


**CONTRACT DOCUMENTS
FOR CONSTRUCTION OF
CITY OF KELLER
PEARSON PUMP STATION
BACK UP GENERATOR
CITY PROJECT NO. 602202**

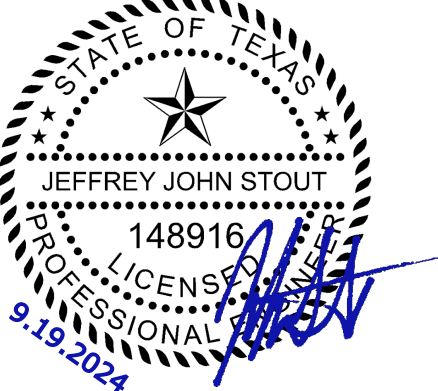


October 2024

00 01 07 DESIGN PROFESSIONAL SEALS

	Specification Sections Sealed
	<p>DIV 00 DIV 01</p>

	Specification Sections Sealed
	<p>DIV 03 DIV 05 DIV 31</p>

	Specification Sections Sealed
	<p>DIV 26</p>

END OF SECTION

00 01 10 TABLE OF CONTENTS

Section	Title
Division 00	Procurement and Contracting Requirements
00 01 01	Project Cover Sheet
00 01 07	Design Professional Seals
00 01 10	Table of Contents
00 11 16	Invitation to Bid
	Notice to Bidders
00 21 13	Instructions to Offerors
00 41 13	Bid Form
00 41 16	Bid Form Exhibit A
00 43 13	Bid Bond
00 45 01	Nonresident Bidders
00 45 02	Non-Collusion Certification
00 45 03	Conflict of Interest Questionnaire
00 45 04	State Sales Tax Requirements
	Vendor Compliance and Contractor Sales Tax Forms
00 45 13	Qualifications Statement
00 52 13	Agreement
00 61 13	Performance Bond
00 61 16	Payment Bond
00 61 19	Maintenance Bond
00 61 20	Maintenance Bond Requirements
00 72 00	General Conditions
00 73 00	Supplementary Conditions
00 73 17	Texas Workers' Compensation Insurance
	Insurance Requirements
00 73 43	Wage Rate Requirements
00 73 46	Wage Determination Schedule
	Certificate of Interested Parties - Form 1295
	DBE Form
	Contact Form TGC 2271
Division 01	General Requirements
01 11 00	Summary of Work
01 26 00	Change Management
01 29 00	Application for Payment Procedures
01 29 01	Measurement and Basis for Payment
01 31 00	Project Management and Coordination
01 31 13	Project Administration
01 33 00	Document Management
01 33 01	Document Register

Section	Title
01 33 02	Shop Drawings
01 33 03	Product Data
01 33 04	Operation and Maintenance Data
01 33 05	Construction Progress Schedule
01 33 06	Graphic Documentation
01 34 00	Buy American Requirements
01 35 00	Special Procedures
01 40 00	Quality Management
01 57 00	Temporary Controls
01 60 00	Product Requirements
01 70 00	Execution and Closeout Requirements
01 74 23	Final Cleaning
01 75 00	Starting and Adjusting
01 78 36	Warranties and Service Agreements
01 79 00	Training of Operation and Maintenance Personnel
Division 03	Concrete
03 30 00.01	Cast-In-Place Concrete (Limited Applications)
Division 05	Metals
05 51 00	Metal Stairs and Platforms
05 52 13	Pipe and Tube Railings
Division 26	Electrical
26 01 26	Testing of Electrical Systems
26 05 00	Common Work Results for Electrical
26 05 13	Medium-Voltage Cables
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 23	Control-Voltage Electrical Power Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Raceways and Boxes for Electrical Systems
26 05 53	Identification for Electrical Systems
26 05 73.01	Electrical Power System Studies
26 12 19	Pad-Mounted, Liquid-Filled, Medium-Voltage Transformers
26 13 00	Medium Voltage Metal Clad Switchgear
26 22 13	Low Voltage Distribution Transformers
26 27 26	Wiring Devices
26 32 13	Engine Generators
Division 31	Earthwork
31 05 13	Soils for Earthwork

Section	Title
31 23 10	Structural Excavation and Backfill

END OF SECTION

00 11 16 INVITATION TO BID

ARTICLE 1 – GENERAL NOTICE

- 1.01 The City of Keller, Texas (Owner) is requesting Bids for the construction of the following Project:
Pearson Pump Station Backup Generator
60202
- 1.02 Description of the Work
- A. Install a backup generator, transformer, and transfer switch to power the Pearson Lower Pump Station.
- 1.03 The Owner’s Budget for the Project is \$2,000,000. The Project is to be substantially complete and ready for operation on or before 10/31/2026. The Project is to be complete and eligible for final payment 30 days after the date for Substantial Completion.

ARTICLE 2 – EXAMINATION AND PURCHASE OF DOCUMENTS

- 2.01 Advertisement and bidding information for the Project can be found at the following procurement website:
- <https://www.civcastusa.com>
- 2.02 Prospective Offerors must register with the procurement website as a plan holder, even if the Contract Documents are obtained from a plan room or other site. All official notifications, Addenda, and other documents will be offered only through the procurement website.
- 2.03 The Contract Documents may be downloaded from the procurement website by prospective Offerors registered as plan holders. Offerors are responsible for ensuring that a complete set of documents, as defined in Section 00 52 13 “Agreement,” are used in the preparation of their Bids. The documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download does not confer a license or grant permission or authorization for any other use. Authorization to download documents includes the right for Offerors to print documents for their sole use, provided they pay all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.
- 2.04 The procurement website will be updated periodically with Addenda, lists of interested parties, reports, or other information relevant to submitting a Bid for the Project.

- 2.05 Printed copies of the Contract Documents, Technical Data, and other information may be examined free of charge at the following address:

Engineer	Owner
Freese and Nichols, Inc.	City of Keller, Texas
801 Cherry Street, Suite 2800	1100 Bear Creek Parkway
Fort Worth, Texas, 76102	Keller, Texas 76248
Rita Tohme, P.E.	Chad Bartee, P.E.

ARTICLE 3 – PRE-BID CONFERENCE

- 3.01 A mandatory pre-bid conference for the Project will be held on **October 23rd, 2024** at the following location:

City of Keller, Texas
1100 Bear Creek Parkway
Keller, Texas 76248

ARTICLE 4 – SITE TOUR

- 4.01 A tour of the Site will be held the afternoon of the pre-bid conference. Prospective Offerors attending this site tour are required to arrange their own transportation to the Site. Maps to the Site will be available at the pre-bid conference.

ARTICLE 5 – QUESTIONS REGARDING BIDDING PROCESS OR SOLICITATION DOCUMENTS

- 5.01 Questions are to be submitted using the question-and-answer process on the procurement website. Responses to questions posted on the procurement website will be posted for the benefit of all Offerors. A response will be posted for questions submitted until 12:00 p.m. on **October 24th, 2024**
- 5.02 A response to a question posted on the procurement website that requires modification of the Contract Documents will be made by Addenda. Modifications to the Contract Documents prior to the award of the Contract can only be made by Addenda. Only answers in Addenda posted on the procurement website will be binding. Oral and other interpretations or clarifications will be without legal effect.

ARTICLE 6 – BID SECURITY

- 6.01 Offerors must submit an acceptable Bid Security with their Bids as a guarantee that the Successful Offeror will enter into a contract for the Project with the Owner within 15 days of Notice of Award of the Contract. The Bid Security must be payable to the City of Keller in the amount of 5 percent of the proposed Contract Price. The Successful Offeror must execute the Contract and bonds on the forms provided in the Contract Documents and provide evidence of insurance as required by the Contract Documents.
- 6.02 Bid Security must be in the form of a bid bond. The bid bond may be submitted on the form provided in Section 00 43 13 "Bid Bond" or Offerors may provide their surety's standard penal

sum bid bond form. The bid bond must reference the Owner and the Project by name as identified in this Section.

ARTICLE 7 – DELIVERY OF BIDS

- 7.01 Sealed Bids must be delivered to the Owner at the address below no later than **2:00 PM on October 30th, 2024**, to be accepted. The Bids will be publicly opened and read aloud at this time and place including the names of the Offerors and their Bids. Bids received after this time will be returned unopened. Address Bids to the Owner as follows:

City of Keller, Texas
1100 Bear Creek Parkway
Attn: Chad Bartee, P.E.
Keller, Texas 76248

- 7.02 All Bids delivered at least 30 minutes before the time designated in Paragraph 7.01 must be delivered to the address shown in Paragraph 7.01.

ARTICLE 8 – AWARD OF CONTRACT

- 8.01 It is the intent of the Owner to award this Contract to the lowest responsible Offeror. The Owner reserves the right to adopt the most advantageous interpretation of the Bids submitted in the case of ambiguity or lack of clearness in stating bid prices, to reject any or all Bids, and/or waive formalities. Bids will remain subject to acceptance and may not be withdrawn within **60** days from the date on which Bids are opened.

ARTICLE 9 – OTHER CONTRACT REQUIREMENTS

- 9.01 Selected Contractor will be required to pay the prevailing wage rates established for this Project in accordance with the Contract Documents and Tex. Gov't Code Chapter 2258.
- 9.02 Performance and payment bonds will be required for this Project.
- 9.03 The Owner intends to use American Rescue Plan Act (ARPA) funds for fees and costs associated with the Contract. The Owner will be required to comply with the requirements of 2 CFR Part 200 and other applicable federal requirements related to the procurement and expenditure of fees and costs related to the project. The Successful Proposer will be required to cooperate fully with the Owner to comply with the applicable requirements.

END OF SECTION

NOTICE TO BIDDERS

SEALED PROPOSALS addressed to the City of Keller, Texas will be received at the Keller City Hall until October 30, 2024 at 2:00 P.M., for the purpose of furnishing all plant, labor, materials and equipment and the performing of all work required in the construction of the **Pearson Pump Station Back Up Generator** and other improvements incidental thereto, at which time and place the proposals will be publicly opened and read aloud and retained by the City for tabulation, checking and evaluation.

BIDS shall be submitted in sealed envelopes upon the blank Bid Form in the Contract Documents booklet. The entire Contract Documents' booklet must be returned in a sealed envelope with the following forms filled out and signed (if necessary); Bid Form, Disadvantaged Business Enterprises Form, Conflict of Interest Questionnaire, Local Government Officer Conflicts Disclosure Statement, Vendor Compliance to State Law form, Contractor Compliance to Texas Sales Tax Code form. The Bid Bond for five (5%) percent of the total bid must be included in the sealed envelope with the bid. The sealed envelope shall be marked "**Pearson Pump Station Back Up Generator and Project Number 602202**"-DO NOT OPEN UNTIL October 30, 2024 at 2:00 P.M."

PLANS AND SPECIFICATIONS and contract documents may be examined without charge at the Keller City Hall, 1100 Bear Creek Parkway, Keller, TX 76244. Copies of such instruments may be downloaded free of charge from <https://www.civcastusa.com>.

"A non-mandatory pre-bid conference will be held at 2:00 P.M. on October 23, 2024 at the **Keller Town Hall, Room 106 - 1100 Bear Creek Pkwy, Keller TX 76248**. Representatives of the Owner and Engineer will be present to discuss the project. Engineer will distribute to prospective bidders of record such Addenda as Engineer considers necessary in response to discussions or inquiries arising at the conference.

In case of ambiguity or lack of clearness in stating proposal prices, the Owner reserves the right to adopt the most advantageous construction thereof, or to reject any or all bids. No bid may be withdrawn within sixty (60) days after date on which bids are opened.

CITY OF KELLER, TEXAS

ADVERTISEMENT DATES:

October 13, 2024

October 20, 2024

00 21 13 INSTRUCTIONS TO OFFERORS

ARTICLE 1 – DEFINED TERMS

- 1.01 The terms used in these Instructions to Offerors have the meanings assigned to them in the General Conditions and Supplementary Conditions.

ARTICLE 2 – RECEIPT OF BIDS

- 2.01 Refer to Section 00 11 16 “Invitation to Bid” for information on receipt of Bids.

ARTICLE 3 – COPIES OF CONTRACT DOCUMENTS

- 3.01 Obtain a complete set of the Contract Documents as indicated in Section 00 52 13 “Agreement.”
- 3.02 Use complete sets of Contract Documents in preparing Bids. Offeror assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete sets of Contract Documents.
- 3.03 Owner makes copies of Contract Documents available for the sole purpose of obtaining Bids for completion of the Project and does not confer a license or grant permission or authorization for any other use.

ARTICLE 4 – QUALIFICATIONS STATEMENT

- 4.01 Submit information as required in Section 00 45 13 “Qualifications Statement” within 5 days of the date Bids are due if requested to do so by the Owner.

ARTICLE 5 – EXAMINATION OF THE CONTRACT DOCUMENTS AND THE SITE

- 5.01 Examine the Contract Documents, the Site, and other information readily available before submitting a Bid.
- A. Examine the Contract Documents and supplemental data:
1. Carefully study the Contract Documents.
 2. Carefully study supplemental information, including Technical Data, record drawings from previous projects, available utility maps, reports, and studies referenced or made available to the Offeror.
 3. Promptly notify the Construction Manager of all conflicts, errors, ambiguities, or discrepancies that the Offeror discovers in the Contract Documents, Addenda, and supplemental information.
 4. Determine that the Contract Documents, Addenda, and supplemental data are generally sufficient to indicate and convey understanding of all terms and conditions for completion of Work to the degree necessary to prepare a Bid for the Project.
 5. Make observations and investigations, correlate knowledge and observations with the requirements of the Contract Documents, and consider these in preparation of a Bid for the Project.

- B. Become familiar with all federal, state, and local Laws and Regulations that may affect cost, progress, or the completion of Work.
- C. Visit the Site to become familiar with any general, local, or Site conditions that may affect the cost, progress, or performance of the Work in any manner. The Site is generally accessible to the public. Coordinate access to private property through the Owner. A tour of the Site will be conducted at the pre-bid conference.
- D. Subsurface exploration is not allowed.
- E. The submission of a Bid will constitute an incontrovertible representation by the Offeror that the Offeror has complied with every requirement of this Article, and that without exception the Bid is premised on the following:
 - 1. Work will be completed in accordance with the Contract Documents for the Contract Price within the Contract Times;
 - 2. Offeror has given the Construction Manager written notice of all conflicts, errors, ambiguities, and discrepancies that the Offeror has discovered in the Contract Documents, Addenda, and the related supplemental data;
 - 3. Written resolutions provided by the Construction Manager are acceptable to the Offeror; and
 - 4. Contract Documents, Addenda, and the related supplemental data are generally sufficient to indicate and convey understanding of all terms and conditions for completion of Work.

ARTICLE 6 – PRE-BID CONFERENCE

- 6.01 A mandatory pre-bid conference will be held at the time and location indicated in Section 00 11 16 “Invitation to Bid.” Bids will not be accepted from Offerors who do not attend the conference. It is the Offerors’ responsibility to sign in at the pre-bid conference to verify their participation.

ARTICLE 7 – INTERPRETATIONS AND ALTERNATE BIDS

- 7.01 Submit all questions about the meaning or intent of the Contract Documents, Addenda, and the related supplemental data to the Construction Manager using the procurement website as indicated in Section 00 11 16 “Invitation to Bid.”
- 7.02 Submit any offer of alternate terms and conditions or offer of Work not in strict compliance with the Contract Documents to the Construction Manager no later than 10 days after the date Project is advertised. Construction Manager and Design Professional will issue Addenda as appropriate if any of the proposed changes to the Contract Documents are accepted. A Bid submitted with clarifications or taking exceptions to the Contract Documents, except as modified by Addenda, will be considered non-responsive.
- 7.03 Offeror may submit a separate and additional Bid if the Offeror includes exceptions or the Offeror wishes to make a Bid that is not in accordance with the terms and conditions of the Contract Documents, or for Work that is not in strict compliance with the Contract Documents. Describe the intent and substance of the changes in the additional Bid in adequate detail so they are clearly understood. Alternate Bids will not be considered in the evaluation of the Bids. Upon

selection of the Bid of the lowest responsible Offeror, and after the award of the Contract, the Construction Manager may issue a Request for a Change Proposal if Owner chooses to accept any Bid alternates.

- 7.04 Addenda may be issued to clarify, correct, or change the Contract Documents, Addenda, or the related supplemental data as deemed advisable by the Owner or Designer.

ARTICLE 8 – BID SECURITY

- 8.01 Offerors must submit an acceptable bid bond as Bid Security with their Bids as required by Section 00 11 16 “Invitation to Bid.” The acceptable bid bond must be issued by a surety legally authorized to do business in Texas and meet the requirements of the General Conditions.
- 8.02 Owner may annul the Notice of Award and retain the Bid Security of the apparent Successful Offeror upon Offeror’s failure to execute and deliver the Agreement or Amendments to the Agreement.
- 8.03 Bid Securities are to remain in effect until the Contract is executed. Bid bonds will become void when the Contract is awarded, or all Bids are rejected.

ARTICLE 9 – LIQUIDATED DAMAGES, RETAINAGE, AND INTEREST

- 9.01 Provisions for liquidated damages and the payment of retainage and interest are set forth in the Agreement.

ARTICLE 10 – PREPARATION OF THE BID FORM

- 10.01 The Bid Form is included with the Contract Documents and is also available at the procurement website. Complete all blanks on the Bid Form by typing or printing in ink. Indicate prices for each item or alternate shown in the Bid Form.
- 10.02 Execute the Bid Form as indicated in the document and include evidence of authority to sign.
- 10.03 Acknowledge receipt of all Addenda by filling in the number and date of each Addendum. Provide a signature as indicated to verify that the Addenda were received. A Bid that does not acknowledge the receipt of all Addenda may be considered non-responsive.
- 10.04 Provide the name, address, and telephone number of the individual to be contacted for any communications regarding the Bid in the Bid Form.
- 10.05 Provide evidence of the Offeror’s authority and qualification to do business in Texas or agree to obtain such qualification prior to award of the Contract. Failure to obtain this qualification will render the Bid non-responsive and Offeror will forfeit its Bid Security.

ARTICLE 11 – CONFIDENTIALITY OF BID INFORMATION

- 11.01 The Owner is a governmental body subject to the limitation of Tex. Gov’t Code Chapter 552 and has limited obligations with regard to protecting confidential information submitted by Offerors. Bids will be opened in a manner that avoids disclosure of trade secrets and confidential information to competing Offerors and keeps the Bids from the public until a contract is awarded. The Owner will protect trade secrets and confidential information to the extent allowed by Laws and Regulations.

- 11.02 Clearly indicate which specific documents are considered to be trade secrets or confidential information by stamping or watermarking all such documents with the word “confidential” prominently on each page or sheet or on the cover of bound documents. Place “confidential” stamps or watermarks so that they do not obscure any of the required information on the document, either in the original or in a way that would obscure any of the required information in a photocopy of the document. Submit all confidential information in a different binder so this confidential material is separate from the rest of the Bid.
- 11.03 The Owner, upon receiving an application or other request for the disclosure of confidential information, will promptly notify Offeror of the request as required by Section 552.305 and request a ruling by the Texas Attorney General as to whether any such information may be released.
- 11.04 Offeror acknowledges and agrees that it will be solely responsible for submitting any arguments, authorities, or other information to the Attorney General of Texas regarding release of the information marked as confidential as provided by Section 552.305(b) and that if disclosure is required, the Owner has no liability for releasing this information and Offeror will not be entitled to exercise any remedy for a disclosure made pursuant to the Chapter 552.
- 11.05 The obligations of the Owner as recipient with respect to confidential information under the terms of this Agreement are subject to the following exceptions:
- A. If confidential information becomes a part of the public domain through publication or otherwise but through no fault of the Owner;
 - B. Owner can demonstrate through suitable documentation that the confidential information was already in the Owner’s possession or otherwise publicly available prior to the date of disclosure hereunder;
 - C. The confidential information is subsequently disclosed to the Owner by a third party who has a lawful right to disclose such information; or
 - D. The Owner is required to disclose the confidential information by court order or by applicable law.
- 11.06 If the Owner is requested or becomes legally compelled (by oral questions, interrogatories, requests for information or documents, subpoena, civil or criminal investigative demand, public information requests, including requests under Chapter 552, or similar process) or is required by a regulatory body to make any disclosure that is prohibited or otherwise constrained by this Agreement, the Owner will provide Offeror with prompt notice of this request so that it may seek an appropriate protective order or other appropriate remedy.

ARTICLE 12 – DELIVERY OF BIDS

- 12.01 Complete and deliver the Bid Form along with all required documents identified in the Bid Form.
- 12.02 Submit the Bid no later than the date and time prescribed and at the place indicated in Section 00 11 16 “Invitation to Bid.” Enclose the Bid in an opaque sealed envelope plainly marked with the Project name and the name and address of the Offeror, along with the Bid Security and other required documents. Enclose the sealed envelope containing the Bid in a separate envelope plainly marked on the outside with the notation “BID ENCLOSED” if the Bid is sent by mail or other delivery system. Address the outer envelope to the mailing address shown

in Section 00 11 16 "Invitation to Bid." Offeror assumes full responsibility for ensuring that the Bid arrives at the prescribed location before the prescribed time.

ARTICLE 13 – MODIFICATION OR WITHDRAWAL OF BIDS

- 13.01 Modify or withdraw a Bid using a document executed in the same manner that a Bid must be executed. Deliver the document to the place where Bids are to be submitted prior to the date and time for the opening of Bids.
- 13.02 An Offeror may withdraw its Bid within 24 hours after Bids are opened if the Offeror files a signed written notice with the Owner and promptly thereafter demonstrates to the reasonable satisfaction of the Owner that there was a material and substantial mistake in the preparation of its Bid. The Bid Security will be returned if it is clearly demonstrated to the Owner that there was a material and substantial mistake in its Bid. An Offeror that requests to withdraw its Bid under these conditions may be disqualified from responding to a reissued Invitation to Bid for the Work to be furnished under these Contract Documents.

