder of each pipe against the other in such a manner that there is no unevenness of any kind along the bottom half of the pipe line.

B. During all phases of pipe installation, dewater trench to prevent floating of pipe.

C. Lay pipe in the uphill direction with the bell end pointing upgrade.

D. Clean pipe joints prior to installing gaskets. Install gaskets in accordance with manufacturers' recommendations.

E. Manufacturers' Recommendations: Perform all work in strict accordance with the manufacturer's recommendations for the type of pipe being installed.

F. Prevent contact between the pipe and compaction equipment. Compaction of bedding and backfill material should generally be done in such a way so that compaction equipment is not used directly above the pipe until sufficient backfill has been placed to assure that such compaction equipment will not have a damaging effect on the pipe.

G. Provide six (6) mil thick polyethylene sheet and tape wrap on steel materials for protection against corrosion after piping installation.

3.3 CONCRETE DRAINAGE STRUCTURES

A. Bedding shall be prepared in accordance with Section 31 23 00 - Excavation, Backfilling and Compaction and as shown on the Drawings.

B. Manholes

1. Furnish precast concrete manholes according to ASTM C478 and use self-centering watertight joints that meet ASTM C443.

C. Grade Rings/Catch Basin Grade Sections

1. Furnish according to ASTM C478 with anchor bolt-holes.

D. Precast Inlets and Boxes

1. Attach and secure all inserts at the place of manufacture such as wall sleeves, gaskets or piping, sumps, steps, access hatches, and any other inserts as shown on the Drawings.

2. Manufacture structures according to applicable requirements of ASTM C858 and as

modified by this Section.

a. Meet ASTM C857 requirements.

3. Provide sufficient lifting points for a safe installation.
    a. Locate lifting devices to avoid interference with the reinforcing steel.
4. Do not move precast units until after 28-day compressive strength has been attained.
    a. Protect the unit from any damage. Replace unacceptable units at no additional cost to the Owner.
5. Refer to ASTM C891. Comply with manufacturer installation guidelines.
    a. Observe precast drainage structures for defects before lowering into excavation.
    b. Clean mating surfaces of all foreign materials such as dirt, mud, and stones and apply proper joint sealing material where applicable.
    c. Assemble all joints tightly.
    d. Use care when joining precast elements in cold weather. Do not force joints together with mechanical equipment.
    e. Sufficiently warm all sealing materials to flow without causing damage to precast joint elements.
6. Furnish structures with appropriate openings for connecting pipe.
    a. Cast or cut structure openings. Do not expose reinforcing steel or reduce reinforcing steel covering at openings.
    b. Do not modify precast units in the field by cutting or enlarging holes or by making any other changes without the manufacturer's and Engineer's approval.
    c. Modify precast units only according to manufacturer requirements.
7. Do not place precast drainage structure in excavation that has water and frozen surfaces.
8. Plug lift insert recesses with a 1:1 sand to cement grout mix. Finish flush with top, bottom, or both surfaces of concrete.

3.4 GRATES, SOLID COVERS, FRAMES, AND MANHOLE STEPS

A. Fabricate according to AWS D1.1.

B. Install according to the manufacturer's recommendations.

3.5 CLEANING AND FLUSHING OF STORM DRAINAGE SYSTEMS

A. Thoroughly clean all pipe lengths or units laid of all debris immediately after laying.

B. Thoroughly clean by flushing and remove all debris from the pipeline and drainage structures prior to acceptance of the work by the Engineer.

3.6 PROTECTION

A. Protect all newly poured concrete from damage by placing barricades or enclosures in accordance with Section 01 57 00 - Construction Facilities and Temporary Controls.

END OF SECTION

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GLENN'S ELECTRIC MOTOR & SUPPLY, INC

11/26/2019 Cornish Well 24 Hour Test

Time and date	GPM	Drawdown
November 26, 2019		
11/26/2019 8:15am	310	22'6"
11/26/2019 9:15am	300	36'8"
11/26/2019 10:15am	295	38'4"
11/26/2019 11:15am	293	39'3"
11/26/2019 12:15pm	290	40'1"
11/26/2019 1:15pm	287	40'7"
11/26/2019 2:15pm	286	40'10"
11/26/2019 3:15pm	285	40' 3"
11/26/2019 4:15pm	285	40'4"
11/26/2019 5:15pm	285	40'6"
11/26/2019 6:15pm	284	40'7"
11/26/2019 7:15pm	280	42'
11/26/2019 8:15pm	280	42'
11/26/2019 9:15pm	283	41'6"
11/26/2019 10:15pm	283	41'2"
11/26/2019 11:15pm	283	41'2"
November 27, 2019		
11/27/2019 12:15am	283	41'5"
11/27/2019 1:15am	283	41'5"
11/27/2019 2:15am	286	40'11"
11/27/2019 3:15am	286	40'11"
11/27/2019 4:15am	283	41'1"
11/27/2019 5:15am	283	41'2"
11/27/2019 6:15am	295	38'10"
11/27/2019 7:15am	295	38'9"
11/27/2019 8:15am	310	16'7"