ARTICLE 14 – OPENING OF BIDS

- 14.01 Bids will be opened at the time and place indicated in Section 00 11 16 "Invitation to Bid." The Owner will publicly acknowledge receipt of Bids received in time to be considered and then open and read aloud the names of the Offerors and the amount bid as required by applicable Laws and Regulations.

ARTICLE 15 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

- 15.01 All Bids will remain subject to acceptance for the number of days specified in Section 00 11 16 "Invitation to Bid." The Owner may, at its sole discretion, release any Bid and return the Bid Security prior to the end of this period.

ARTICLE 16 – EVALUATION OF BIDS

- 16.01 The Owner will consider the proposed Contract Price and Contract Times and the qualifications of the Offerors to determine the lowest responsible Offeror.
- 16.02 Owner may conduct such investigations as it deems necessary to establish the responsibility, qualifications, and financial ability of consultants, individuals, or entities proposed to furnish parts of the Work in accordance with the Contract Documents.
- 16.03 Each Offeror agrees to waive any claim it has or may have against the members of the OPT and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any Bid.
- 16.04 Notwithstanding any other provision of the Contract Documents, it is stipulated and agreed that by accepting a Bid, the Owner has not and does not waive its sovereign immunity from suit and/or liability.

ARTICLE 17 – AWARD OF CONTRACT

- 17.01 Owner reserves the right to reject any and all Bids, including non-conforming, non-responsive, or conditional Bids. The Owner may also reject the Bid of any Offeror if the Owner believes that

it would not be in the best interest of the Owner to make an award to that Offeror. The Owner reserves the right to waive all formalities.

- 17.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered, except as additional Bids in accordance with Article 7. Reasonable grounds for believing that any Offeror has an interest in more than one Bid for the Work will be cause for disqualification of that Offeror and the rejection of all Bids in which that Offeror has an interest.

17.03 The Contract will be awarded to the lowest responsible Offeror if a contract is to be awarded.

- 17.04 Owner may consider the following in evaluating the Bids and awarding the Contract:

- A. Offeror's qualifications and ability to demonstrate current capability to complete the Project in conformance with the requirements of the Contract Documents.
- B. Compliance of the Bids with requirements of the Contract Documents.
- C. Alternates and unit prices if requested in the bid forms.
- D. The amount bid.

E. Proposed date of completion and the ability to meet intermediate Milestones that may have been established for the Project.

ARTICLE 18 – BONDS AND INSURANCE

- 18.01 The General Conditions set forth the Owner's requirements as to bonds and insurance. When the Successful Offeror delivers the executed Agreement to the Owner, it must be accompanied by the performance and payment bonds and required evidence of insurance.

- 18.02 Provide performance and payment bonds for this Project that fully comply with the provisions of Tex. Gov't Code Chapter 2253. Administration of these bonds will conform to Chapter 2253 and the provisions of the Contract Documents.

ARTICLE 19 – SIGNING OF THE AGREEMENT

- 19.01 The Notice of Award to the Successful Offeror will be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents that are identified in the Agreement. The Successful Offeror must sign and deliver the required number of counterparts of the Agreement and attached documents to the Owner within 15 days. The Owner will deliver two fully signed counterparts to the Successful Offeror within 10 days after receiving the signed documents from the Successful Offeror.

- 19.02 The Successful Offeror must also complete and submit a Certificate of Interested Parties (Form 1295) to the Owner as required by Tex. Gov't Code Chapter 2252 with the signed Agreement.

ARTICLE 20 – SALES AND USE TAXES

- 20.01 The Owner generally qualifies as a tax-exempt agency as defined by the statutes of the State of Texas and is usually not subject to any local or state sales or use taxes, however certain items such as rented equipment may be taxable even though Owner is a tax-exempt agency. Offerors assume responsibility for including any applicable sales taxes in their Bids and for complying with all applicable statutes and rulings of the State of Texas Comptroller.

- 20.02 It is the Owner's intent to have this Contract qualifies as a "separated contract." In order for this Contract to qualify:
- A. Obtain a sales tax permit from the State of Texas Comptroller if awarded this Contract.
 - B. Identify the dollar value of materials exempt from the sales tax. This information must be reported in Section 00 45 04 "State Sales Tax Requirements." Bids that do not include the information requested in this Section may be considered non-responsive.

ARTICLE 21 – WAGE RATES

- 21.01 This Contract is subject to Tex. Gov't Code Chapter 2258 concerning payment of prevailing wage rates. Requirements for paying the prevailing wage rates are discussed in Section 00 73 43 "Wage Rate Requirements." A schedule listing the minimum wage rates for various classifications of laborers which have been established by the Owner for this Project are included in Section 00 73 46 "Wage Determination Schedule." Offerors will be required to pay at least the minimum wages shown on this list and comply with all applicable federal, state, and local Laws and Regulations related to the payment of prevailing wage rates.

END OF SECTION

00 41 13 BID FORM

ARTICLE 1 – BID RECIPIENT

- 1.01 Offeror submits this Bid to:
- City of Keller, Texas
Public Works Administration
1100 Bear Creek Parkway
Keller, TX 76248
Attention: Chad Bartee, P.E. City Engineer
Pearson Pump Station Backup Generator 602202

ARTICLE 2 – OFFEROR’S ACKNOWLEDGMENTS

- 2.01 Offeror proposes and agrees, if this Bid is accepted, to enter into an Agreement with the Owner on the form included in the Contract Documents and to perform all Work specified or indicated in Contract Documents for the Contract Price indicated in this Bid or as modified by Contract Amendment. Offeror agrees to complete the Work within the Contract Times established in the Agreement or as modified by Contract Amendment and comply with all terms and conditions of the Contract Documents.
- 2.02 Offeror accepts all terms and conditions of Section 00 11 16 “Invitation to Bid” and Section 00 21 13 “Instructions to Offerors.”
- 2.03 Offeror accepts the provisions of the Agreement as to liquidated damages in the event of its failure to complete Work in accordance with the schedule set forth in the Agreement.
- 2.04 Offeror acknowledges receipt of the following Addenda:

Addendum No.	Addendum Date	Signature Acknowledging Receipt

ARTICLE 3 – OFFEROR’S REPRESENTATIONS

- 3.01 Offeror has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
- 3.02 Offeror has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- 3.03 Offeror is familiar with Laws and Regulations that may affect cost, progress, and performance of the Work.
- 3.04 Offeror has carefully studied the following Site-related reports and drawings as identified in the Supplementary Conditions:
- A. Drawings of physical conditions relating to existing surface or subsurface structures at the Site;
 - B. Underground Facilities referenced in reports and drawings; and

- C. Technical Data related to each of these reports and drawings.
- 3.05 Offeror has considered the:
 - A. Information known to the Offeror;
 - B. Information commonly known to contractors doing business in the locality of the Site;
 - C. Information and observations obtained from visits to the Site; and
 - D. The Contract Documents.
- 3.06 Offeror has considered the items identified in this Article with respect to the effect of such information, observations, and documents on:
 - A. The cost, progress, and performance of the Work;
 - B. The means, methods, techniques, sequences, and procedures of construction to be employed by Offeror; and
 - C. Offeror's safety precautions and programs.
- 3.07 Offeror 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 Documents based on the information and observations referred to in the preceding paragraphs.
- 3.08 Offeror 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.
- 3.09 Offeror has correlated the information known to the Offeror, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- 3.10 Offeror has given the Construction Manager written notice of all conflicts, errors, ambiguities, or discrepancies that the Offeror has discovered in the Contract Documents, and the written resolution provided by the Construction Manager is acceptable to the Offeror.
- 3.11 The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- 3.12 Offeror's submittal of a Bid constitutes an incontrovertible representation that, without exception, all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 4 – BASIS OF OFFER

- 4.01 Offeror will complete the Work in accordance with the Contract Documents for:

Lump Sum Bid Price	\$
--------------------	----

ARTICLE 5 – TIME OF COMPLETION

- 5.01 Offeror will complete the Work required to be substantially completed within 730 calendar days after the date when the Contract Times commence to run as provided in the General Conditions.

Offeror will complete the Work required for final payment in accordance with the General Conditions within **30** days after the date when the Contract Times commence to run.

ARTICLE 6 – ATTACHMENTS TO THIS BID

6.01 The following documents are attached to and made a condition of this Bid:

- A. Section 00 41 16 “Bid Form Exhibit A.”
- B. Section 00 43 13 “Bid Bond.”
- C. Section 00 45 01 “Nonresident Bidders.”
- D. Section 00 45 02 “Non-Collusion Certification.”
- E. Section 00 45 03 “Conflict of Interest Questionnaire.”
- F. Section 00 45 04 “State Sales Tax Requirements.”

ARTICLE 7 – BID DELIVERY

7.01 This Bid is submitted by:

Offeror: _____
(typed or printed name of organization)

Signature: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

Phone: _____ Email: _____

(Attach evidence of authority to sign if Offeror is a corporation, partnership, or a joint venture.)

END OF SECTION

00 41 16 Bid Form Exhibit A

Project:	Pearson Pump Station Backup Generator		Project No.:
Owner:	City of Keller, Texas		602202
Design Professional:	Freese and Nichols, Inc.		KEL23741
Offeror:			

Base Bid					
Item No.	Item Description	Unit	Estimated Quantity	Unit Price	Extended Amount
Items in Base Bid (excluding Allowances) per Section 01 29 01 "Measurement and Basis for Payment"					
A-01	Concrete Generator Pad	CY	28		
A-02	Compacted Structural Fill	CY	61		
A-03	Prefabricated Metal Platform	SF	132		
A-04	Prefabricated Metal Stairs	EA	4		
A-05	Generator Enclosure	SF	150		
A-06	1200A Medium Voltage ATS, 40kA	EA	1		
A-07	Generator - 480V, 500kW, UL 142, Level 2 Sound Attenuation	EA	1		
A-08	480V to 4160V, 3 Phase 750KVA Step Up Transformer	EA	1		
A-09	Misc. Electrical (Grounding, Lights, Receptacles, etc.)	LS	1		
A-10	Cable and Conduit	LS	1		
A-11	Electrical Pullboxes	EA	3		
A-12	Electrical Manholes	EA	2		
A-13	Instrumentation & SCADA	LS	1		
A-14	Power System Studies	LS	1		
A-15	Start-up and Testing	LS	1		
A	Total Base Bid Items Amount (Sum of Extended Amounts for each Base Bid Line Item)				\$ -
B	Add (+) or Deduct (-) (See Note 1)				
C	Total Adjusted Base Bid Amount (A plus B)				\$ -

Item No.	Item Description	Unit	Estimated Quantity	Unit Price	Extended Amount
Allowances in Base Bid per Section 01 23 10 "Alternates and Allowances"					
D-01					
D-02					
D-03					
D-04					
D-05					
D	Total Allowance Amount (Sum of Extended Amounts for Each Allowance Line Item)				\$ -
E	Total Base Bid with Allowances (Sum of C and D)				\$ -
Extra Work in Base Bid per Section 01 29 01 "Measurement and Basis for Payment"					
F-01					
F-02					
F-03					
F-04					
F-05					
G	Total Allowance Amount (Sum of Extended Amounts for Each Allowance Line Item)				\$ -
H	Total Base Bid with Allowances and Extra Work Items(Sum of E and G)				\$ -
Alternates to be considered for inclusion in the Contract per Section 01 23 10 "Alternates and Allowances"					
I-01					
I-02					
I-03					
J	Total Amount for Alternates for Consideration (Sum of Extended Amounts for Each Alternate Line Item)				\$ -
K	Total Base Bid with Allowance and Alternates for Consideration (Sum of E and J)				\$ -

Contract Time

L	Offeror agrees to reach Substantial Completion in		days
M	Offeror agrees to reach Final Completion in		days

Cost + Time Evaluation

N	Total Base Bid (Line E)	\$	-
O	Offeror Days to Substantial Completion		days
P	Value per Day of Construction	\$	- per day
Q	Value for Days of Construction (O X P)		
R	Basis for Comparison of Bids (N + Q)		

Notes	
1	Provision is made for Offeror to include an addition or deduction in the Bid to reflect any last minute adjustments in price. The addition or deduction, if made, will be applied proportionately to the following Items: [List Base Bid Items to which the Add or Deduct will be applied.]

BID SUBMITTED BY:

Offeror: _____
Signature: _____
Printed Name: _____
Title: _____
Date: _____

00 43 13 BID BOND

Offeror as Principal	Surety
Name:	Name:
Mailing address (principal place of business):	Mailing address (principal place of business):
Owner	Physical address (principal place of business):
Name:	
Mailing address (principal place of business):	Telephone (Main):
	Telephone (Claims):
Contract	Surety's state of incorporation:
Project name and number:	<i>By submitting this bond, Surety affirms it is authorized to do business and licensed to execute bonds in the state where the Project is located.</i>
Bid/Proposal Due Date:	Local Agent for Surety
Bond	Name:
Contract Price Offered:	Company:
	Mailing address (principal place of business):
Penal Sum of Bond:	
5% of Contract Price offered	
Date of Bond:	Telephone (Main):

Surety and Offeror, intending to be legally bound by this bond, do each cause this bond to be duly executed on its behalf by its authorized officer, agent, or representative. Surety and Offeror bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally to this bond. The condition of this obligation is such that if Owner accepts the Offeror's Bid or Proposal and Offeror delivers the executed Agreement and the required bonds and evidence of insurance within the time stipulated in the Bidding or Proposal Documents this obligation is null and void. Payment under this bond will be due and payable upon default by Offeror and within 30 days after receipt by Offeror and Surety of written notice of default from Owner. This Agreement shall be administered and interpreted under the laws of the state where the Project is located. Venue lies exclusively in [specify name of county and state] for any legal action.

Offeror as Principal	Surety
Signature: _____	Signature: _____
Name: _____	Name: _____
Title: _____	Title: _____
Email: _____	Email: _____
	<i>(Attach Power of Attorney)</i>

END OF SECTION

00 45 01 NONRESIDENT BIDDERS

Texas Government Code Chapter 2252 applies to the award of government contracts to nonresident bidders. This chapter provides that:

“a government entity may not award a governmental contract to a nonresident bidder unless the nonresident underbids the lower bid submitted by a responsible resident bidder by an amount that is not less than the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in the state in which the nonresident’s principal place of business is located.”

“Nonresident bidder” refers to a person who is not a resident of Texas.

“Resident bidder” refers to a person whose principal place of business is in this state, including a contractor whose ultimate parent company or majority owner has its principal place of business in this state.

Check the statement that is correct for Offeror:

- ☐ Offeror (includes parent company or majority owner) qualifies as a resident bidder whose principal place of business is in Texas.
- ☐ Offeror qualifies as a nonresident bidder whose principal place of business or residency is in the state of: _____

Any determination of state bidder preference law will be based on the Texas Comptroller’s annual summary of other state bidder preference laws.

Offeror: _____
(typed or printed name of organization)

Signature: _____
(individual’s signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Business Address:

Phone: _____ Email: _____
(Attach evidence of authority to sign if Offeror is a corporation, partnership, or a joint venture.)

END OF SECTION

STATE OF _____ §

Owner: City of Keller, Texas
1100 Bear Creek Parkway
Keller, Texas 76248

Offeror certifies that it has not been a party to any collusion among Offerors in the restraint of freedom of competition by agreement to submit a Bid or Proposal at a fixed price or to refrain from submitting a Bid or Proposal; or with any official or employee of the Owner as to quantity, quality, or price in the prospective contract, or any other terms of said prospective contract; or in any discussion between Offerors and any official of the Owner concerning exchange of money or other thing of value for special consideration in the letting of a contract.

Offeror: _____
(typed or printed name of organization)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

(Attach evidence of authority to sign if Offeror is a corporation, partnership, or a joint venture.)

Non-Collusion Certification
KEL23741 - City of Keller Pearson Pump Station Backup Generator

00 45 02 - 1
September 19, 2024

CONFLICT OF INTEREST QUESTIONNAIRE For vendor doing business with local governmental entity		FORM CIQ
<p>This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.</p> <p>This questionnaire is being filed in accordance with Chapter 176 of the Local Government Code by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).</p> <p>By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. See Section 176.006(a-1), Local Government Code.</p> <p>A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.</p>	OFFICE USE ONLY <div style="border: 1px solid black; height: 100px; width: 100%;"></div>	
1	Name of vendor who has a business relationship with local governmental entity. <div style="border: 1px solid black; height: 30px; width: 100%;"></div>	
2	<input type="checkbox"/> Check this box if you are filing an update to a previously filed questionnaire. (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)	
3	Name of local government officer about whom the information is being disclosed. <div style="border: 1px solid black; height: 30px; width: 100%;"></div> <div style="text-align: center; margin-top: 5px;">Name of Officer</div>	
4	Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary. <p>A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>	
5	Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more. <div style="border: 1px solid black; height: 100px; width: 100%;"></div>	
6	<input type="checkbox"/> Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1)	
7	<div style="border: 1px solid black; height: 40px; width: 100%;"></div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 60%;">Signature of vendor doing business with the governmental entity</div> <div style="width: 35%;">Date</div> </div>	

CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Government Code may be found at <http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm>. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

- (A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;
- (B) a transaction conducted at a price and subject to terms available to the public; or
- (C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds \$2,500 during the 12-month period preceding the date that the officer becomes aware that

- (i) a contract between the local governmental entity and vendor has been executed;
- or
- (ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than \$100 in the 12-month period preceding the date the officer becomes aware that:

- (i) a contract between the local governmental entity and vendor has been executed; or
- (ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

- (1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);
- (2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or
- (3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

(1) the date that the vendor:

- (A) begins discussions or negotiations to enter into a contract with the local governmental entity; or
- (B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

(2) the date the vendor becomes aware:

- (A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);
- (B) that the vendor has given one or more gifts described by Subsection (a); or
- (C) of a family relationship with a local government officer.

END OF SECTION

00 45 04 STATE SALES TAX REQUIREMENTS

Comply with all applicable sales, excise, and use tax requirements of the Texas Tax Code. The Offeror hereby certifies that the Contract Price is divided as follows:

Tax exempt products, materials, and services (See Notes 1 and 2)	\$	_____
Taxable products, materials, and services (See Note 3)	\$	_____
Total (See Note 4)	\$	_____

Offeror: _____
(typed or printed name of organization)

Signature: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Business Address: _____

Phone: _____ Email: _____

(Attach evidence of authority to sign if Offeror is a corporation, partnership, or a joint venture.)

Notes:

1. Exempt products and materials are those items purchased for the Project which are physically incorporated into the facilities constructed for the Owner or are necessary and essential for the performance of the Work and are completely consumed at the Site. For purposes of this definition, products and materials are completely consumed if after being used once for its intended purpose it is used up or destroyed. Products and materials rented or leased for use in the performance of the Work cannot be completely consumed for the purposes of this definition.
2. Exempt services are those services performed at the Site where the Contract expressly requires the specific service to be provided or purchased by the person performing the Work or the service is integral to the performance of the Work.
3. Products, materials, and services are not tax exempt if they are used by the Contractor but are not physically incorporated into the Owner's facilities or are not consumed by construction as defined above. Machinery or equipment and its accessories and repair and replacement parts used in the performance of the Work are not exempt.
4. The total sum of the amount for tax exempt and taxable products, materials, and services must equal the Contract Price.

END OF SECTION

VENDOR COMPLIANCE TO STATE LAW

The 1985 Session of the Texas Legislature passed House Bill 620 relative to the award of contracts to non-resident bidders. This law provides that, in order to be awarded a contract as low bidder, non-resident bidders (out-of-state contractors whose corporate offices or principal place of business are outside of the state of Texas) bid projects for construction, improvements, supplies or services in Texas at an amount lower than the lowest Texas resident bidder by the same amount that a Texas resident bidder would be required to underbid a non-resident bidder in order to obtain a comparable contract in the state in which the non-resident's principal place of business is located. The appropriate blanks in Section A must be filled out by all out-of-state or non-resident contractors to do so will automatically disqualify that bidder. Resident bidders must check the blank in Section B.

- A. Non-resident vendors in _____ (give state), our principal place of business, are required to be _____ percent lower than resident bidders by state law. A copy of the statute is attached.
- B. _____ Our Principal place of business or corporate offices are in the State of Texas.

BIDDER:

_____ _____ Address	By: _____ Signature: _____ Title: _____
_____ City State Zip	

THIS FORM MUST BE RETURNED WITH YOUR BID

CONTRACTOR COMPLIANCE TO TEXAS SALES TAX CODE

Comply with all requirements of the Texas Sales Tax Code. The Contractor hereby certifies that the Contract Amount is divided as follows:

Material incorporated into the Project
(Resold to the Owner as defined in Tax Code) \$ _____

All other charges and costs \$ _____

Total * \$ _____

* The total must equal the total amount of the Contract:

CONTRACTOR:

By: _____
(signature of authorized person)

Address _____

Signature: _____

City State Zip

Title: _____

THIS FORM MUST BE RETURNED WITH YOUR BID

00 45 13 QUALIFICATIONS STATEMENT

ARTICLE 1 – REQUIREMENTS FOR THE QUALIFICATIONS STATEMENT

- 1.01 The Qualifications Statement must be submitted by the apparent low Offeror within 5 calendar days of the bid opening and include the information as described in this Section as a minimum. Failure to submit the required information in the Qualifications Statement may result in Owner considering the Bid non-responsive and may result in rejection of the Bid by Owner. Offerors may be required to provide supplemental information if requested by Owner to clarify, enhance, or supplement the information provided in the Qualifications Statement.
- 1.02 Offeror must provide the information requested in this Qualifications Statement using the forms attached to this Section. The information requested in these forms must be provided completely and in detail. Information that cannot be totally incorporated in the forms may be included as an appendix to the form. This appendix must be clearly referenced by appendix number on the form, and the appended material must include the appendix number on every sheet of the appendix. The appendix must include only the information that responds to the question or item number to which the appended information applies.
- 1.03 Offeror may provide supplemental information to the Qualifications Statement such as organizational brochures or other marketing information to help demonstrate their qualifications to Owner. This information may not be submitted as a substitute for the information specifically requested in this Section. The reference must include the specific paragraph or section that applies to that question or item if this information is included as an appendix to the information requested in Article 2.

ARTICLE 2 – INSTRUCTIONS FOR PREPARING THE QUALIFICATIONS STATEMENT

- 2.01 Offeror's Organization and General Information:
 - A. Provide general information about the Offeror's organization using copies of Table 1. Provide the same information for each joint venture partner if the Offeror is a joint venture.
 - B. Provide information regarding the operational structure of the Offeror's organization, including a list of officers, the limits of authority for these individuals with regards to the proposed Project, documentation of authority to execute documents, and a copy of organizations' certificate of authorization to conduct business in the state the Project is located in. If the Project is located in a state that licenses contractors, Offeror must also provide documentation showing that the organization is licensed as a general contractor in that state, including any applicable classifications and limitations.
 - C. Financial Management:
 1. Provide the Offeror's most recent audited financial statement and the most recent financial statement if the most recent audited financial statement is more than 2 years old.

2. Provide the Offeror's financial summary information in Table 1, including the financial indicators from the Offeror's most recent financial statement using the formulas below:

Current Ratio: $\text{Current Assets} \div \text{Current Liabilities}$

Quick Ratio: $(\text{Cash and Cash Equivalents} + \text{Accounts Receivable} + \text{Short Term Investments}) \div \text{Current Liabilities}$

3. Describe the resources that are available to Offeror to provide adequate cash flow for the Project if the Offeror's Current Ratio or Quick Ratio are less than 1.0.

D. Safety:

1. Provide a narrative not to exceed four pages describing the Offeror's success in implementing an effective project site safety program. Provide a narrative describing the Offeror's safety program and a statement regarding the organization's commitment to safety. Do not provide copies of safety manuals or programs.
2. Provide Experience Modification Ratio (EMR) and Total Recordable Frequency Rate (TRFR) history for the last 3 years for Offeror and any proposed subcontractors that will provide Work valued at 25 percent or more of the Contract Price. Provide this information in Table 1.
 - a. Offeror's EMR is a computation by the insurance industry that compares a company's annual losses in workers' compensation insurance claims against its policy premiums over a three-year period, excluding the current year.
 - b. Offeror's TRFR is a calculation of a firm's total number of OSHA-recordable injuries and illnesses over a given period (usually a year), divided by the total number of personnel-hours worked.

- E. Claims Experience and Litigation History: Provide a list of all claims or litigation involving owners on other construction projects that have been active over the last 5 years or that are currently unresolved. Include this information in Table 1. Provide a narrative describing the issues being contested and when it is anticipated that the disputes will be resolved. Claims are to include only those items which have progressed through the change management process for the project and are being disputed by Offeror or the project owner.

- F. Past Experience with the Owner: Provide a list of projects that have been completed with Owner over the last 5 years. Include this information in Table 1. Provide a narrative not to exceed two pages describing how this experience will impact the performance of Offeror on this Project.

2.02 Project Experience:

- A. Provide a list of projects completed by Offeror in the last 5 years using copies of Table 2.
- B. Provide detailed descriptions of projects which demonstrate the experience of the Offeror's team with construction of similar projects. Experience must include, as a minimum, the

satisfactory completion of at least five similar projects within the last 5 years. Offerors not meeting the requirement for similar projects may be disqualified as being non-responsive.

- C. Provide a narrative not to exceed two pages for each project describing up to five specific projects that qualify as similar projects. Projects selected must demonstrate the capabilities of Offeror.

2.03 Experience and Qualifications of Proposed Key Personnel:

- A. Provide a narrative not to exceed four pages describing the Offeror's project management structure and the qualifications of the project management team for this Project. Include an organization chart showing the relationship between Offeror and key subcontractors and suppliers.
- B. Provide information on the key personnel proposed for this Project on Tables 3 through 7. Key personnel include the project manager, project superintendent, safety manager, and quality control manager. Offeror may provide information on an alternate individual if it is not able to commit to one individual for the Project at the time the Bid is submitted. Qualifications of these individuals will be considered in evaluating the Offeror's qualifications. Offeror must commit to providing the services of the proposed key personnel or alternate for the life of the Project as a condition of qualification. Failure to provide the proposed key personnel may result in the disqualification of Offeror and will provide the basis for termination of the Contract at the discretion of Owner.
- C. Include a list of the current project assignments for each of the individuals proposed, the anticipated completion date for these assignments, and the percentage of the time they will have available to devote to this Project. The project superintendent must be dedicated to the Project full time for the duration of the Project. If any other key personnel are not devoted solely to the Project, indicate how time is to be divided between the Project and other assignments. Specifically address how and when individuals currently on other assignments will transition to the Project.
- D. Provide resumes not exceeding two pages for each individual proposed for the key personnel positions and their alternates. Resumes must describe the qualifications of the individual and include the following as a minimum: technical experience, managerial experience, education and formal training, primary language, and a work history which describes project experience, including the roles and responsibilities for each assignment. Additional information highlighting the experience which makes them the best candidate for the assignment should also be included. Focus on projects on which individuals proposed have had significant involvement in the last 5 years and which demonstrate experience with similar projects.
- E. Identify individuals that will fill one or more of these key roles and describe their ability to handle multiple responsibilities. Provide a written narrative describing the percentage of the time that will be devoted to each role and the qualifications to fulfill each role if an individual is to fulfill more than one of the key personnel roles.
- F. Provide a tabulation of the projects on which the key personnel have been personally involved using copies of Table 7. This tabulation is to include the name and a current telephone number for references for each of these project assignments.
- G. Provide a narrative not to exceed two pages for each project the proposed individuals have worked on that qualify as similar projects. Specifically identify the role and responsibilities

of the individual on these similar projects. Projects selected must demonstrate the capabilities of the proposed key personnel.

- H. Provide a narrative not to exceed ten pages to describe the overall performance of the individuals on these projects. This narrative may include references to letters of recommendation, project awards, and other references to demonstrate experience in constructing a project which meets the project owner's expectations for a quality project constructed on time and within budget.

2.04 Offeror's Ability to Complete Projects within the Contract Price and Contract Times:

- A. Provide a tabulation of budget performance on projects completed by Offeror within the last 5 years using copies of Table 8 to demonstrate the ability of the Offeror to complete projects for the Contract Price. Notes may be added to each line item to describe circumstances for change orders beyond the control of Offeror.
- B. Provide a tabulation of all projects completed by Offeror within the last 5 years on Table 9 to demonstrate performance in completing projects on time. Notes may be added to the tabulations to indicate the reasons for not meeting original contract completion dates.

ARTICLE 3 – BID REQUIREMENTS

- 3.01 Provide the Qualifications Statement using the referenced tables and narrative descriptions as described in this Section. Pages are to be 8-1/2 x 11, with a minimum font size of 10. Provide a tab to separate materials responding to each of the rating categories listed in Article 2.
- 3.02 Additional information may be included in appendices attached to the Bid. Each appendix must reference the section of the criteria it is in reference to.
- 3.03 Provide one printed copy of the Bid at the time and place set forth in Section 00 11 16 "Invitation to Bid." Provide a digital copy of the Bid in Portable Document Format (pdf) on a CD. This digital copy is to include all information required to evaluate the Bid.

ARTICLE 4 – FORMS

- 4.01 The following tables are attached to this Section:

Table	Description
1	General Information
2	Current Projects and Project Completed within the last 5 Years
3	Proposed Project Managers
4	Proposed Project Superintendents
5	Proposed Project Safety Managers
6	Proposed Project Quality Control Managers
7	Project Information for Key Personnel
8	Demonstration of Budget Performance
9	Demonstration of On-Time Performance

ARTICLE 5 – CERTIFICATION

- 5.01 By submitting this Qualifications Statement and related information, Offeror certifies that it has read this Qualifications Statement and that the Offeror's responses are true and correct and contain no material misrepresentations, and that the individual signing below is authorized to make this certification on behalf of the Offeror's organization.

Offeror: _____
(typed or printed name of organization)

Signature: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Attest: _____
(individual's signature)

Designated Representative:

Name: _____

Title: _____

Address for giving notices:

Phone: _____ Email: _____

(Attach evidence of authority to sign if Offeror is a corporation, partnership, or a joint venture.)

Table 1 - General Information

Organization			
Legal Name of Business			
Form of Business Entity: <input type="checkbox"/> Joint Venture <input type="checkbox"/> Corporation <input type="checkbox"/> General Partnership <input type="checkbox"/> Limited Partnership			
Date Business was formed		State under which Business was formed	
Is this Business authorized to operate in the Project location: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Pending			
Is this Business licensed as a general contractor in the Project location: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Pending <input type="checkbox"/> N/A			
List of companies, firms, or organizations that own any part of this Business.			
Name of company, firm, or organization.			Percent ownership
Principal Office			
Primary contact		Main telephone number	
Email address		Website address	
Business address of principal office			
Regional Office			
Primary contact		Main telephone number	
Email address		Website address	
Business address of regional office			
Business History			
List of names that this Business currently has or anticipates operating under over the history of the Business, including the names of related companies presently doing business.			
Names of organization	From date	To date	
Indicators of Organization Size			
Average number of current full-time employees			
Average estimate of revenue for the current year			

Table 1 - General Information Cont'd

Previous Contracting Experience			
Years of experience in projects similar to the proposed Project:			
As a general contractor		As a joint venture partner	
Has this organization or a participating or predecessor organization ever been disqualified as a bidder by any local, state, or federal agency within the last 5 years? <input type="checkbox"/> Yes* <input type="checkbox"/> No			
Has this organization or a participating or predecessor organization ever been barred from contracting by any local, state, or federal agency within the last 5 years? <input type="checkbox"/> Yes* <input type="checkbox"/> No			
Has this organization or a participating or predecessor organization been released from a bid or proposal in the past 5 years? <input type="checkbox"/> Yes* <input type="checkbox"/> No			
Has this organization or a participating or predecessor organization ever defaulted on a project or failed to complete any contract awarded to it? <input type="checkbox"/> Yes* <input type="checkbox"/> No			
Has this organization or a participating or predecessor organization ever refused to construct or refused to provide materials defined in the contract documents or in a change order? <input type="checkbox"/> Yes* <input type="checkbox"/> No			
Is this organization or a participating or predecessor organization currently involved in any litigation or contemplating litigation? <input type="checkbox"/> Yes* <input type="checkbox"/> No			
Provide full details in a separate attachment for each statement above with a "yes" response above.			
Previous History with Owner			
List projects that have been completed with the Owner over the last 5 years. If more than 5 projects, list only the most recent.			
	Project Name		Year
1			
2			
3			
4			
5			
Previous Claims History and Litigation Experience			
List all claims or litigation involving owners on other construction projects that have been active over the last 5 years or that are currently unresolved.			
	Description of Claim or Litigation		Status
1			
2			
3			
4			
5			

Table 1 - General Information Cont'd

Surety								
Surety Name								
Mailing address (principal place of business):					Physical address (principal place of business):			
Telephone (main number)					Telephone (claims notices)			
Name of Local Agent for Surety								
Telephone				Email				
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? <input type="checkbox"/> Yes <input type="checkbox"/> No								
Is surety listed in the U.S. Department of the Treasury's Listing of Approved Sureties (Department Circular 570 "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies")? <input type="checkbox"/> Yes <input type="checkbox"/> No								
Insurance								
Name of Insurance Provider								
Provider is a corporation organized and existing under the laws of the state of								
Is Provider licensed or authorized to issue insurance policies in the Project location?							<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does Provider have an A.M. Best Rating of A-VIII or Better?							<input type="checkbox"/> Yes <input type="checkbox"/> No	
Mailing Address (principal place of business)								
Physical Address (principal place of business)								
Telephone (main number)								
Telephone (for notice of claims)								
Local Agent for Provider								
Address for Local Agent								
Telephone for Local Agent								
Construction Site Safety Experience								
Provide Offeror's Experience Modification Ratio (EMR) and Total Recordable Frequency Rate (TRFR) for the last 3 years and the EMR and TRFR history for the last 3 years of any proposed Subcontractor that will provide Work valued at 25% or more of the Contract Price.								
Year	Offeror		Subcontractor		Subcontractor		Subcontractor	
	EMR	TRFR	EMR	TRFR	EMR	TRFR	EMR	TRFR
1								
2								
3								

Table 1 - General Information Cont'd

Financial Summary Information for Offeror		
Date of Offeror's most current financial statement		
Date of Offeror's most current audited financial statement		
Financial indicators from the most current financial statement:		
Offeror's Current Ratio = Current Assets ÷ Current Liabilities		
Offeror's Quick Ratio = (Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities		
Describe the resources that are available to the Offeror to provide adequate cash flow for the Project if Offeror's Current Ratio or Quick Ratio are less than 1.0:		
Disadvantaged Business Certifications		
Name of Certification	Certifying Agency	Certification Date
<input type="checkbox"/> Disadvantage Business Enterprise		
<input type="checkbox"/> Minority Business Enterprise		
<input type="checkbox"/> Woman Business Enterprise		
<input type="checkbox"/> Disabled Veteran Owned Business		
<input type="checkbox"/> Historically Underutilized Business		
<input type="checkbox"/> Small Business Enterprise		
<input type="checkbox"/> Other		
<input type="checkbox"/> None		

Table 2 - Current Projects and Project Completed within the last 5 Years

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

Table 3 - Proposed Project Managers

Name of Organization			
Primary Candidate			
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	
Role on project		Role on project	
Alternate Candidate			
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	
Role on project		Role on project	

Table 4 - Proposed Project Superintendents

Name of Organization			
Primary Candidate			
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	
Role on project		Role on project	
Alternate Candidate			
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	
Role on project		Role on project	

Table 5 - Proposed Project Safety Managers

Name of Organization			
Primary Candidate			
Name of individual			
Years of experience as project safety manager			
Years of experience with this organization			
Number of similar projects as project safety 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	
Role on project		Role on project	
Alternate Candidate			
Name of individual			
Years of experience as project safety manager			
Years of experience with this organization			
Number of similar projects as project safety 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	
Role on project		Role on project	

Table 6 - Proposed Project Quality Control Managers

Name of Organization			
Primary Candidate			
Name of individual			
Years of experience as quality control manager			
Years of experience with this organization			
Number of similar projects as quality control 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	
Role on project		Role on project	
Alternate Candidate			
Name of individual			
Years of experience as quality control manager			
Years of experience with this organization			
Number of similar projects as quality control 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	
Role on project		Role on project	

Table 7 - Project Information for Key Personnel

Name of Organization							
Provide information on all projects completed by the Organization within the last 5 years.							
Project Owner				Project Name			
General Description of Project							
Project Budget and Schedule Performance							
Budget History	Amount	% of Bid Amount	Schedule Performance		Date	Days	
Original Contract Price			Notice to Proceed				
Change Orders			Contract Substantial Completion Date at Notice to Proceed				
Owner Enhancements			Contract Final Completion Date at Notice to Proceed				
Unforeseen Conditions			Change Order Authorized Substantial Completion Date				
Design Issues			Change Order Authorized Final Completion Date				
Total			Actual / Estimated Substantial Completion Date				
Final Cost			Actual / Estimated Final Completion Date				
Key Project Personnel							
		Project Manager	Project Superintendent	Safety Manager	Quality Control Manager		
Name							
Percentage of time devoted to the project							
Percentage of time proposed for this Project							
Did Individual start and complete the project?							
If not, who started or completed the project in their place?							
Reason for change?							
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							
Surety							
Issues / disputes resolved or pending resolution by arbitration, litigation or dispute review boards							
Number of issues resolved		Total amount involved in resolved issues		Number of issues pending		Total amount involved in issues pending	

Table 8 - Demonstration of Budget Performance

Name of Offeror							
Provide information on all projects completed by the Offeror within the last 5 years.							
Owner Name	Project Description	Original Contract Price	Value of Change Orders			Total Change Orders	Percent of Changes to Original Contract Price
			Owner Enhancements	Unforeseen Conditions	Design Issues		
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							

Table 9 - Demonstration of On-Time Performance

Name of Organization							
Provide information on all projects completed by the Organization within the last 5 years.							
Owner Name	Project Description	Original Contract Date for Substantial Completion	Original Contract Date for Final Completion	Amended Contract Date for Substantial Completion	Amended Contract Date for Final Completion	Actual Contract Date for Substantial Completion	Actual Contract Date for Final Completion
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							
Notes:							

END OF SECTION

00 52 13 AGREEMENT

This Agreement is between City of Keller, Texas (Owner) and [name of Contractor to be inserted at time of Contract execution] (Contractor).

Owner and Contractor agree as follows:

ARTICLE 1 – WORK

- 1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is designated as follows:

Pearson Pump Station Backup Generator
602202

ARTICLE 2 – DESIGN PROFESSIONAL

- 2.01 The Design Professional for this Project is:

Freese and Nichols, Inc.
801 Cherry Street, Suite 2800
Fort Worth, Texas 76102

ARTICLE 3 – CONTRACT TIMES

- 3.01 Contract Times

- A. The Work is required to be substantially complete on or before 10/31/2026, and complete and ready for final payment in accordance with the General Conditions on or before 11/30/2026.

- 3.02 Liquidated Damages

- A. Owner and Contractor recognize that the Contract Times specified for Critical Operations, and Substantial Completion and Final Completion are of the essence in the Contract. Owner and Contractor recognize that the Owner will suffer financial loss if the Work is not completed within the Contract Times specified in this Agreement and in Section 01 35 00 "Special Procedures" as may be adjusted in accordance with the General Conditions. Owner and Contractor 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 within the Contract Times. Accordingly, instead of requiring proof of the amount of these damages, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
1. Contractor agrees to pay Owner \$1,000 for each day that expires after the time specified in this Agreement for Substantial Completion until the Work is substantially complete.

2. Contractor agrees to pay Owner \$1,000 for each day that expires after the time specified in this Agreement for Final Completion until the Work is completed and ready for final payment in accordance with the General Conditions.
- B. Liquidated damages for failing to timely attain Substantial Completion and Final Completion are not additive and will not be imposed concurrently.
- C. Contractor agrees to pay the Owner liquidated damages as stipulated in Section 01 35 00 "Special Procedures" for failure to meet Contract Times for Critical Operations.
- D. OPT will determine whether the Work has been completed within the Contract Times. Assessment of liquidated damages by the Owner does not waive the Owner's right to assess or collect additional damages which the Owner may sustain by the failure of the Contractor to perform in accordance with the terms of the Contract.

ARTICLE 4 – CONTRACT PRICE

- 4.01 Owner will pay the Contractor the following amount for completion of the Work in accordance with the Contract Documents:

Not To Exceed	\$
---------------	----

ARTICLE 5 – PAYMENT PROCEDURES

- 5.01 Submit Applications for Payment in accordance with the General Conditions. Applications for Payment will be processed by the Construction Manager per Section 01 29 00 "Application for Payment Procedures."
- 5.02 Owner will make progress payments on or about the **25th** day of each month during performance of the Work. Payment is based on the total earned value of Work completed in the previous month in accordance with the Schedule of Values established as provided in the General Conditions.
- 5.03 Payment will be made for the total earned value of Work completed in the previous month after deducting:
- A. Retainage calculated per this Agreement;
 - B. Set-offs determined in accordance with the General Conditions; and
 - C. The total amount of payments previously made.
- 5.04 Retainage
- A. Progress payments will be made in an amount equal to 90 percent of the total earned value to date for completed Work and properly stored materials. The remaining 10 percent of the total earned value to date will be held as retainage in accordance with Tex. Gov't Code Chapter 2252.
- 5.05 Release or reduction in retainage is contingent upon the consent of surety to the reduction in retainage. Submit a Consent of Surety Company to Reduction of or Partial Release of Retainage form as provided by or approved by the Construction Manager.
- 5.06 Owner will pay the remainder of the Contract Price as recommended by Construction Manager in accordance with the General Conditions upon Final Completion and acceptance of the Work.

ARTICLE 6 – PAYMENT OF INTEREST

- 6.01 All moneys not paid when due as provided in the General Conditions will earn interest at the rate specified in Tex. Gov't Code Chapter 2251. Interest accrual will cease upon payment by the Owner.

ARTICLE 7 – CONTRACTOR'S REPRESENTATIONS

- 7.01 The Contractor makes the following representations:

- A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
- B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Contractor is familiar with Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied the following Site related reports and drawings as identified in the Supplementary Conditions:
 - 1. Geotechnical Data Reports regarding subsurface conditions at or adjacent to the Site;
 - 2. Drawings of physical conditions relating to existing surface or subsurface structures at the Site;
 - 3. Underground Facilities referenced in reports and drawings;
 - 4. Reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site; and
 - 5. Technical Data related to each of these reports and drawings.
- E. Contractor has considered the:
 - 1. Information known to Contractor;
 - 2. Information commonly known to contractors doing business in the locality of the Site;
 - 3. Information and observations obtained from visits to the Site; and
 - 4. The Contract Documents.
- F. Contractor has considered the items identified in this Article with respect to the effect of such information, observations, and documents on:
 - 1. The cost, progress, and performance of the Work;
 - 2. The means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and
 - 3. Contractor's safety precautions and programs.
- G. Based on the information and observations referred to in the preceding paragraphs, 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 Documents.

- H. 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.
- I. Contractor has correlated the information known to the Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- J. Contractor has given the Construction Manager written notice of all conflicts, errors, ambiguities, or discrepancies that the Contractor has discovered in the Contract Documents, and the written resolution provided by the Construction Manager is acceptable to the Contractor.
- K. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- L. Contractor's entry into this Agreement 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.

ARTICLE 8 – ACCOUNTING RECORDS

- 8.01 Accounting Record Availability: Contractor is to establish and maintain, in accordance with generally accepted accounting practices, full and detailed accounting records of materials incorporated into the Project, and labor, tools, materials, and equipment used for the Work, consistent with the requirements of the General Conditions and as necessary for proper financial management under this Agreement. Subject to prior written notice, provide Owner reasonable access during normal business hours to Contractor's records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and the Contractor's fee. Preserve all such documents for a period of 3 years after the final payment by the Owner.

ARTICLE 9 – OTHER REQUIREMENTS

- 9.01 Ineligibility to Receive State Grants or Loans or Receive Payment on State Contracts: As required by Tex. Fam. Code Section 231.006, Contractor certifies that the individual or business entity named in this contract, bid, or application is not ineligible to receive the specified grant, loan, or payment and acknowledges that this Contract may be terminated and payment may be withheld if this certification is inaccurate.
- 9.02 Workers' Compensation Insurance
 - A. By signing this Agreement, Contractor certifies that it provides workers' compensation insurance coverage for all employees employed on this Project pursuant to Tex. Lab. Code Section 406.096(a).
 - B. As required by Section 406.096(b), Contractor must require each Subcontractor to certify in writing to the Contractor that the Subcontractor provides workers' compensation insurance coverage for all of the employees it employs on this Project. Contractor must provide these certifications to the Owner within 10 days of the Effective Date of the Agreement.

- 9.03 Prohibition on Contracts with Companies Engaged in Business with Iran, Sudan, or Foreign Terrorist Organizations
- A. Tex. Gov't Code Chapter 2252, Subchapter F, prohibits the award of governmental contracts to companies engaged in business with Iran, Sudan, or foreign terrorist organizations.
 - B. By signing this Agreement, Contractor certifies that it is not ineligible to be awarded this Contract under Chapter 2252, Subchapter F.
- 9.04 Prohibition on Contracts with Certain Companies that Boycott Israel
- A. Tex. Gov't Code Chapter 2271 prohibits a governmental entity from entering into a contract with a company for goods or services unless the contract contains a written verification from the company that it: (1) does not boycott Israel; and (2) will not boycott Israel during the term of the contract.
 - B. By signing this Agreement, Contractor certifies that it does not boycott Israel and will not boycott Israel during the term of this Contract.
- 9.05 Prohibition on Contracts with Companies That Discriminate Against Firearm and Ammunition Industries
- A. Tex. Gov't Code Chapter 2274 prohibits a governmental entity from entering into a contract with a company for goods or services unless the contract contains a written verification from the company that it: (1) does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association; and (2) will not discriminate during the term of the contract against a firearm entity or firearm trade association.
 - B. By signing this Agreement, Contractor certifies that it does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association and will not discriminate against a firearm entity or firearm trade association during the term of the contract.
- 9.06 Prohibition on Contracts with Certain Foreign-Owned Companies in Connection with Critical Infrastructure
- A. Tex. Gov't Code Chapter 2275 prohibits a governmental entity from entering into certain contracts or other agreements relating to critical infrastructure if the governmental entity knows that the company has ownership interests held or controlled by citizens or the governments of China, Iran, North Korea, Russia or other countries designated by the State of Texas.
 - B. By signing this Agreement, Contractor certifies that it is not ineligible to be awarded this Contract under this Chapter 2275.
- 9.07 Prohibition on Contracts with Companies Boycotting Certain Energy Companies
- A. Tex. Gov't Code Chapter 2276 prohibits a governmental entity from entering into a contract with a company for goods or services unless the contract contains a written verification from the company that it: (1) does not boycott energy companies; and (2) will not boycott energy companies during the term of the contract.
 - B. By signing this Agreement, Contractor certifies that it does not boycott energy companies and will not boycott energy companies during the term of this Contract.

- 9.08 Certificate of Interested Parties: Contractor must complete and submit a Certificate of Interested Parties (Form 1295) to the Owner with the signed Agreement as required by Tex. Gov't Code Section 2252.908.

ARTICLE 10 – VENUE

- 10.01 This Agreement shall be administered and interpreted under the laws of the State of Texas. Contractor agrees that venue lies exclusively in Tarrant County, Texas for any legal action.

ARTICLE 11 – CONTRACT DOCUMENTS

11.01 Contract Documents

- A. Specifications Sections listed in Section 00 01 10 "Table of Contents" except as specifically excluded in Paragraph 12.02.
- B. Drawings listed in the Sheet Index on the Drawings.
- C. Addenda (Numbers 00 91 01 to 00 91 **[XX]**, inclusive).
- D. Appendices listed in Section 00 01 10 "Table of Contents" except as specifically excluded in Paragraph 12.02.
- E. The following are also Contract Documents which may be delivered or issued on or after the Effective Date of the Contract:
 - 1. Notice to Proceed.
 - 2. Contract Amendment(s).
 - 3. Change Order(s).
 - 4. Field Order(s).
 - 5. Work Change Directive(s).
- F. There are no Contract Documents other than those listed above in this Paragraph. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

11.02 Bidding Requirements and Informational Documents

- A. The following Bidding Requirements are not Contract Documents:
 - 1. None
- B. The following documents are provided for information only and are not part of the Contract Documents:
 - 1. None

The Effective Date of the Contract is **[date to be inserted at the time of contract execution]**.

Owner: _____
(typed or printed)

Contractor: _____
(typed or printed)

By: _____
(individual's signature)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Title: _____
(typed or printed)
(Attach evidence of authority to sign)

Address for giving notice:

Address for giving notice:

Designated representative:

Designated representative:

Name: _____

Name: _____

Title: _____

Title: _____

Address: _____

Address: _____

Phone: _____

Phone: _____

Email: _____

Email: _____

END OF SECTION

00 61 13 PERFORMANCE BOND

<p>Contractor as Principal</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>	<p>Surety</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>
<p>Owner</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>	<p>Physical address (principal place of business):</p> <p>Telephone (Main):</p> <p>Telephone (Claims):</p>
<p>Contract</p> <p>Project name and number:</p> <p>Contract Price:</p> <p>Effective Date of Contract:</p>	<p>Surety's state of incorporation:</p>
	<p><i>By submitting this bond, Surety affirms that it is licensed to provide and execute this bond and authorized to do business in Texas.</i></p>
	<p>Local Agent for Surety</p> <p>Name:</p> <p>Mailing address (principal place of business):</p> <p>Telephone (Main):</p>
<p>Bond</p> <p>Bond Amount: 100 percent of Contract Price</p> <p>Date of Bond:</p> <p>(Date of Bond cannot be earlier than Effective Date of Contract)</p>	<p><i>The address of the surety company to which any notice of claim should be sent may be obtained from the Texas Dept. of Insurance by calling the following toll-free number: 1-800-252-3439.</i></p>

Surety and Contractor, intending to be legally bound and obligated to Owner, do each cause this performance bond to be duly executed on its behalf by its authorized officer, agent, or representative. The Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally to this bond. The condition of this obligation is such that if the Contractor as Principal faithfully performs the Work required by the Contract then this obligation will be null and void; otherwise the obligation is to remain in full force and effect. Provisions of this bond shall be pursuant to the terms and provisions of Texas Government Code Chapter 2253 as amended and all liabilities on this bond shall be determined in accordance with the terms and provisions of said Chapter to the same extent as if it were copied at length herein. Venue lies exclusively in [specify name] County, Texas for any legal action.

Contractor as Principal

Signature: _____

Name: _____

Title: _____

Email: _____

Surety

Signature: _____

Name: _____

Title: _____

Email: _____

(Attach Power of Attorney and place surety seal below)

END OF SECTION

00 61 16 PAYMENT BOND

<p>Contractor as Principal</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>	<p>Surety</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>
<p>Owner</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>	<p>Physical address (principal place of business):</p> <p>Telephone (Main):</p> <p>Telephone (Claims):</p>
<p>Contract</p> <p>Project name and number:</p> <p>Contract Price:</p> <p>Effective Date of Contract:</p>	<p>Surety's state of incorporation:</p> <p><i>By submitting this bond, Surety affirms that it is licensed to provide and execute this bond and authorized to do business in Texas.</i></p>
<p>Bond</p> <p>Bond Amount: 100 percent of Contract Price</p> <p>Date of Bond:</p> <p>(Date of Bond cannot be earlier than Effective Date of Contract)</p>	<p>Local Agent for Surety</p> <p>Name:</p> <p>Mailing address (principal place of business):</p> <p>Telephone (Main):</p> <p><i>The address of the surety company to which any notice of claim should be sent may be obtained from the Texas Dept. of Insurance by calling the following toll-free number: 1-800-252-3439.</i></p>

Surety and Contractor intending to be legally bound and obligated to Owner do each cause this payment bond to be duly executed on its behalf by its authorized officer, agent, or representative. The Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally to this bond. The condition of this obligation is such that if the Contractor as Principal pays all claimants providing labor or materials to Contractor or to a Subcontractor in the prosecution of the Work required by the Contract then this obligation will be null and void; otherwise the obligation is to remain in full force and effect. Provisions of the bond shall be pursuant to the terms and provisions of Texas Government Code Chapter 2253 as amended and all liabilities on this bond shall be determined in accordance with the terms and provisions of said Chapter to the same extent as if it were copied at length herein. Venue lies exclusively in [specify name] County, Texas for any legal action.

Contractor as Principal

Signature: _____

Name: _____

Title: _____

Email: _____

Surety

Signature: _____

Name: _____

Title: _____

Email: _____

(Attach Power of Attorney and place surety seal below)

END OF SECTION



CITY OF KELLER, TEXAS

CONTRACTOR'S MAINTENANCE BOND

STATE OF _____|

KNOW ALL MEN BY THESE PRESENTS

COUNTY OF _____|

That _____ as principal, and
(Name of Contractor)

_____, a corporation organized under the laws
(Name of Surety)

of _____ as Sureties do hereby expressly acknowledge themselves to be held and bound to pay
unto the CITY OF KELLER, TEXAS, a municipal corporation, the sum of

_____ Dollars (\$_____) for payment of which
(One Hundred (100%) of Total Contract Price)

sum will truly be made unto said CITY OF KELLER, TEXAS, and its successors, said principal and
sureties do hereby bind themselves, their assigns and successors jointly and severally.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a
certain contract with _____ dated the _____ day of _____, A.D.
20____, a copy of which is hereto attached and made apart hereof for the installation of the backup
generator, transformer and transfer switch to serve Pearson Lower Pump Station for the City of Keller
and,

WHEREAS, said Contract was entered into pursuant to the requirements of the City of Keller and,

WHEREAS, in said Contract, Contractor binds itself to use of materials and methods of
construction such that improvements will be initially complete free of perceptible defects and will remain
in good repair and condition and free of perceptible defects for and during the period of TWO (2) YEARS
after the date of acceptance of the completed improvements by the City; and,

WHEREAS, said Contract binds itself to construct said improvements in such manner and obtain
inspection approvals in proper sequence as are required to obtain acceptance by the City and to repair
or reconstruct the said improvements in whole or in part at any time within said TWO (2) YEARS period
to such extent as the City deems necessary to properly correct all defects except those which have been
caused by circumstances and conditions occurring after the time of construction over which the
Contractor had no control which are other than those arising from defect of construction by the
Contractor; and,

WHEREAS, after acceptance of the improvements by the City, said Contractor binds itself, upon receiving notice from the City of the need therefore to repair or reconstruct said improvements and if the Contractor fails to make the necessary corrections the City of Keller may do and have done all said corrective work and shall have recovery hereon for all expenses thereby incurred.

NOW THEREFORE, if said Contractor shall keep and perform its said agreement to maintain, repair or reconstruct said improvements for a period of TWO (2) YEARS, as provided, then these presents shall be null and void, and have no further effect. Otherwise, this Bond shall be and remain in full force and effect, said City shall have and recover from the said Contractor and its Surety damages in the premises as prescribed by said Contract. This obligation shall be a continuing one and successive recoveries may be had hereon for successive breaches until the full amount hereof is exhausted.

IN WITNESS WHEREOF, the said _____ HAS CAUSED
(Name of Contractor)

THESE PRESENTS TO BE EXECUTED BY _____ and the
(Contractors Authorized Signature)

said _____ has caused these presents to be executed by its
(Surety)

_____ has hereunto set his hand this the _____ day
(Attorney-in-fact) or (Official)

of _____, A.D., 2024.

SURETY

By: _____

Title _____

Address _____

Phone _____

PRINCIPAL

By: _____

Title _____

Address _____

Phone _____

The name and address of the Resident Agent of Surety is:

_____ Phone _____

00 61 20 MAINTENANCE BOND REQUIREMENTS

ARTICLE 1 – MAINTENANCE BOND REQUIREMENTS

- 1.01 Provide a maintenance bond that complies with the requirements of this Section. A maintenance bond is defined as a performance bond that extends the correction period for a specified period of time beyond the one-year correction period described in the General Conditions.
- 1.02 Provide a maintenance bond that begins at the end of the one-year correction period and continues for the period stated in Section 00 61 19 “Maintenance Bond.”
- 1.03 Provide a maintenance bond in the amount stated in Section 00 61 19 “Maintenance Bond.”
- 1.04 Provide a maintenance bond that meets the same requirements for bonds as the Contractor’s performance bond as described in the Contract Documents.
- 1.05 Surety for the maintenance bond must meet the same requirements for the performance and payment bonds as set forth in the General Conditions.
- 1.06 Indemnification provisions of the General Conditions apply to the maintenance bond period.

ARTICLE 2 – DOCUMENTATION

- 2.01 Provide a maintenance bond using the form provided in Section 00 61 19 “Maintenance Bond.”
- 2.02 Comply with the requirements of Section 01 70 00 “Execution and Closeout Requirements.”

ARTICLE 3 – CORRECTIVE ACTION DURING THE MAINTENANCE BOND PERIOD

- 3.01 Correct Defective Work during the one-year correction period in accordance with the General Conditions.
- 3.02 Correct Defective Work during the maintenance bond period just as required for the one-year correction period specified in the General Conditions. Provide labor and materials required to correct Defective Work or correct Work that does not function as required by the Contract Documents.
- 3.03 Correction of Defective Work during the maintenance bond period does not extend the correction period as is required under the provisions of the one-year correction period described in the General Conditions.
- 3.04 Promptly correct damages to the Site or adjacent areas that Contractor has arranged to use through construction easements or other agreements. Promptly correct damages to the Work or the work of others. Make the corrections without cost to Owner.
- 3.05 Owner may correct Defective Work without notice to Contractor in an emergency where delay would cause serious risk of loss or damage.
- 3.06 Include the cost for correcting Defective Work during the maintenance bond period in the Contract Price. Include all costs associated with providing the maintenance bond in the Contract Price.
- 3.07 Reimburse Owner for engineering and special services required to be furnished by Owner which are directly attributable to the corrective Work.

3.08 Remedy for Failure to Correct Defective Work:

- A. Owner may correct Defective Work if Contractor fails or refuses to perform corrective Work within 10 days after Owner notifies Contractor of Defective Work.
- B. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this paragraph are to be paid by Contractor or its surety. These claims, costs, losses, and damages include costs of repair and the cost of replacement of work of others destroyed or damaged by correction, removal, or replacement of the Contractor's Defective Work. Owner is not required to obtain the lowest price for the Work performed when exercising its rights or remedies under this paragraph.

ARTICLE 4 – INSURANCE REQUIREMENTS

- 4.01 Provide insurance as required by the Contract Documents during the maintenance bond period. Provide evidence of insurance prior to beginning corrective Work if evidence of insurance is not current.

END OF SECTION

TABLE OF CONTENTS

	Page
Article 1 – Definitions and Terminology	5
1.01 Defined Terms.....	5
1.02 Terminology	10
Article 2 – Preliminary Matters	12
2.01 Delivery of Bonds and Evidence of Insurance.....	12
2.02 Copies of Documents	12
2.03 Before Starting Construction	12
2.04 Electronic Transmittals	13
Article 3 – Contract Documents: Intent, Requirements, Reuse.....	13
3.01 Intent.....	13
3.02 Reference Standards	14
3.03 Reporting and Resolving Discrepancies	15
3.04 Interpretation of the Contract Documents.....	16
3.05 Reuse of Documents	16
Article 4 – Commencement and Progress of the Work	16
4.01 Commencement of Contract Times; Notice to Proceed	16
4.02 Progress Schedule	16
4.03 Delays in Contractor’s Progress	17
Article 5 – Site; Subsurface and Physical Conditions; Hazardous Environmental Conditions	18
5.01 Availability of Lands	18
5.02 Use of Site and Other Areas.....	18
5.03 Subsurface and Physical Conditions.....	19
5.04 Differing Subsurface or Physical Conditions	20
5.05 Underground Facilities.....	21
5.06 Hazardous Environmental Conditions at Site	23
Article 6 – Bonds and Insurance	24
6.01 Performance, Payment, and Other Bonds	24
6.02 Licensed Sureties	25
6.03 Insurance - General Provisions	25
Article 7 – Contractor’s Responsibilities	26
7.01 Contractor’s Means and Methods of Construction	26
7.02 Supervision and Superintendence	27
7.03 Labor; Working Hours	27

7.04	Services, Materials, and Equipment	27
7.05	Concerning Subcontractors, and Suppliers	28
7.06	Patent Fees and Royalties	29
7.07	Permits	29
7.08	Taxes	29
7.09	Laws and Regulations.....	29
7.10	Safety and Protection	30
7.11	Hazard Communication Programs	31
7.12	Emergencies.....	31
7.13	Contractor's General Warranty and Guarantee	31
7.14	Correction Period	32
7.15	Indemnification	33
7.16	Delegation of Professional Design Services	33
Article 8 – Other Work at the Site.....		34
8.01	Other Work	34
8.02	Coordination	35
8.03	Legal Relationships.....	35
Article 9 – Owner's and OPT's Responsibilities.....		36
9.01	Communications to Contractor	36
9.02	Replacement of Owner's Project Team Members.....	36
9.03	Furnish Data	36
9.04	Pay When Due.....	36
9.05	Lands and Easements; Reports and Tests.....	36
9.06	Insurance.....	36
9.07	Modifications	36
9.08	Inspections, Tests, and Approvals.....	36
9.09	Limitations on OPT's Responsibilities	36
9.10	Undisclosed Hazardous Environmental Condition.....	37
9.11	Compliance with Safety Program.....	37
Article 10 – Design Professional's and Construction Manager's Status During Construction		37
10.01	Owner's Representative.....	37
10.02	Visits to Site.....	37
10.03	Rejecting Defective Work	37
10.04	Decisions on Requirements of Contract Documents and Acceptability of Work	38
Article 11 – Changes to the Contract		38
11.01	Amending and Supplementing the Contract Documents	38
11.02	Contract Amendments.....	39

11.03	Change Orders	39
11.04	Work Change Directives.....	40
11.05	Field Orders.....	40
11.06	Change Proposals.....	40
11.07	Change of Contract Price; Contract Times	41
11.08	Execution of Change Orders and Contract Amendments.....	41
11.09	Notice to Surety	42
Article 12	– Claims.....	42
12.01	Claims.....	42
Article 13	– Cost of the Work; Allowances; Unit Price Work.....	43
13.01	Cost of the Work	43
13.02	Allowances	46
13.03	Unit Price Work.....	47
13.04	Contingencies.....	47
Article 14	– Tests and Inspections; Correction, Removal, or Acceptance of Defective Work	48
14.01	Access to Work.....	48
14.02	Tests, Inspections, and Approvals.....	48
14.03	Defective Work	49
14.04	Acceptance of Defective Work	49
14.05	Uncovering Work	50
14.06	Owner May Stop the Work	50
14.07	Owner May Correct Defective Work.....	51
Article 15	– Payments to Contractor; Set-offs; Final Completion.....	51
15.01	Progress Payments.....	51
15.02	Contractor’s Warranty of Title	53
15.03	Substantial Completion.....	53
15.04	Partial Utilization.....	54
15.05	Final Inspection	54
15.06	Final Payment.....	54
15.07	Waiver of Claims	55
Article 16	– Suspension of Work and Termination	55
16.01	Owner May Suspend Work	55
16.02	Owner May Terminate for Cause.....	55
16.03	Owner May Terminate for Convenience	56
16.04	Contractor May Stop Work or Terminate	57
Article 17	– Final Resolution of Disputes	57
17.01	Methods and Procedures.....	57

Article 18 – Miscellaneous	58
18.01 Computation of Times	58
18.02 Independent Contractor	58
18.03 Cumulative Remedies	58
18.04 Limitation of Damages	58
18.05 No Waiver	58
18.06 Severability.....	58
18.07 Survival of Obligations	59
18.08 No Third-Party Beneficiaries	59
18.09 Successors and Assigns	59
18.10 Assignment of Contract	59
18.11 No Waiver of Sovereign Immunity.....	59
18.12 Controlling Law	59

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

- A. A term with initial capital letters, including the term's singular and plural forms, has the meaning indicated in this Paragraph wherever used in the Bidding Requirements or Proposal Requirements or Contract Documents. In addition to the terms specifically defined, terms with initial capital letters in the Contract Documents may include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Documents issued prior to the receipt of Bids or Proposals which clarify or modify the Bidding Requirements/Proposal Requirements or the proposed Contract Documents.
 2. *Agreement*—The document signed by Owner and Contractor that establishes the Contract Price and Contract Times, and designates the specific documents that are Contract Documents.
 3. *Application for Payment*—The documents used by Contractor to request payments from Owner and the supporting documentation required by the Contract Documents.
 4. *Bid; Proposal*—An offer submitted to Owner for the Project setting forth the Contract Price and Contract Times for the Work to be performed.
 5. *Bidding Documents; Proposal Documents*—The Bidding Requirements or Proposal Requirements, the proposed Contract Documents, and Addenda.
 6. *Bidding Requirements; Proposal Requirements*—The Invitation to Bid or Request for Proposals, Instructions to Offerors, Bid Security or Proposal Security, Bid Form or Proposal Form and attachments, and required certifications and affidavits.
 7. *Bid Security; Proposal Security*—The financial security provided by Offeror at the time the Bid or Proposal is submitted and held by Owner until the Agreement is executed and the evidence of insurance and bonds required by the Contract Documents are provided.
 8. *Change Order*—A document issued on or after the Effective Date of the Contract and signed by Owner and Contractor which modifies the Work, Contract Price, Contract Times, or terms and conditions of the Contract.
 9. *Change Proposal*—A document submitted by Contractor in accordance with the requirements of the Contract Documents:
 - a. Requesting an adjustment in Contract Price or Contract Times;
 - b. Contesting an initial decision concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents;
 - c. Challenging a Set-off against payment due; or
 - d. Seeking other relief with respect to the terms and conditions of the Contract.
 10. *Claim*—A demand or assertion by Owner or Contractor submitted in accordance with the requirements of the Contract Documents. A demand for money or services by an entity other than Owner or Contractor 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. *Construction Manager*—The individual or entity named as Construction Manager in the Agreement and the consultants, subconsultants, individuals, or entities directly or indirectly employed or retained by them to provide construction management as advisor services to Owner.
13. *Construction Manager at Risk (CMAR)*—The individual or entity selected by Owner to construct the Project using the Construction Manager at Risk project delivery method. The term Contractor means Construction Manager at Risk in the Contract Documents when the Construction Manager at Risk project delivery method is used.
14. *Contract*—The entire integrated set of documents concerning the Work and describing the relationship between the Owner and Contractor.
15. *Contract Amendment*—A document issued on or after the Effective Date of the Contract and signed by Owner and Contractor which:
 - a. Authorizes new phases of the Work and establishes the Contract Price, Contract Times, or terms and conditions of the Contract for the new phase of Work; or
 - b. Modifies the terms and conditions of the Contract, but does not make changes in the Work.
16. *Contract Documents*—Those items designated as Contract Documents in the Agreement.
17. *Contract Price*—The monetary amount stated in the Agreement and as adjusted by Modifications, and increases or decreases in unit price quantities, if any, that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
18. *Contract Times*—The number of days or the dates by which Contractor must achieve specified Milestones, achieve Substantial Completion, and complete the Work.
19. *Contractor*—The individual or entity with which Owner has contracted to perform the Work.
20. *Contractor's Team*—Contractor, Subcontractors, Suppliers, and individuals or entities directly or indirectly employed or retained by Contractor, Subcontractors, or Suppliers to perform part of the Work, or anyone for whose acts they may be liable.
21. *Cost of the Work*—The sum of costs incurred for the performance of the Work as allowed by Article 13.
22. *Day*—A day of 24 hours measured from midnight to the next midnight.
23. *Defective*—When applied to Work, refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. Does not conform to the Contract Documents;

- b. Does not meet the requirements of applicable inspections, reference standards, tests, or approvals referred to in the Contract Documents; or
 - c. Has been damaged prior to Construction Manager's recommendation of final payment unless responsibility for the protection of the Work has been assumed by Owner at Substantial Completion in accordance with Article 15.
24. *Design Professional*—The individuals or entity named as the Architect or Engineer in the Agreement and the subconsultants, individuals, or entities directly or indirectly employed or retained by Design Professional to provide design or other technical services to Owner. Design Professional has responsibility for design and technical issues related to the Contract Documents.
25. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work. Shop Drawings and other documents generated by Contractor's Team are not Drawings.
26. *Effective Date of the Contract*—The date indicated in the Agreement on which the Contract becomes effective.
27. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including Shop Drawings and other Submittals, that are in an electronic or digital format.
28. *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.
29. *Field Order*—A document issued by Construction Manager or Design Professional requiring changes in the Work that do not change the Contract Price or the Contract Times.
30. *Final Completion*—The point where the Work is complete in accordance with the Contract Documents, items and documents required by the Contract Documents have been accepted by Owner and the Project is ready for Final Payment.
31. *Guaranteed Maximum Price (GMP)*—The maximum amount to be paid by Owner for the sum of the Cost of the Work plus Contractor's fee as set forth in the Agreement, subject to increases or decreases for changes in the Work, when the Construction Manager at Risk project delivery method is used.
32. *Hazardous Environmental Condition*—The presence of Constituents of Concern at the Site in quantities or circumstances that may present a danger to persons or property exposed to Constituents of Concern. The presence of Constituents of Concern at the Site necessary for the execution of the Work or to be incorporated into the Work is not a Hazardous Environmental Condition provided these Constituents of Concern are

controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract.

- a. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
 - b. 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.
33. *Indemnified Costs*—All costs, losses, judgments, and damages resulting from claims or demands against Owner’s Indemnitees. These costs include fees for design professionals, attorneys, and other professionals and any legal, court, arbitration, or other dispute resolution costs.
 34. *Laws and Regulations; Laws or Regulations*—Applicable laws, statutes, rules, regulations, ordinances, codes, permits, and binding decrees, resolutions, and orders of governmental bodies, agencies, authorities, and courts having jurisdiction over the Project.
 35. *Liens*—Charges, security interests, or encumbrances upon Contract related funds, real property, or private property.
 36. *Manufacturer*—The individual or entity that designs, casts, fabricates, manufactures, assembles, tests, and provides materials or equipment to be incorporated in the Work.
 37. *Milestone*—A principal event in the performance of the Work that Contractor is required by Contract to complete by a specified date or within a specified time.
 38. *Modification*—Change made to the Contract Documents by Contract Amendment, Change Order, Field Order, or Work Change Directive.
 39. *Notice of Award*—The notice of Owner’s acceptance of the Successful Offeror’s Bid or Proposal.
 40. *Notice to Proceed*—A notice to Contractor of the Contract Times and the date Work is to begin.
 41. *Offeror*—An individual or entity that submits a Bid or Proposal to Owner.
 42. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
 43. *Owner’s Budget*—The amount budgeted by Owner for the construction of the Project.
 44. *Owner’s Indemnitees*—Each member of OPT and their officers, directors, members, partners, employees, agents, consultants, and subcontractors.
 45. *Owner’s Project Team (OPT)*—The Owner, Design Professional, Construction Manager, and the other entities identified in the Supplementary Conditions and the consultants, subconsultants, individuals or entities directly or indirectly employed or retained by them to provide services to Owner.

46. *Progress Schedule*—A schedule prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
47. *Project*—The total undertaking to be accomplished for Owner under the Contract Documents.
48. *Project Construction Manager (PCM)*—The authorized representative of OPT assigned to assist Construction Manager at the Site. The term Project Construction Manager includes assistants and field staff of Construction Manager.
49. *Project Management Information System (PMIS)*—The online project management system that will be used by OPT and Contractor to submit and share documentation and other related communications and information for this Project.
50. *Samples*—Physical examples of materials, equipment, or workmanship representing some portion of the Work that are used to establish the standards for that portion of the Work.
51. *Schedule of Anticipated Payments*—A detailed tabulation, prepared and maintained by Contractor, showing the anticipated amount of each Application for Payment and the month in which they will be submitted.
52. *Schedule of Submittals*—A detailed tabulation, prepared and maintained by Contractor, of each required submittal and the time requirements for review and approval of each submittal.
53. *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 Contractor’s Applications for Payment.
54. *Set-off*—A reduction in payment due to Contractor under Article 15.
55. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by Contractor’s Team 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.
56. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed. The Site includes rights-of-way, easements, and other lands or areas furnished by Owner which are designated for use by Contractor.
57. *Specifications*—The part of the Contract that describes the requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
58. *Subcontractor*—An individual or entity having a direct contract with Contractor or with other Subcontractors or Suppliers for the performance of a part of the Work.
59. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Construction Manager, or that is indicated as a Submittal in the Schedule of Submittals accepted by Construction Manager. Submittals, whether approved or accepted by OPT, are not Contract Documents.

60. *Substantial Completion*—The point where the Work or a specified part of the Work is sufficiently complete to be used for its intended purpose in accordance with the Contract Documents.
61. *Successful Offeror*—The Offeror to which Owner awards the Contract.
62. *Supplementary Conditions*—The part of the Contract that amends or supplements the General Conditions.
63. *Supplier*—A Manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with Subcontractors or other Suppliers to furnish materials or equipment to be incorporated in the Work.
64. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions with respect to either:
 - a. Existing subsurface conditions at or adjacent to the Site;
 - b. Existing physical conditions at or adjacent to the Site including existing surface or subsurface structures at the Site, except Underground Facilities; or
 - c. Hazardous Environmental Conditions at the Site.
65. *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 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.
66. *Unit Price Work*—Work to be paid for based on unit prices.
67. *Work*—The construction of the Project or its component parts as required by the Contract Documents. Work includes and is the result of performing and providing all labor, services, and documentation to construct the Project; providing all materials and equipment to be incorporated into the Project, and providing related services for testing, startup and commissioning, all as required by the Contract Documents.
68. *Work Change Directive*—A directive issued to Contractor on or after the Effective Date of the Contract ordering an addition, deletion, or revision in the Work. The Work Change Directive serves as a memorandum of understanding regarding the directive until a Change Order can be issued.

1.02 Terminology

- A. The words and terms discussed in this Paragraph 1.02 are not defined terms that require initial capital letters, but when used in the Bidding Requirements or Proposal Requirements or Contract Documents, have the indicated meaning.
- B. Contract Documents are written using imperative language:
 1. Simple imperative sentence structure is used which places a verb as the first word in the sentence. It is understood that the words “furnish,” “install,” “perform,” “provide,”

or similar words include the meaning of the phrase "Contractor shall..." before these words.

2. Unless specifically stated that action is to be taken by OPT or others, it is understood that the action described is a requirement of Contractor.
- C. The use of the words "furnish," "install," "perform," and "provide" have the following meanings when used relating to services, materials, or equipment:
1. Furnish means to supply and deliver the specified services, materials, or equipment to the Site or other specified location ready for use or installation.
 2. Install means to complete construction or assembly of the specified services, materials, or equipment so they are ready for their intended use.
 3. Perform or provide means to furnish and install specified services, materials, or equipment, complete and ready for their intended use.
 4. Perform or provide the specified services, materials, or equipment complete and ready for intended use if the Contract Documents require specific services, materials, or equipment, but do not expressly use the words "furnish," "install," "perform," or "provide."
- D. The meaning and intent of certain terms or adjectives are described as follows:
1. The terms "as allowed," "as approved," "as ordered," "as directed," or similar terms in the Contract Documents indicate an exercise of professional judgment by OPT.
 2. Adjectives like "reasonable," "suitable," "acceptable," "proper," "satisfactory," or similar adjectives are used to describe a determination of OPT regarding the Work.
 3. Any exercise of professional judgment by OPT will be made solely to evaluate the Work for general compliance with the Contract Documents unless there is a specific statement in the Contract Documents indicating otherwise.
 4. The use of these or similar terms or adjectives does not assign a duty or give OPT authority to supervise or direct the performance of the Work, or assign a duty or give authority to OPT to undertake responsibilities contrary to the provisions of Article 9, Article 10 or other provisions of the Contract Documents.
- E. Requirements apply to all Work of the same kind, class, and type even though the word "all" or "any" is not stated.
- F. The terms "includes" and "including" are used as terms of enlargement and not of limitation or exclusive enumeration, and use of these terms does not create a presumption that components not expressed are excluded. The terms "consist of" or "consisting of" limits the interpretation to only those items specifically listed.
- G. It is understood that the cost of providing Work is included in the Contract Price and no additional compensation is to be paid by Owner unless specifically stated otherwise in the Contract Documents. Expressions like "at no additional cost to Owner," "at Contractor's expense," or similar words mean that Contractor is to include the cost of this Work in their Contract Price and perform or provide specified Work without an increase in the Contract Price.

- H. Words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with this recognized meaning unless stated otherwise in the Contract Documents.
- I. Written documents are required where reference is made to notices, reports, approvals, consents, statements, instructions, opinions, or other types of documentation or communications required by the Contract Documents. Approval and consent documents must be received by Contractor prior to the action or decision for which approval or consent is given. These may be made in printed or electronic format through OPT's Project Management Information System or other electronic media as required by the Contract Documents or approved by Construction Manager.
- J. Giving notice as required by the Contract Documents may be by printed or electronic media using a method that requires acknowledgment of the receipt of that notice.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 Delivery of Bonds and Evidence of Insurance

- A. Provide required bonds and evidence of insurance required by the Contract Documents to Construction Manager with the executed Agreement.
- B. Evidence of insurance must include copies of the insurance policies, including all endorsements, and identification of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

2.02 Copies of Documents

- A. OPT will furnish one copy of the executed Contract Documents in electronic portable document format (PDF). This document is the Project Record Copy of the Contract Documents.

2.03 Before Starting Construction

- A. Provide the following preliminary documents in accordance with the Contract Documents within 10 days after the Effective Date of the Contract:
 - 1. Progress Schedule;
 - 2. Schedule of Submittals;
 - 3. Schedule of Values; and
 - 4. Schedule of Anticipated Payments.
- B. Designate the specific individuals authorized to act as representatives of Contractor. These individuals must have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of Contractor.
- C. Owner will designate the specific individuals authorized to act as representatives of Owner and the limits of their authority regarding acting on behalf of Owner.

2.04 Electronic Transmittals

- A. Except as otherwise stated elsewhere in the Contract Documents, the OPT and Contractor will send and accept Electronic Documents sent by Electronic Means using the protocols specified in Section 01 33 00 "Document Management."

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 Intent

- A. Requirements of each part of the Contract Documents are as binding as if required by all Contract Documents. It is the intent of the Contract Documents to describe a functionally complete project. The Contract Documents do not indicate or describe all the Work required to complete the Project. Additional details required for construction of the Project are to be provided by Contractor and coordinated with OPT.
- B. Provide the labor, documentation, services, materials, or equipment that may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result, whether specifically called for in the Contract Documents or not. Include these related costs in the offered Contract Price.
- C. Provide equipment that is functionally complete as described in the Contract Documents. The Drawings and Specifications do not indicate or describe all the Work required to complete the installation of equipment purchased by the Owner or Contractor. Additional details required for the correct installation of selected equipment are to be provided by Contractor and coordinated with Design Professional through Construction Manager.
- D. Comply with the most stringent requirements where compliance with two or more standards is specified and they establish different or conflicting requirements for the Work, unless the Contract Documents indicate otherwise.
- E. Provide materials and equipment comparable in quality to similar materials and equipment incorporated in the Project or as required to meet the minimum requirements of the application if the materials and equipment are shown in the Drawings but are not included in the Specifications.
- F. The Project Record Copy of the Contract Documents governs if there is a discrepancy between the Project Record Copy of the Contract Documents and subsequent electronic or digital versions of the Contract Documents, including printed copies derived from these electronic or digital versions.
- G. The Contract supersedes all prior written or oral negotiations, representations, and agreements. The Contract Documents comprise the entire Agreement between Owner and Contractor. The Contract Documents may be modified only by a Modification.
- H. Request clarification from Construction Manager for a decision before proceeding if Contractor is not clear on the meaning of the Contract Documents. Construction Manager is to issue clarifications and interpretations of the Contract Documents in accordance with the Contract Documents.

I. Organization of the Documents:

1. Organization of the Contract Documents is not intended to control or lessen the responsibility of Contractor when dividing Work among Subcontractors or Suppliers, or to establish the extent of Work to be performed by trades, Subcontractors, or Suppliers, except on multi-prime contracts. Specifications or details do not need to be indicated or specified in each Specification or Drawing. Items shown in the Contract Documents are applicable regardless of their location in the Contract Documents.
2. Standard Paragraph titles and other identifications of subject matter in the Specifications are intended to aid in locating and recognizing various requirements of the Specifications. Titles do not define, limit, or otherwise restrict Specification text.
3. The Contract requirements described in the General Conditions, Supplementary Conditions, and General Requirements (Division 01 of the Specifications) apply to Work regardless of where it is described in the Contract Documents, unless specifically noted otherwise.
4. Specifications or details do not need to be indicated or specified in each Specification or Drawing. Items shown in the Contract Documents are applicable regardless of their location in the Contract Documents.

J. 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.

K. Nothing in the Contract Documents creates:

1. a contractual relationship between OPT 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. an obligation on the part of OPT 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. Standard Specifications, Codes, Laws and Regulations:

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of technical societies, organizations, or associations, or to Laws or Regulations, whether specific or implied, are those in effect at the time Contractor's Bid or Proposal is submitted or when Contractor negotiates the Contract Price unless specifically stated otherwise in the Contract Documents.
2. No provision of referenced standard specifications, manuals, reference standards, codes, or instructions of a Supplier changes the duties or responsibilities of OPT or Contractor from those described in the Contract Documents or assigns a duty to or gives authority to OPT to supervise or direct the performance of the Work or undertake responsibilities inconsistent with the Contract Documents.

3. The provisions of the Contract Documents take precedence over standard specifications, manuals, reference standards, codes, or instructions of a Supplier unless specifically stated otherwise in the Contract Documents.
- B. Comply with applicable construction industry standards, whether referenced or not.
 1. Standards referenced in the Contract Documents govern over standards not referenced but recognized as applicable in the construction industry.
 2. Comply with the requirements of the Contract Documents if they produce a higher quality of Work than the applicable construction industry standards.
 3. Submit questions regarding which code or standard is applicable to Construction Manager. Design Professional will determine whether a code or standard is applicable, which of several codes or standards are applicable, or if the Contract Documents produce a higher quality of Work. Construction Manager will respond to the question as appropriate.
- C. Make copies of reference standards available if requested by Construction Manager.

3.03 Reporting and Resolving Discrepancies

- A. Reporting Discrepancies:
 1. Carefully study the Drawings and verify pertinent figures and dimensions with respect to actual field measurements before undertaking the Work. Immediately report conflicts, errors, ambiguities, or discrepancies that Contractor discovers or has actual knowledge of to Construction Manager.
 2. Immediately notify the Construction Manager of conflicts, errors, ambiguities, or discrepancies in the Contract Documents or discrepancies between the Contract Documents and:
 - a. Applicable Laws or Regulations;
 - b. Actual field conditions;
 - c. Standard specifications, manuals, reference standards, or codes; or
 - d. Instructions of Suppliers.
 3. Do not proceed with affected Work until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation from Construction Manager or by a Modification to the Contract Documents issued pursuant to Paragraph 11.01, except in an emergency as required by Paragraph 7.12.
 4. Contractor is liable to OPT for failure to report conflicts, errors, ambiguities, or discrepancies in the Contract Documents of which Contractor has actual knowledge.
 5. Contractor is deemed to have included the most expensive item, system, procedure, etc. in the Contract Price if a conflict, error, ambiguity, or discrepancy in the Contract Documents was known, but not reported prior to submitting the Bid or Proposal or when Contractor negotiates the Contract Price.

3.04 Interpretation of the Contract Documents

- A. Submit questions concerning the non-technical or contractual/administrative requirements of the Contract Documents to Construction Manager immediately after the question arises. Construction Manager will provide an interpretation of the Contract Documents regarding these questions and will coordinate the response of OPT to Contractor.
- B. Submit questions regarding the design of the Project described in the Contract Documents to Construction Manager immediately after the question arises. Construction Manager will request an interpretation of the Contract Documents from Design Professional. Construction Manager will coordinate the response of OPT to Contractor.
- C. OPT may initiate a Modification to the Contract Documents through Construction Manager if a response to the question indicates that a change in the Contract Documents is required. Contractor may appeal Design Professional's or Construction Manager's interpretation by submitting a Change Proposal.

3.05 Reuse of Documents

- A. Contractor's Team has no rights to the Contract Documents and may not use the Contract Documents or copies or electronic media editions of the Contract Documents other than for the construction of this Project. This provision survives final payment or termination of the Contract.
- B. Contractor can retain a copy of the Contract Documents for record purposes, unless specifically prohibited by Owner for security reasons. Surrender paper and digital copies of the Contract Documents and other related documents and remove these documents from computer equipment or storage devices as a condition of final payment if Owner so directs.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 Commencement of Contract Times; Notice to Proceed

- A. The Contract Times commence to run on the date indicated in the Notice to Proceed. If a Notice to Proceed is not issued, the Contract Times will commence to run 15 days after the Contract is signed by all parties.
- B. Begin performing the Work on the date indicated in the Notice to Proceed. Do not begin Work before the date indicated in the Notice to Proceed or prior to providing evidence that insurance required in Article 6 is in effect.

4.02 Progress Schedule

- A. Construct the Work in accordance with the Progress Schedule established in accordance with the Contract Documents.
 - 1. Adjust the Progress Schedule as required to accurately reflect actual progress on the Work.
 - 2. Submit proposed adjustments in the Progress Schedule that change the Contract Times in accordance with the requirements of Article 11.

- B. Continue performing Work and adhere to the Progress Schedule during disputes or disagreements with Owner. Do not delay or postpone Work pending resolution of disputes or disagreements, or during an appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree.

4.03 Delays in Contractor's Progress

- A. Contractor is not entitled to an adjustment in Contract Price or Contract Times for delays, disruptions, or interference caused by or within the control of Contractor's Team.
- B. Contractor is entitled to an equitable adjustment in Contract Price or Contract Times if OPT directly delays, disrupts, or interferes with the performance or progress of the Work. Contractor is not entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Owner if this delay is concurrent with a delay, disruption, or interference attributable to or within the control of Contractor's Team.
- C. Contractor is entitled to an equitable adjustment in the Contract Times, but not Contract Price, if Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of OPT or Contractor. These adjustments in Contract Times are Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. These unanticipated causes include:
 - 1. Severe and unavoidable natural catastrophes e.g. fires, floods, epidemics, and earthquakes;
 - 2. Acts of war or terrorism;
 - 3. Acts or failures to act of utility owners or other third-party entities other than those third-party utility owners performing other work at or adjacent to the Site as arranged by Owner and, as contemplated in Article 8;
 - 4. The existence of a differing subsurface or physical condition;
 - 5. An Underground Facility not shown or not indicated with reasonable accuracy by the Contract Documents;
 - 6. Hazardous Environmental Conditions; and
 - 7. 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 unless this other work also for Owner.
- D. Contractor is entitled to an equitable adjustment in the Contract Times, but not Contract Price, if Contractor's performance or progress is delayed or disrupted by weather conditions provided such weather conditions exceed those that could normally be expected for the Site in that month of the year, unless other provisions for weather related delays are included in the Contract Documents. Contractor is to include time associated with normal weather-related delays in the Project Schedule and assumes the risks, including costs, associated with delays related to normal weather conditions.
- E. Contractor is only entitled to an adjustment of the Contract Times for specific delays, disruptions, and interference to the performance or progress of the Work that can be

demonstrated to directly impact the ability of Contractor to complete the Work within the Contract Times. No adjustments in Contract Times are allowed for delays on components of the Work which were or could have been completed without impacting the Contract Times.

- F. Notify Construction Manager immediately of a potential delaying, disrupting, or interfering event. Submit a Change Proposal seeking an adjustment in Contract Price or Contract Times within 30 days of the commencement of the delaying, disrupting, or interfering event. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11. Change Proposal seeking an increase in Contract Times or Contract Price submitted must include supporting data that details 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;
 5. A revised Progress Schedule indicating all the activities affected by the delay, disruption, or interference;
 6. An explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work;
 7. The impact on Contract Price; and
 8. Such additional supporting documentation as OPT may require.

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

5.01 Availability of Lands

- A. Owner will furnish the Site and inform Contractor of encumbrances or restrictions known to Owner related to use of the Site with which Contractor must comply in performing the Work.
- B. Provide for additional lands and access Contractor requires for temporary construction facilities or storage of materials and equipment, other than those identified in the Contract Documents. Provide documentation of authority to use these additional lands to Construction Manager before using them.

5.02 Use of Site and Other Areas

- A. Confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Owner or Contractor has arranged to use through construction easements or agreements, and other adjacent areas as permitted by Laws and Regulations. Assume full responsibility for damage

or injuries which result from the performance of the Work or from other actions or conduct of Contractor's Team, including:

1. Damage to the Site;
 2. Damage to adjacent areas used for Contractor's Team's operations;
 3. Damage to other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and
 4. Injuries and losses sustained by the owners or occupants of these lands or areas.
- B. Take the following action if a damage or injury claim is made by the owner or occupant of adjacent land or area because of the performance of the Work, or because of other actions or conduct of Contractor's Team:
1. Take immediate corrective or remedial action as required by Paragraph 7.10; and
 2. Attempt to settle the claim through negotiations with the owner or occupant, or otherwise resolve the claim by mediation or other dispute resolution proceeding or at law; and
 3. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, INDEMNIFY AND HOLD HARMLESS OWNER'S INDEMNITEES FROM AND AGAINST ANY SUCH CLAIM AND ALL INDEMNIFIED COSTS ARISING OUT OF OR RELATING TO ANY CLAIM OR ACTION BROUGHT BY ANY SUCH OWNER OR OCCUPANT AGAINST OWNER'S INDEMNITEES 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 CONTRACTOR'S TEAM.**

5.03 Subsurface and Physical Conditions

- A. 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 these reports and drawings.
- B. If no Technical Data have been identified in the Supplementary Conditions, then Technical Data is defined, with respect to conditions at the Site, 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, or 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.

- D. Contractor may rely upon the accuracy of the Technical Data contained in these reports and drawings, but these reports and drawings are not Contract Documents. Except for this reliance on Technical Data, Contractor may not rely upon or make claims against Owner's Indemnitees with respect to:
1. The completeness of reports and drawings for Contractor's purposes, including aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, or Contractor's safety precautions and programs;
 2. Other data, interpretations, opinions, and information contained in these reports or shown or indicated in the 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. Contractor's interpretation of or conclusions drawn from Technical Data or other data, interpretations, opinions, or information.

5.04 Differing Subsurface or Physical Conditions

- A. Notify Construction Manager immediately, but in no event later than 3 days, after becoming aware of a subsurface or physical condition that is uncovered or revealed at the Site, and before further disturbing the subsurface or physical conditions or performing any related Work that:
1. Establishes that the Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
 2. Requires 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.
- B. Do not further disturb or perform Work related to this subsurface or physical condition, except in an emergency as required by Paragraph 7.12, until permission to do so is issued by Construction Manager.
- C. Construction Manager is to notify OPT after receiving notice of a differing subsurface or physical condition from Contractor. OPT will:
1. Promptly review the subsurface or physical condition;
 2. Determine the necessity of OPT's obtaining additional exploration or tests with respect to the subsurface or physical condition;
 3. Determine if the subsurface or physical condition falls within one or more of the differing site condition categories in Paragraph 5.04.A;
 4. Prepare recommendations regarding Contractor's resumption of Work relating to the subsurface or physical condition in question;
 5. Determine the need for changes in the Drawings or Specifications; and

6. Advise Contractor of OPT's findings, conclusions, and recommendations.
- D. Construction Manager is to issue a statement to Contractor regarding the subsurface or physical condition in question and recommend action as appropriate after review of OPT's findings, conclusions, and recommendations. Construction Manager may instruct Contractor to resume Work if OPT determines that the subsurface or physical condition in question has been adequately documented.
- E. Contractor is entitled to an equitable adjustment in Contract Price or Contract Times to the extent that a differing subsurface or physical condition causes a change in Contractor's cost or time to perform the Work provided the condition falls within one or more of the categories described in Paragraph 5.04.A. Any adjustment in Contract Price for Work that is paid for on a unit price basis is subject to the provisions of Paragraph 13.03. Contractor is not entitled to an adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 1. Contractor knew of the existence of the subsurface or physical condition at the time Contractor made an offer to Owner with respect to Contract Price and Contract Times;
 2. The existence of the subsurface or physical condition could have been discovered or revealed by examinations, investigations, explorations, tests, or studies of the Site and contiguous areas expressly required by the Bidding Requirements or Proposal Requirements or the Contract Documents prior to when Contractor's Bid or Proposal is submitted or when Contractor negotiates the Contract Price; or
 3. Contractor failed to give notice as required by Paragraph 5.04.A.
- F. Contractor may submit a Change Proposal no later than 30 days after Construction Manager's issuance of the OPT's statement to Contractor regarding the subsurface or physical condition in question.

5.05 Underground Facilities

- A. The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to OPT by the owners of these Underground Facilities or by others. OPT is not responsible for the accuracy or completeness of information or data provided by others that OPT makes available to Contractor. Contractor is responsible for:
 1. Reviewing and checking available information and data regarding existing Underground Facilities at the Site;
 2. Complying with Laws and Regulations related to locating Underground Facilities before beginning Work;
 3. Locating Underground Facilities shown or indicated in the Contract Documents;
 4. Coordinating the Work with the owners, including Owner, of Underground Facilities during construction; and
 5. The safety and protection of existing Underground Facilities at or adjacent to the Site and repairing damage resulting from the Work.
- B. Notify Construction Manager and the owner of the Underground Facility immediately if an Underground Facility is uncovered or revealed at the Site that was not shown in the

Contract Documents or was not shown with reasonable accuracy in the Contract Documents. Do not further disturb conditions or perform Work affected by this discovery, except in the event of an emergency as required by Paragraph 7.12.

- C. OPT is to take the following action after receiving notice from Construction Manager:
 - 1. Promptly review the Underground Facility to determine if the Underground Facility was shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy;
 - 2. Identify and communicate with the owner of the Underground Facility;
 - 3. Prepare recommendations to OPT regarding Contractor's resumption of Work relating to this Underground Facility;
 - 4. Determine the extent to which a change is required in the Drawings or Specifications to document the consequences of the existence or location of the Underground Facility; and
 - 5. Construction Manager will advise Contractor of OPT's findings, conclusions, and recommendations and provide revised Drawings and Specifications if required.
- D. Construction Manager is to issue a statement to Contractor regarding the Underground Facility in question and recommend action as appropriate after review of OPT's findings, conclusions, and recommendations.
- E. Contractor is entitled to an equitable adjustment in the Contract Price or Contract Times to the extent that the existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy. Any adjustment in Contract Price for Work that is paid for on a unit price basis is subject to the provisions of Paragraph 13.03.
- F. Contractor is not entitled an adjustment in the Contract Price or Contract Times with respect to an existing Underground Facility at the Site if:
 - 1. Contractor knew of the existence of the existing Underground Facility at the Site at the time Contractor made an offer to Owner with respect to Contract Price and Contract Times;
 - 2. The existence of the existing Underground Facility at the Site could have been discovered or revealed by examinations, investigations, explorations, tests, or studies of the Site and contiguous areas expressly required by the Bidding Requirements or Proposal Requirements or the Contract Documents prior to when Contractor's Bid or Proposal is submitted or when Contractor negotiates the Contract Price; or
 - 3. Contractor failed to give notice as required by Paragraph 5.05.B.
- G. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of adjustments in the Contract Price or Contract Times no later than 30 days after Construction Manager's issuance of OPT's statement to Contractor regarding the Underground Facility.

5.06 Hazardous Environmental Conditions at Site

- A. The Supplementary Conditions identify those reports and drawings known to OPT relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and the Technical Data contained in these reports and drawings.
- B. Contractor may rely upon the accuracy of the Technical Data contained in reports and drawings relating to Hazardous Environmental Conditions identified in the Supplementary Conditions, but these reports and drawings are not Contract Documents. Except for the reliance on expressly identified Technical Data, Contractor may not rely upon or make claims against Owner's Indemnitees with respect to:
 - 1. The completeness of these reports and drawings for Contractor's purposes, including aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor or Contractor's safety precautions and programs related to Hazardous Environmental Conditions;
 - 2. Other data, interpretations, opinions, and information contained in these reports or shown or indicated in the drawings; or
 - 3. Any Contractor interpretation of or conclusion drawn from Technical Data or other data, interpretations, opinions, or information.
- C. The results of tests performed on materials described in environmental reports specifically prepared for the Project and made available to Contractor are defined as Technical Data unless Technical Data has been defined more specifically in the Supplementary Conditions.
- D. Contractor is not responsible for removing or remediating Hazardous Environmental Conditions encountered, uncovered, or revealed at the Site unless this removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- E. Contractor is responsible for controlling, containing, and duly removing and remediating Constituents of Concern brought to the Site by Contractor's Team and paying associated costs.
 - 1. Owner may remove and remediate the Hazardous Environmental Condition and impose a Set-off against payments to Contractor for associated costs if Contractor's Team creates a Hazardous Environmental Condition and Contractor does not take acceptable action to remove and remediate the Hazardous Environmental Condition.
 - 2. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER'S INDEMNITEES FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS ARISING OUT OF OR RELATING TO THE FAILURE TO CONTROL, CONTAIN, OR REMOVE A CONSTITUENT OF CONCERN BROUGHT TO THE SITE BY CONTRACTOR'S TEAM, OR TO A HAZARDOUS ENVIRONMENTAL CONDITION CREATED BY CONTRACTOR'S TEAM. NOTHING IN THIS PARAGRAPH SHALL OBLIGATE CONTRACTOR TO INDEMNIFY ANY INDIVIDUAL OR ENTITY FROM AND AGAINST THE CONSEQUENCES OF THAT INDIVIDUAL'S OR ENTITY'S OWN NEGLIGENCE.**

- F. Immediately notify Construction Manager and take the following action if Contractor uncovers or reveals a Hazardous Environmental Condition at the Site or adjacent areas used by Contractor's Team that was not created by Contractor's Team:
1. Secure or otherwise isolate this condition;
 2. Stop Work in affected areas or connected with the condition, except in an emergency as required by Paragraph 7.12; and
 3. Do not resume Work relating to the Hazardous Environmental Condition or in affected areas until after OPT has obtained required permits and Construction Manager sends notice to Contractor:
 - a. Specifying that this condition and affected areas are or have been rendered safe for the resumption of Work; or
 - b. Specifying special conditions under which Work may be resumed safely.
 4. Owner may order the portion of the Work that is in the area affected by the Hazardous Environmental Condition to be deleted from the Work following the procedures in Article 11 if Contractor does not agree to:
 - a. Resume the Work based on a reasonable belief it is unsafe; or
 - b. Resume the Work under the special conditions provided by Construction Manager.
 5. Owner may have this deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- G. Contractor may submit a Change Proposal or Owner may impose a Set-off if an agreement is not reached within 10 days of Construction Manager's notice regarding the resumption of Work as to whether Contractor is entitled to an adjustment in Contract Price or Contract Times or on the amount or extent of adjustments resulting from this Work stoppage or special conditions under which Contractor agrees to resume Work.
- H. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 Performance, Payment, and Other Bonds

- A. Furnish a performance bond in an amount equal to the Contract Price as security for the faithful performance of Work. Contractor is to use amounts paid by Owner to Contractor under the Contract for the performance of the Contract. This bond is to remain in effect until 1 year after the date of final payment.
- B. Furnish a payment bond in an amount equal to the Contract Price as security to ensure payment of Contractor's obligations under the Contract Documents. This bond is to remain in effect until 1 year after the date of final payment.
1. Notify Construction Manager of claims filed against the payment bond. Notify the claimant and Construction Manager of undisputed amounts and the basis for

challenging disputed amounts when a claimant has satisfied the conditions prescribed by Laws and Regulations. Promptly pay undisputed amounts.

2. Owner is not liable for payment of costs or expenses of claimants under the payment bond. Owner has no obligations to pay, give notice, or take other action to claimants under the payment bond.
 3. OPT will provide a copy of the payment bond and payment information to Subcontractors, Suppliers, or other persons or entities claiming to have furnished labor or materials used in the performance of the Work that request this information in accordance with Laws and Regulations.
- C. Notify Construction Manager immediately if the surety on bonds furnished by Contractor:
1. Is declared bankrupt, or becomes insolvent;
 2. Has its right to do business in state in which the Project is located is terminated; or
 3. Ceases to meet the requirements of Paragraph 6.02.
- D. Provide a bond and surety which comply with the requirements of Paragraph 6.02 within 20 days after the event giving rise to this notification.
- E. Furnish other bonds as required by the Contract Documents.
- F. Owner may exclude Contractor from the Site and exercise Owner's termination rights under Article 16 if Contractor fails to obtain or maintain required bonds.

6.02 Licensed Sureties

- A. Provide bonds in the form prescribed by the Contract Documents from sureties named in the U.S. Department of the Treasury's Listing of Approved Sureties (Department Circular 570 "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies").
- B. Provide bonds required by the Contract Documents from surety companies that are duly licensed or authorized to provide bonds in the state in which the Project is constructed.

6.03 Insurance - General Provisions

- A. Obtain and maintain insurance with coverage amounts equal to or greater than the amounts specified in Section 00 73 16 "Insurance Requirements" or greater where required by Laws and Regulations.
- B. Obtain insurance from companies that are duly licensed or authorized in the state in which the Project is constructed to issue insurance policies and that have an A.M. Best rating of A-VIII or better.
- C. Deliver evidence of insurance in accordance with Section 00 73 16 "Insurance Requirements" to Owner to demonstrate that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Provide copies of these certificates to Owner and additional insured.
- D. Furnish copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles upon request by Owner or any additional insured. Contractor

may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this paragraph.

- E. OPT's failure to demand such certificates or other evidence of Contractor's full compliance with the insurance requirements or failure to identify a deficiency in compliance from the evidence provided is not a waiver of Contractor's obligation to obtain and maintain the insurance required by the Contract Documents.
- F. Notify Owner if Contractor fails to purchase or maintain the insurance required by the Contract Documents. Do not perform any Work on the Project unless the required insurance policies are in effect. Owner may exclude Contractor from the Site and exercise Owner's termination rights under Article 16 if Contractor fails to obtain or maintain the required insurance.
- G. Owner may elect to obtain equivalent insurance to protect Owner's interests without prejudice to any other right or remedy if Contractor fails to obtain or maintain the required insurance. Owner may impose a reasonable Set-off against payments due under Article 15 to recover the cost of the insurance.
- H. Owner does not represent that the insurance coverage and limits established in this Contract are adequate to protect Contractor or Contractor's interests.
- I. The required insurance and insurance limits do not limit Contractor's liability under the indemnities granted to Owner's Indemnitees in the Contract Documents.
- J. Provide for an endorsement that the "other insurance" clause will not apply to OPT where OPT is an additional insured shown on the policy. Contractor's insurance is primary and non-contributory with respect to any insurance or self-insurance carried by OPT for liability arising out of operations under this Agreement.
- K. Include and list OPT and any other individuals or entities identified in Section 00 73 16 "Insurance Requirements" as additional insureds on all policies except for the workers' compensation policy and Contractor's professional liability policy.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 Contractor's Means and Methods of Construction

- A. Contractor is solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. Provide professional engineering or other design services if the Contract Documents require such services or if Contractor determines that such services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety. Engineering or other design services are to be provided by a properly licensed design professional authorized to provide these services in the state in which the Project is constructed. Such services are not Owner-delegated professional design services under this Contract, and OPT does not have 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. Supervise, inspect, and direct the performance of the Work.
- B. Provide a competent resident superintendent acceptable to OPT. The resident superintendent or acceptable qualified assistant is to always be present when Work is being done. Do not replace this resident superintendent except under extraordinary circumstances. Provide a replacement resident superintendent equally competent to the previous resident superintendent if replacement is required. Notify Owner prior to replacing the resident superintendent and obtain Owner's consent to the change in superintendent.

7.03 Labor; Working Hours

- A. Provide competent, suitably qualified personnel to complete the Work. Maintain good discipline and order at the Site. Contractor is responsible for all acts and omissions of Contractor's Team.
- B. Perform Work at the Site during regular working hours except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent to the Site and except as otherwise stated in the Contract Documents.
- C. Do not perform Work on a Saturday, Sunday, or Owner-observed holiday without Construction Manager's consent. If a legal holiday falls on a Saturday, it will be observed the preceding Friday. If a legal holiday falls on a Sunday, it will be observed the following Monday.
- D. Pay additional cost incurred by Owner for services of Construction Manager to observe Work constructed outside of regular working hours. Construction Manager will issue a Set-off in the Application for Payment for this cost per Paragraph 15.01.B.

7.04 Services, Materials, and Equipment

- A. Provide services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and other facilities and incidentals necessary for the performance, testing, startup, and completion of the Work, whether or not these items are specifically called for in the Contract Documents.
- B. Provide new materials and equipment to be incorporated into the Work. Provide special warranties and guarantees required by the Contract Document. Provide satisfactory evidence, including reports of required tests, as to the source, kind, and quality of materials and equipment as required by the Contract Documents or as requested by Construction Manager.

- C. Store, apply, install, connect, erect, protect, use, clean, and condition materials and equipment in accordance with instructions of the applicable Supplier, unless otherwise required by the Contract Documents.

7.05 Concerning Subcontractors, and Suppliers

- A. Contractor may retain Subcontractors and Suppliers which are acceptable to Owner for the performance of parts of the Work. Contractor must retain specific Subcontractors or Suppliers if required to do so by the Contract Documents. Contractor must use Subcontractors or Suppliers named in the Bid or Proposal if Contractor was selected in part based on these named Subcontractors or Suppliers.
- B. Submit a list of proposed Subcontractors and Suppliers to Construction Manager prior to entering into binding subcontracts or purchase orders. These proposed Subcontractors or Suppliers are deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 10 days after receiving this list.
- C. Owner may require the replacement of Subcontractors or Suppliers retained by Contractor. Provide an acceptable replacement for the rejected Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements, subject to Contractor's reasonable objections.
- D. Contractor may be entitled to an adjustment in Contract Price or Contract Times with respect to a replacement of Subcontractors or Suppliers required by Owner. Notify Construction Manager immediately if a replacement of Subcontractors or Suppliers increases the Contract Price or Contract Times. Initiate a Change Proposal for the adjustment within 10 days of Owner's notice to replace a Subcontractor or Supplier. Do not make the replacement until the change in Contract Price or Contract Times has been accepted by Owner if Change Proposal is to be submitted. Contractor is not entitled to an adjustment in Contract Price or Contract Times if OPT requires the replacement of the Subcontractor or Supplier based on an unacceptable safety record, lack of experience or qualifications, or other cause.
- E. Acceptance by Owner of Subcontractors, Suppliers, or other individuals or entities, whether initially or as a replacement, does not constitute a waiver of the obligation of Contractor to complete the Work in accordance with the Contract Documents.
- F. Maintain a current and complete list of Subcontractors and Suppliers that are to perform or furnish part of the Work.
- G. Contractor is fully responsible for the acts and omissions of Subcontractors and Suppliers and is solely responsible for scheduling and coordinating their Work.
- H. Require Subcontractors, Suppliers, and other individuals or entities performing or furnishing Work to communicate with OPT through Contractor.
- I. Contracts between Contractor and their Subcontractors or Suppliers may specifically bind the Subcontractors or Suppliers to the applicable terms and conditions of the Contract Documents. Contractor is responsible for meeting the requirements of the Contract Documents if they choose to not bind the Subcontractors or Suppliers to applicable terms or conditions of the Contract Documents.

- J. OPT may furnish information about amounts paid to Contractor for Work provided by Subcontractors or Suppliers to the entity providing the Work.
- K. Nothing in the Contract Documents:
 - 1. Creates a contractual relationship between members of OPT and members of Contractor's Team; or
 - 2. Creates an obligation on the part of Owner to pay or to see to the payment of money due members of Contractor's Team, except as may be required by Laws and Regulations.

7.06 Patent Fees and Royalties

- A. Pay license fees, royalties, and costs incident to the use of inventions, designs, processes, products, or devices which are patented or copyrighted by others in the performance of the Work, or to incorporate these inventions, designs, processes, products, or devices which are patented or copyrighted by others in the Work. The Contract Documents identify inventions, designs, processes, products, or devices OPT knows are patented or copyrighted by others, or that its use is subject to patent rights or copyrights calling for the payment of a license fee or royalty to others. Contractor is to include the cost associated with the use of patented or copyrighted products or processes, whether specified or selected by Contractor, in the Contract Price.
- B. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER'S INDEMNITEES FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS ARISING OUT OF OR RELATING TO ANY INFRINGEMENT OF PATENT RIGHTS OR COPYRIGHTS BY CONTRACTOR'S TEAM 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.**

7.07 Permits

- A. Obtain and pay for construction permits and licenses, and certificates of occupancy, if required. OPT is to assist Contractor in obtaining permits and licenses when required to do so by applicable Laws and Regulations. Pay governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time the Contractor's Bid or Proposal is submitted or when Contractor negotiates the Contract Price.

7.08 Taxes

- A. Contractor is responsible for all taxes and duties arising out of the Work. Contractor is responsible for including in the Contract Price any applicable sales and use taxes and is responsible for complying with all applicable Laws and Regulations. Pay sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations.

7.09 Laws and Regulations

- A. Give required notices and comply with Laws and Regulations applicable to the performance of the Work. OPT is not responsible for monitoring Contractor's compliance with Laws or Regulations except where expressly required by applicable Laws and Regulations.

- B. Pay costs resulting from actions taken by Contractor that are contrary to Laws or Regulations. Contractor is not responsible for determining that the design aspects of the Work described in the Contract Documents is in accordance with Laws and Regulations. This does not relieve Contractor of its obligations under Paragraph 3.03.
- C. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD OWNER'S INDEMNITEES HARMLESS FROM ALL CLAIMS AND INDEMNIFIED COSTS RESULTING FROM ACTIONS TAKEN BY CONTRACTOR'S TEAM THAT ARE CONTRARY TO LAWS OR REGULATIONS.**
- D. Owner or Contractor may give notice to the other party of changes in Laws or Regulations that may affect the cost or time of performance of the Work, including:
 - 1. Changes in Laws or Regulations affecting procurement of permits; and
 - 2. Sales, use, value-added, consumption, and other similar taxes which come into effect after Contractor's Bid or Proposal is submitted or when Contractor negotiates the Contract Price.
- E. Contractor may submit a Change Proposal or Owner may initiate a Claim within 30 days of this notice if Owner and Contractor are unable to agree on entitlement to or on the amount or extent of adjustments in Contract Price or Contract Times resulting from these changes.

7.10 Safety and Protection

- A. Contractor is solely responsible for initiating, maintaining, and supervising safety precautions and programs relating to the Work. This 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. Take necessary precautions for the safety of persons on the Site or who may be affected by the Work, and provide the necessary protection to prevent damage, injury, or loss to:
 - 1. Work and materials and equipment to be incorporated in the Work, whether stored on or off the Site; and
 - 2. Other property at or adjacent to the Site, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement during construction.
- C. Comply with applicable Laws and Regulations relating to the safety and protection of persons or property. Erect and maintain necessary safeguards for safety and protection. Notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site when prosecution of the Work may affect them. Cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- D. Remedy damage, injury, or loss to property referred to in Paragraph 7.10.B caused by Contractor's Team. Pay remediation costs unless the damage or loss is:
 - 1. Attributable to the fault of the Contract Documents;
 - 2. Attributable to acts or omissions of OPT; or

- 3. Not attributable to the actions or failure to act of Contractor's Team.
- E. Contractor's duties and responsibilities for safety and protection of persons or the Work or property at or adjacent to the Site continues until Work is completed and resumes whenever Contractor's Team returns to the Site to fulfill warranty or correction obligations or to conduct other tasks.
- F. Comply with the applicable requirements of the Owner's safety program if required to do so in the Supplementary Conditions. A copy of the Owner's safety program will be provided in the Bidding Documents or Proposal Documents.
- G. Provide a qualified and experienced safety representative at the Site whose duties and responsibilities are the prevention of accidents and maintaining and supervising safety programs.

7.11 Hazard Communication Programs

- A. Coordinate the exchange of safety data sheets or other hazard communication information required to be made available or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.12 Emergencies

- A. Act to prevent threatened damage, injury, or loss in emergencies affecting the safety or protection of persons or the Work or property at or adjacent to the Site. Notify Construction Manager immediately if Contractor believes that significant changes in the Work or variations from the Contract Documents have been caused or are required because of this need to act. A Modification is to be issued by Construction Manager if OPT determines that the incident giving rise to the emergency action was not the responsibility of Contractor and that a change in the Contract Documents is required because of the action taken by Contractor in response to this emergency.

7.13 Contractor's General Warranty and Guarantee

- A. Contractor warrants and guarantees to Owner that Work is in accordance with the Contract Documents and is not Defective. Owner is entitled to rely on Contractor's warranty and guarantee. 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 7.14. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.13 is limited only by applicable Laws and Regulations restricting actions to enforce such rights. Assume and bear responsibility for costs and time delays associated with variations from the requirements of the Contract Documents.
- B. This Contractor's warranty and guarantee excludes defects or damage caused by abuse, improper maintenance or operation, or modification by OPT; or normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete Work in accordance with the Contract Documents is absolute. None of the following constitute an acceptance of Defective Work,

a release of Contractor's obligation to perform Work in accordance with the Contract Documents or a release of Owner's warranty or guarantee rights under this Paragraph:

1. Observations by OPT;
 2. Recommendation by Construction Manager or payment by Owner of progress or final payments;
 3. The issuance of a certificate of Substantial Completion;
 4. The issuance of a certificate of Final Completion;
 5. The end of the correction period established in Paragraph 7.14;
 6. Use or occupancy of part of the Work by Owner;
 7. Review and approval of a Shop Drawing or Sample;
 8. Inspections, tests, or approvals by others; or
 9. Correction of Defective Work by Owner.
- D. The Contract Documents may require Contractor to accept the assignment of a contract between the Owner and a contractor or supplier. The specific warranties, guarantees, and correction obligations contained in an assigned contract govern with respect to Contractor's performance obligations to Owner for the Work described in an assigned contract.

7.14 Correction Period

- A. Promptly correct Defective Work without cost to Owner for 1 year after the date of Substantial Completion or longer periods of time prescribed by the terms of the Contract Documents.
- B. Promptly correct damages to the Site or adjacent areas that Contractor has arranged to use through construction easements or other agreements. Promptly correct damages to Work or the work of others. Make corrections without cost to Owner.
- C. Owner may have the Defective Work and damages described in Paragraphs 7.14.A and 7.14.B corrected if Contractor does not comply with the terms of Construction Manager's instructions, or in an emergency where delay would cause serious risk of loss or damage.
- D. **NOTWITHSTANDING ANYTHING TO THE CONTRARY IN THIS AGREEMENT OR THE CONTRACT DOCUMENTS AND TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD OWNER'S INDEMNITEES HARMLESS FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS ARISING OUT OF OR RELATING TO THE CORRECTION OF DEFECTIVE WORK.**
- E. The correction period starts to run from the date when a specific item of equipment or systems are placed in continuous beneficial use by Owner before Substantial Completion of Work if so provided in the Specifications or if accepted for beneficial use by Owner.
- F. The correction period is extended for an additional period of 1 year for Defective Work corrected after the date of Substantial Completion or after the accepted date the correction period starts to run as described in Paragraph 7.14.E. This extended correction

period starts to run when Defective Work has been satisfactorily corrected under this Paragraph 7.14.

- G. Contractor's obligations under this Paragraph 7.14 are in addition to other obligations or warranties. The provisions of this Paragraph 7.14 are not a substitute for, or a waiver of, the provisions of applicable statutes of limitation or repose.

7.15 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'S INDEMNITEES FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS ARISING OUT OF OR RELATING TO THE PERFORMANCE OF THE WORK, PROVIDED THAT ANY SUCH CLAIM, ACTION, LOSS, 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'S TEAM.**
- B. The indemnification obligation under Paragraph 7.15.A is not limited by the amount or type of damages, compensation, or benefits payable by or for members of Contractor's Team or other individuals or entities under workers' compensation acts, disability benefit acts, or other employee benefit acts in claims against Owner's Indemnitees by an employee or the survivor or personal representative of employee of Contractor's Team.

7.16 Delegation of Professional Design Services

- A. Contractor is to provide professional design services required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures.
- B. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. This delegation will specify the performance and design criteria that such services must satisfy and the Submittals that Contractor must furnish to Construction Manager with respect to Owner delegated design. Contractor is not required to provide these professional services in violation of applicable Laws and Regulations.
- C. Owner-delegated professional design services provided through Contractor are 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 other Submittals prepared by such design professional. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Construction Manager, then such Shop Drawing or other Submittal must bear the design professional's written approval when submitted by Contractor to Construction Manager.
- D. OPT is entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by Contractor's design professionals, provided OPT has specified to Contractor the performance and design criteria that these services must satisfy.

- E. Pursuant to this Paragraph 7.16, OPT's review and approval of 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;
 - 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 is not responsible for the adequacy of the performance or design criteria specified by OPT. Advise OPT if the performance or design criteria are known or considered likely to be inadequate or otherwise deficient.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 Other Work

- A. Owner may arrange for other work at or adjacent to the Site which is not part of the Contractor's Work. This other work may be performed by Owner's employees or through other contractors. Utility owners may perform work on their utilities and facilities at or adjacent to the Site. Include costs associated with coordinating with entities performing other work or associated with connecting to this other work in the Contract Price if this other work is shown in the Contract Documents.
- B. OPT is to notify Contractor of other work prior to starting the work and provide any knowledge they have regarding the start of utility work at or adjacent to the Site to Contractor.
- C. Provide other contractors:
 - 1. Proper and safe access to the Site;
 - 2. Reasonable opportunity for the introduction and storage of materials and equipment; and
 - 3. Reasonable opportunity to execute their work.
- D. Provide cutting, fitting, and patching of the Work required to properly connect or integrate with other work. Do not endanger the work of others by cutting, excavating, or otherwise altering the work of others without the consent of Construction Manager and the others whose work will be affected.
- E. Inspect the work of others and immediately notify Construction Manager if the proper execution of part of Contractor's Work depends upon work performed by others and this work has not been performed or is unsuitable for the proper execution of Contractor's Work. Contractor's failure to notify Construction Manager constitutes an acceptance of this other work as acceptable for integration with Contractor's Work. This acceptance does not apply to latent defects or deficiencies in the work of others.
- F. Take adequate measures to prevent damages, delays, disruptions, or interference with the work of Owner, other contractors, or utility owners performing other work at or adjacent to the Site.

- G. The provisions of this Article 8 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 4.03.

8.02 Coordination

- A. Owner has sole authority and responsibility for coordination of this other work unless otherwise provided in the Contract Documents. Owner is to identify the entity with authority and responsibility for coordination of the activities of the various contractors, the limitations of their authority, and the work to be coordinated prior to the start of other work at or adjacent to the Site.

8.03 Legal Relationships

- A. Contractor may be entitled to a change in Contract Price or Contract Times if, while performing other work at or adjacent to the Site for Owner, the OPT, other contractor, or utility owner:
 - 1. Damages the Work or property of Contractor's Team;
 - 2. Delays, disrupts, or interferes with the execution of the Work; or
 - 3. Increases the scope or cost of performing the Work through their actions or inaction.
- B. Notify Construction Manager immediately of the event leading to a potential Change Proposal so corrective or mitigating action can be taken. Submit the Change Proposal within 30 days of the event if corrective action has not adequately mitigated the impact of the actions or inactions of others. Information regarding this other work in the Contract Documents is used to determine if Contractor is entitled to a change in Contract Price or Contract Times. Changes in Contract Price require that Contractor assign rights against the other contractor or utility owner to Owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Changes in Contract Times require that the time extension is essential to Contractor's ability to complete the Work within the Contract Times.
- C. Take prompt corrective action if Contractor's Team damages, delays, disrupts, or interferes with the work of Owner's employees, other contractors, or utility owners performing other work at or adjacent to the Site or agree to compensate other contractors or utility owners for correcting the damage. Promptly attempt to settle claims with other contractors or utility owners if Contractor damages, delays, disrupts, or interferes with the work of other contractors or utility owners performing other work at or adjacent to the Site.
- D. Owner may impose a Set-off against payments due to Contractor and assign the Owner's contractual rights against Contractor with respect to the breach of the obligations described in this Paragraph 8.03 to other contractors or utility owners if damages, delays, disruptions, or interference occur.
- E. **NOTWITHSTANDING ANYTHING TO THE CONTRARY IN THIS AGREEMENT OR THE CONTRACT DOCUMENTS AND TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD OWNER'S INDEMNITEES**

HARMLESS FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS RESULTING FROM CONTRACTOR'S TEAM'S ACTION OR INACTION RELATED TO DAMAGES, DELAYS, DISRUPTIONS, OR INTERFERENCE WITH THE WORK OF OWNER'S EMPLOYEES, OTHER CONTRACTORS, OR UTILITY OWNERS PERFORMING OTHER WORK AT OR ADJACENT TO THE SITE.

ARTICLE 9 – OWNER'S AND OPT'S RESPONSIBILITIES

9.01 Communications to Contractor

- A. OPT issues communications to Contractor through Construction Manager except as otherwise provided in the Contract Documents.

9.02 Replacement of Owner's Project Team Members

- A. Owner may replace members of OPT at its discretion.

9.03 Furnish Data

- A. OPT is to furnish the data required of OPT under the Contract Documents.

9.04 Pay When Due

- A. Owner is to make payments to Contractor when due as described in Article 15.

9.05 Lands and Easements; Reports and Tests

- A. Owner's duties with respect to providing lands and easements are described in Paragraph 5.01. OPT will make copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site available to Contractor in accordance with Paragraph 5.03.

9.06 Insurance

- A. Owner's responsibilities with respect to purchasing and maintaining insurance are described in Article 6.

9.07 Modifications

- A. Owner's responsibilities with respect to Modifications are described in Article 11.

9.08 Inspections, Tests, and Approvals

- A. OPT's responsibility with respect to certain inspections, tests, and approvals are described in Paragraph 14.02.

9.09 Limitations on OPT's Responsibilities

- A. OPT does not supervise, direct, or have control or authority over, and is not responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or related safety precautions and programs, or for failure of Contractor to comply with Laws

and Regulations applicable to the performance of the Work. OPT is not responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

- B. OPT is not responsible for the acts or omissions of Contractor's Team. No actions or failure to act, or decisions made in good faith to exercise or not exercise the authority or responsibility available under the Contract Documents creates a duty in contract, tort, or otherwise of OPT to the Contractor or members of Contractor's Team.

9.10 Undisclosed Hazardous Environmental Condition

- A. OPT's responsibility for undisclosed Hazardous Environmental Conditions is described in Paragraph 5.06.

9.11 Compliance with Safety Program

- A. Contractor is to inform OPT of its safety programs and OPT is to comply with the specific applicable requirements of this program.

ARTICLE 10 – DESIGN PROFESSIONAL'S AND CONSTRUCTION MANAGER'S STATUS DURING CONSTRUCTION

10.01 Owner's Representative

- A. Construction Manager is Owner's representative. The duties and responsibilities and the limitations of authority of Construction Manager as Owner's representative are described in the Contract Documents.

10.02 Visits to Site

- A. Design Professional is to make periodic visits to the Site to observe the progress and quality of the Work. Design Professional is to determine, in general, if the Work is proceeding in accordance with the Contract Documents based on observations made during these visits. Design Professional is not required to make exhaustive or continuous inspections to check the quality or quantity of the Work. Design Professional is to inform OPT of issues or concerns and Construction Manager is to work with Contractor to address these issues or concerns. Design Professional's visits and observations are subject to the limitations on Design Professional's authority and responsibility described in the Contract Documents.
- B. Construction Manager is to observe the Work to check the quality and quantity of Work, implement Owner's quality assurance program and administer the Contract as Owner's representative as described in the Contract Documents. Construction Manager's visits and observations are subject to the limitations on Construction Manager's authority and responsibility described in the Contract Documents.

10.03 Rejecting Defective Work

- A. OPT has the authority to reject Work in accordance with Article 14. Construction Manager is to notify Contractor of Defective Work of which it is aware and document when Defective Work has been corrected or accepted in accordance with Article 14.

10.04 Decisions on Requirements of Contract Documents and Acceptability of Work

- A. Construction Manager is to render decisions regarding non-technical or contractual/administrative requirements of the Contract Documents and will coordinate the response of OPT to Contractor.
- B. Design Professional is to render decisions regarding the conformance of the Work to the requirements of the Contract Documents. Design Professional will render a decision to either correct the Defective Work, or accept the Work under the provisions of Paragraph 14.04, if Work does not conform to the Contract Documents. Construction Manager will coordinate the response of OPT to Contractor.
- C. Construction Manager will issue a Request for a Change Proposal if a Modification is required. Construction Manager will provide documentation for changes related to the non-technical or contractual/administrative requirements of the Contract Documents. Design Professional will provide documentation if design related changes are required through Construction Manager.
- D. Contractor may appeal OPT's decision by submitting a Change Proposal if Contractor does not agree with the OPT's decision.

ARTICLE 11 – CHANGES TO THE CONTRACT

11.01 Amending and Supplementing the Contract Documents

- A. A Contract Amendment, Change Order, Work Change Directive, or Field Order may modify the Contract Documents. Modifications that include a change in the Contract Price or Contract Times can only be made in a Contract Amendment or Change Order.
- B. 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 design or technical matters, must be supported by Design Professional's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of Design Professional.
- C. Proceed with the Changes in the Work or, in the case of a deletion in the Work, immediately cease construction activities related to the deleted Work upon receipt of the Modification.
- D. Contractor is not entitled to an increase in the Contract Price or an extension of the Contract Times with respect to Work performed that is not required by the Contract Documents, except in the case of an emergency as provided in Paragraph 7.12, or in the case of uncovering Work as provided in Paragraph 14.05. Contractor is responsible for costs and time delays associated with variations from the requirements of the Contract Documents unless the variations are specifically approved by Change Order.
- E. Acceptance of a Modification by Contractor constitutes agreement that the compensation provided by that Modification is the full, complete, and final compensation for all costs Contractor has or may incur because of or relating to this Modification whether these costs are known, unknown, foreseen, or unforeseen at this time, including any cost for delay, extended overhead, ripple or impact cost, or any other effect on changed or unchanged Work as a result of this Modification.

- F. Acceptance of a Modification by Contractor constitutes agreement that the changes in Contract Times are the complete and final adjustments for direct impacts to the ability of Contractor to complete the Work within the Contract Times and are the only adjustments to which Contractor is entitled.
- G. Perform added or revised Work under the applicable provisions of the Contract Documents for the same or similar Work unless different Drawings, Specifications, or directions are provided in the Modification.
- H. Nothing in this paragraph 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.

11.02 Contract Amendments

- A. Owner and Contractor may modify the terms and conditions of the Contract Documents without the recommendation of Design Professional using a Contract Amendment.
- B. A Contract Amendment may also be used for authorizing a new task order for task order contracts or a new phase of the Work when using phased construction or purchasing Goods and Special Services to be incorporated into the Project. The Contract Amendment may be used to establish the Contract Price, Contract Times, or terms and conditions of the Contract for the new task order or phase of Work if not already established in the Contract Documents.

11.03 Change Orders

- A. All changes to the Contract Documents that include a change in the Contract Price or the Contract Times for previously authorized Work and changes to the Work requiring Design Professional's approval must be made by a Change Order. Change Orders prepared by Construction Manager may cover:
 - 1. Changes in Contract Price or Contract Times which are submitted by Contractor as a Change Proposal and agreed to by the parties;
 - 2. Changes in Contract Price or Contract Times to pay for undisputed Work performed in accordance with a Work Change Directive;
 - 3. Changes in Contract Price or Contract Times making final adjustments for Work covered under Alternates and Allowances;
 - 4. Changes in Contract Price or Contract Times making final adjustments to actual quantities for Unit Price Work;
 - 5. Changes in Contract Price resulting from an Owner Set-off, unless the set off has been successfully challenged by Contractor;
 - 6. Changes in Contract Price or Contract Times resulting from resolution of Claims;
 - 7. Changes in Contract Price or Contract Times 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
 - 8. Other similar provisions that will modify the Contract Price or Contract Times.

- B. A Change Order may also be used to establish modifications of the Contract Documents that do not affect the Contract Price or Contract Times.

11.04 Work Change Directives

- A. A Work Change Directive does not change the Contract Price or the Contract Times, but is evidence that the parties expect that the modifications ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations on the Contract Price and Contract Times.
- B. Contractor must submit a Change Proposal seeking an adjustment of the Contract Price or the Contract Times no later than 30 days after the completion of the Work set out in the Work Change Directive if negotiations are unsuccessful under the terms of the Contract Documents governing adjustments.

11.05 Field Orders

- A. Design Professional may require minor changes in the Work that do not change the Contract Price or Contract Times using a Field Order through Construction Manager. Construction Manager may issue a Field Order for non-technical, administrative issues. Submit a Change Proposal if Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times before proceeding with the Work described in the Field Order.

11.06 Change Proposals

- A. Submit a Change Proposal to Construction Manager to:
 - 1. Request an adjustment in the Contract Price or Contract Times;
 - 2. Contest an initial decision by OPT concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents;
 - 3. Contest a Set-off against payment due; or
 - 4. Seek other relief under the Contract Documents.
- B. Notify Construction Manager immediately if a Change Proposal is to be submitted. Submit each Change Proposal to Construction Manager no later than 30 days after the event initiating the Change Proposal. Submit the following as part of the Change Proposal:
 - 1. Any proposed change in Contract Price, Contract Times, or other relief, accompanied by a statement that the requested Change Order is the entire adjustment to which Contractor believes it is entitled;
 - 2. The reason for the proposed change; and
 - 3. Supporting data, accompanied by a statement that the supporting data is accurate and complete.
- C. Construction Manager is to advise OPT regarding the Change Proposal. OPT is to review each Change Proposal and Contractor's supporting data, and within 30 days after receipt of the documents, direct Construction Manager to either approve or deny the Change Proposal in whole or in part. Construction Manager is to issue a Change Order for an approved Change Proposal. Change Proposals are denied if Construction Manager does not

act on the Change Proposal within 30 days. Contractor may start the time for appeal of the denial under Article 12.

11.07 Change of Contract Price; Contract Times

- A. Change Proposals for an adjustment in the Contract Price must comply with the provisions of this Paragraph 11.07. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12. Any adjustment of the Contract Times is subject to the limitations described in Paragraph 4.03.
- B. An adjustment in the Contract Price is to be determined as follows:
 - 1. By applying unit prices to the quantities of the items involved, subject to the provisions of Paragraph 13.03, where the Work involved is covered by unit prices in the Contract Documents;
 - 2. By a mutually agreed lump sum where the Work involved is not covered by unit prices in the Contract Documents; or
 - 3. Payment based on the Cost of the Work determined as provided in Article 13 when the Work involved is not covered by unit prices in the Contract Documents or the parties do not reach a mutual agreement to a lump sum.
- C. The original Contract Price may not be increased by more than 25 percent unless further limited by Laws and Regulations. Owner may decrease the Work by up to 25 percent of the Contract Price without adjusting Contractor's fee.

11.08 Execution of Change Orders and Contract Amendments

- A. Each Change Order or Contract Amendment must be specific and final as to changes in Contract Price and Contract Times for the changes described in the Change Order or Contract Amendment. Acceptance of a Change Order or Contract Amendment by Contractor constitutes a full accord and satisfaction for all claims and costs of any kind, whether direct or indirect, including impact, delay, or acceleration damages related to the Change Order or Contract Amendment. The execution of a Change Order or Contract Amendment by Contractor constitutes conclusive evidence of Contractor's agreement to the ordered changes in the Work, with no reservations or other provisions allowing for future changes in the Contract Price or Contract Times. This Contract, as amended, forever releases any claim against Owner for additional time or compensation for matters relating to or arising out of or resulting from the Work included within or affected by the executed Change Order or Contract Amendment. This release applies to claims related to the cumulative impact of all Change Orders or Contract Amendment and to any claim related to the effect of a change on unchanged Work.
- B. A Change Order or Contract Amendment is deemed to be in full force as if executed by Contractor if Contractor refuses to execute a Change Order or Contract Amendment that is required to be executed under the terms of this Paragraph 11.08.

11.09 Notice to Surety

- A. Notify the surety of Modifications affecting the general scope of the Work, changes in the provisions of the Contract Documents, or changes in Contract Price or Contract Times. Adjust the amount of each bond when Modifications change the Contract Price.

ARTICLE 12 – CLAIMS

12.01 Claims

- A. Follow the Claims process described in this Article for a demand or assertion by Contractor:
 - 1. Contesting an initial decision by OPT concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents;
 - 2. Contesting OPT's decision regarding a Change Proposal;
 - 3. Seeking resolution of a contractual issue that OPT has declined to address;
 - 4. Seeking other relief with respect to the terms of the Contract; or
 - 5. Any issue, request, demand, or dispute arising after Construction Manager's recommendation of Final Payment not specifically listed in the Certificate of Final Completion.
- B. Notify Construction Manager no later than 7 days after the start of the event giving rise to the Claim or, in the case of appeals regarding Change Proposals, within 7 days of the decision under appeal. The responsibility to substantiate a Claim rests with the entity making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Price or Contract Times, Contractor must certify that the Claim is made in good faith, that the supporting data is 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. The entity receiving a Claim is to review the Claim and consider its merits. The Owner and Contractor are to seek to resolve the Claim through the exchange of information and direct negotiations. The Owner and Contractor may extend the time for resolving the Claim by mutual agreement. Notify Construction Manager of actions taken on a Claim.
- D. Owner and Contractor may mutually agree to mediate the underlying dispute at any time after initiation of a Claim.
 - 1. The agreement to mediate suspends the Claims process.
 - 2. Owner or Contractor may unilaterally terminate the mediation process after 60 days from the agreement to mediate and resume the Claims process as of the date of the termination. The Claim process resumes as of the date of the conclusion of the mediation, as determined by the mediator, if the mediation is unsuccessful in resolving the dispute.
 - 3. Owner and Contractor are to each pay one-half of the mediator's fees and costs.
- E. If the entity receiving a Claim approves the Claim in part or denies it in part, this action is final and binding unless the other entity invokes the procedure described in Article 17 for final resolution of disputes within 30 days of this action.

- F. Notify Construction Manager if efforts to resolve the Claim are not successful and the Claim is denied. A denial of the Claim is final and binding unless the other entity invokes the procedure described in Article 17 for the final resolution of disputes within 30 days of the denial.
- G. The results of the agreement or action on the Claim is to be incorporated in a Change Order by Construction Manager to the extent they affect the Contract Documents, the Contract Price, or the Contract Times if the Owner and Contractor reach an agreement regarding a Claim.

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

13.01 Cost of the Work

- A. The Cost of the Work is the sum of costs described in this Paragraph 13.01, except those excluded in Paragraph 13.01.D, necessary for the proper performance of the Work. 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, time-and-materials, or other cost-based terms; or
 - 2. To determine the value of a Change Order, Change Proposal, Claim, Set-off, or other adjustment in Contract Price.
- B. Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the events giving rise to the adjustment when the value of the adjustment is determined on the basis of the Cost of the Work.
- C. Costs included in the Cost of the Work may not exceed the costs commonly incurred in the proximate area of the Site for similar work unless agreed to by Owner. Cost of the Work includes only the following items:
 - 1. Payroll costs for Contractor's employees performing the Work, including one foreman per crew, and other required and agreed upon personnel for the time they are employed on the Work. Employees are to be paid according to wage rates for job classifications as agreed to by Owner in advance of the Work. Rates paid for this Work are to be the same as paid for Contract Work as established by certified payroll. Payroll costs may include:
 - a. Actual costs paid for salaries and wages;
 - b. Actual cost paid for fringe benefits, which consists of:
 - 1) Social security contributions,
 - 2) Unemployment,
 - 3) Excise and payroll taxes,
 - 4) Workers' compensation,
 - 5) Health and retirement benefits, and
 - 6) Paid time off for sick leave, vacations and holidays; and

- c. Actual cost of additional compensation paid for performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, to the extent authorized by Owner.
- 2. Cost of materials and equipment furnished and incorporated in the Work, including transportation and storage costs and required Suppliers' field services. Contractor may retain cash discounts unless Owner provided funds to Contractor for early payment of these materials and equipment. Cash discounts are to be credited to Owner if Owner provides funds for early payment. Make provisions for trade discounts, rebates, refunds, and returns from sale of surplus materials and equipment and reduce the Cost of the Work by these amounts.
- 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. Obtain competitive bids from Subcontractors acceptable to Owner if required by OPT. Bids are to be opened in the presence of Construction Manager and other designated members for OPT. Provide copies of bids to Construction Manager to use in determining, with OPT, which bids are acceptable. The Subcontractor's Cost of the Work and fee are determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01 if the subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee.
- 4. Supplemental 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. Costs of materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site including transportation and maintenance costs related specifically to the Work;
 - c. Costs of engineers, architects, testing laboratories, surveyors, employed or retained for services specifically related to the Work.
 - d. Actual cost for construction equipment, including the costs of transporting, loading, unloading, assembling, dismantling, and removing construction equipment, whether owned by Contractor or rented from others.
 - 1) Cost for construction equipment must not exceed the cost shown in the most current edition of the rental rate book named in the Supplemental Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
 - 2) 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.

- e. Applicable sales, consumer, use, and other similar taxes related to the Work for which Owner is not exempt, and which Contractor pays consistent with Laws and Regulations;
 - f. Deposits lost for causes other than negligence of Contractor's Team;
 - g. Royalty payments and fees for permits and licenses;
 - h. Cost of additional utilities, fuel, and sanitary facilities at the Site;
 - i. Minor expense items directly required by the Work; and
 - j. Premiums for bonds and insurance required by the Contract Documents.
- D. The Cost of the Work does not include the following administrative costs which are to be covered by the Contractor's fee:
- 1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, safety managers, superintendents, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, 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.C.1.
 - 2. The cost of purchasing, renting or furnishing any tool or equipment whose current price would be less than \$500 if purchased new at retail.
 - 3. Office expenses 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 actions of Contractor's Team for the correction of Defective Work, disposal of materials or equipment that do not comply with Specifications, and correcting damage to property.
 - 6. Losses, damages, and related expenses caused by damage to the Work or sustained by Contractor in connection with the performance of the Work. Contractor is entitled to recover costs if covered by Owner's insurance, if applicable. Such losses may include settlements made with the approval of Owner. Do not include these losses, damages, and expenses in the Cost of the Work when determining Contractor's fee.
 - 7. Expenses incurred in preparing and advancing Claims.
 - 8. Any Indemnified Cost paid with regard to Contractor's indemnification of Owner's Indemnitees.
 - 9. Other overhead or general expense costs and the costs of items not described in Paragraph 13.01.C.
- E. Contractor's fee is determined in accordance with the Agreement when the Work is performed on a cost-plus basis.

- F. Contractor's Fee is determined as follows for Work included in a Change Proposal.
1. Contractor's fee is 15 percent of the costs included in the Cost of the Work per Paragraph 13.01.C.1 for payroll cost and per Paragraph 13.01.C.2 for cost of materials and equipment furnished and incorporated in the Work.
 2. Contractor's fee is 5 percent of costs included in the Cost of the Work paid by Contractor for Work performed by Subcontractors per Paragraph 13.01.C.3.
 3. No fee will be payable for costs included in the Cost of the Work for supplemental costs per Paragraph 13.01.C.4.
 4. Fees are to be determined as follows where one or more tiers of Subcontracts are used:
 - a. The Subcontractor's fee is 15 percent for costs incurred under Paragraphs 13.01.C (excluding Paragraph 13.01.C.3) for the Subcontractor that performs the Work;
 - b. The Contractor and Subcontractors of a tier higher than that of the Subcontractor that performs the Work are allowed a fee of 5 percent of the total costs incurred by the next lower tier Subcontractor; and
 - c. Regardless of the number of subcontractor tiers involved, the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that performs the Work.
- G. When a Change Proposal includes additions and credits, the Contractor's fee will be calculated on the sum of costs for each cost category in Paragraph 13.01.C. and applying the appropriate fee from Paragraph 13.01.E. The amount to be credited by Contractor to Owner for any Change Proposal which results in a net decrease in the Cost of Work will be the amount of the actual net decrease in the Cost of Work plus an additional amount equal to 5 percent of the actual net decrease in the Cost of Work.
- H. Establish and maintain records in accordance with generally accepted accounting practices and submit these records, including an itemized cost breakdown together with supporting data, in a form and at intervals acceptable to Construction Manager whenever the Cost of the Work is to be determined pursuant to this Paragraph 13.01.

13.02 Allowances

- A. Include allowances specified in the Contract Documents in the Contract Price and provide Work covered by the allowance as authorized by Owner through Construction Manager.
- B. Contractor agrees that:
1. The cash allowance is used to compensate Contractor for the cost of furnishing materials and equipment for the Work covered by the allowance item in the Contract Documents. Cost may include applicable taxes. Make provisions for trade discounts, rebates, and refunds and reduce the allowance costs by these amounts.
 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

3. Costs for cash allowances and installation costs as described in Paragraphs 13.02.B.1 and 13.02.B.2 above are included in the Contract Price.
- C. Construction Manager will issue a Change Order to adjust the Contract Price by the difference between the allowance amount and the actual amount paid by Contractor for Work covered by the allowance. The Change Order will be issued at the time costs are incurred by Contractor for Work covered by the allowance and this Work is included on the Application for Payment.

13.03 Unit Price Work

- A. The initial Contract Price for Unit Price Work is equal to the sum of the unit price line items in the Agreement. Each unit price line item amount is equal to the product of the unit price for each line item 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 comparing offers and determining an initial Contract Price. Payments to Contractor for Unit Price Work are to be based on actual quantities measured for Work in place.
- C. Each unit price is deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Construction Manager is to determine the actual quantities and classifications of Unit Price Work performed by Contractor to be incorporated into each Application for Payment. Construction Manager's decision on actual quantities is final and binding, subject to the provisions of Paragraph 13.03.E.
- E. Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price within 30 days of Construction Manager's decision under Paragraph 13.03.D, if:
 1. The total cost of a particular item of Unit Price Work amounts to 20 percent or more of the total Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 20 percent from the estimated quantity of an item indicated in the Agreement;
 2. There is no corresponding adjustment with respect to other items of Work; and
 3. Contractor believes it has incurred additional expense as a result of this condition or if Owner believes that the quantity variation entitles Owner to an adjustment in the Contract Price.
- F. Construction Manager will issue a Change Order adjusting estimated quantities to actual quantities to determine the final Contract Price.

13.04 Contingencies

- A. Contingency funds may be included in the Contract Price to pay for Work not defined specifically by the Contract Documents that is essential to the completion of the Project. Contingency funds will be as described in the Agreement.

- B. The contingency funds may be used for costs incurred by Contractor, provided these costs are approved by Owner. Costs are to be determined and documented in accordance with Paragraph 13.01. The contingency funds are not to be used for the following items:
 - 1. Cost overruns due to changes in material costs after the Contract Price is established, unless specific price escalation provisions are made in the Agreement;
 - 2. Rework required to correct Defective Work;
 - 3. Inefficiencies in completing the Work due to Contractor's selected means, methods, sequences, or procedures of construction;
 - 4. Work Contractor failed to include in the Contract Price;
 - 5. Changes required by changes in Laws and Regulations enacted after the Contract Price is established; or
 - 6. Any Work that does not constitute a change in Scope in the Work included in the Contract Price.
- C. Construction Manager is to issue a Change Order for approved expenditures from contingency funds. When the Change Order is issued, the costs are to be added to the Application for Payment. Contractor is to maintain a tabulation showing the contingency amount, adjustments to the contingency amount, and amounts remaining as the Project progresses.
- D. Any contingency amounts that are not included in a Change Order are retained by Owner. A Change Order will be issued to deduct unused contingency amounts from the Contract Price prior to Final Payment.

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

14.01 Access to Work

- A. Provide safe access to the Site and the Work for the observation, inspection, and testing of the Work in progress. Contractor can require compliance with Contractor's safety procedures and programs as part of providing safe access.

14.02 Tests, Inspections, and Approvals

- A. OPT may retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform inspections. Cooperate with inspection and testing personnel and assist with providing access for required inspections, tests, and handling test specimens or Samples.
- B. Arrange for and facilitate inspections, tests, and approvals required by Laws or Regulations of governmental entities having jurisdiction that require Work to be inspected, tested, or approved by an employee or other representative of that entity. Pay associated costs and furnish Construction Manager with the required certificates of inspection or approval.
- C. Arrange, obtain, and pay for inspections and tests required:
 - 1. By the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to OPT;

2. To attain OPT'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;
 5. For acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work;
 6. For re-inspecting or retesting Defective Work, including any associated costs incurred by the testing laboratory for cancelled tests or standby time; and
 7. For retesting due to failed tests.
- D. Provide independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to OPT to provide these inspections and tests.

14.03 Defective Work

- A. It is Contractor's obligation to ensure that the Work is not Defective.
- B. OPT has the authority to determine whether Work is Defective and to reject Defective Work.
- C. Construction Manager is to notify Contractor of Defective Work of which OPT has actual knowledge.
- D. Promptly correct Defective Work.
- E. Take no action that would void or otherwise impair Owner's special warranties or guarantees when correcting Defective Work.
- F. Pay claims, costs, losses, and damages arising out of or relating to Defective Work, including:
 1. Costs for correction, removal, and replacement of Defective Work;
 2. Cost of the inspection and testing related to correction of Defective Work;
 3. Costs for Design Professional's fees associated with review and approval of design modifications for correction, removal, and replacement of Defective Work.
 4. Fines levied against Owner by governmental authorities because of Defective Work; and
 5. Costs of repair or replacement of work of others resulting from Defective Work.

14.04 Acceptance of Defective Work

- A. Owner may elect to accept Defective Work instead of requiring correction or removal and replacement of Defective Work provided:
 1. This acceptance occurs prior to final payment;
 2. Design Professional confirms that the Defective Work is in general accordance with the design intent and applicable design principles; and

3. Design Professional confirms that acceptance of the Defective Work does not endanger public health or safety.
- B. Owner may impose a reasonable Set-off against payments due under Article 15 for costs associated with OPT's evaluation of Defective Work to determine if it can be accepted and to determine the diminished value of the Work. Owner may impose a reasonable Set-off against payments due under Article 15 if the parties are unable to agree as to the decrease in the Contract Price to compensate Owner for the diminished value of Defective Work accepted. Construction Manager is to issue a Change Order for acceptance of the Defective Work prior to final payment. Pay an appropriate amount to Owner if the acceptance of Defective Work occurs after final payment.

14.05 Uncovering Work

- A. OPT has the authority to require inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. Work that is covered prior to approval of Construction Manager must be uncovered for OPT's observation if requested by Construction Manager. Pay for uncovering Work and its subsequent restoration unless Contractor has given Construction Manager timely notice of Contractor's intention to cover the Work and Construction Manager fails to act with reasonable promptness in response to this notice.
- C. Provide necessary labor, material, and equipment and uncover, expose, or otherwise make available the portion of the Work suspected of being Defective for observation, inspection, or testing if OPT considers it necessary or advisable that covered Work be observed by Design Professional or inspected or tested by others as directed by Construction Manager.
 1. Pay for claims, costs, losses, and damages associated with uncovering, exposing, observing, inspecting, and testing if it is found that the uncovered Work is Defective. Pay costs for correction of Defective Work. Pay for reconstruction, repair, or replacement of work of others if it is found that the uncovered Work is Defective.
 2. Submit a Change Proposal for an increase in the Contract Price or an extension of the Contract Times directly attributable to this uncovering, exposure, observation, inspection, testing, and reconstruction if the uncovered Work is found to not be Defective.

14.06 Owner May Stop the Work

- A. Owner may order Contractor to stop the Work if:
 1. The Work is Defective;
 2. Contractor fails to supply sufficient skilled workers or suitable materials or equipment;
or
 3. Contractor performs Work that may fail to conform to the Contract Documents when completed.
- B. This stop work order is to remain in effect until the reason for the stop work order has been eliminated. Owner's right to stop the Work does not create a duty to exercise this right for the benefit of Contractor's Team or surety.

14.07 Owner May Correct Defective Work

- A. Owner may remedy Defective Work after 7 days' notice to Contractor if Contractor fails to correct Defective Work, or to remove and replace Defective Work as required by OPT;
- B. Owner may:
 - 1. Exclude Contractor from the Site;
 - 2. Take possession of the Work and suspend Contractor's services related to the Work; and
 - 3. Incorporate stored materials and equipment in the Work.
- C. Allow OPT access to the Site and off-site storage areas to enable Owner to exercise the rights and remedies under this paragraph.
- D. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 are to be charged against Contractor as a Set-off against payments due under Article 15. These claims, costs, losses, and damages include costs of repair and the cost of replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's Defective Work.
- E. Contractor is not allowed an extension of the Contract Times because of delays in the performance of the Work attributable to the exercise of the Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; FINAL COMPLETION

15.01 Progress Payments

- A. Progress payments are to be submitted to Construction Manager on the Application for Payment form provided by Construction Manager following procedures in the Contract Documents.
 - 1. Progress payments for lump sum Work are to be paid based on the earned value to date at the amounts shown in the Schedule of Values submitted as required by Paragraph 2.03. Final payment will be for the total lump sum amount.
 - 2. Progress payments for Unit Price Work are based on the number of units completed as determined under the provisions of Paragraph 13.03.
 - 3. Progress payments for Work to be paid based on the Cost of the Work per Article 13 are to be paid for Work completed by Contractor during the pay period.
- B. Reduction in Payment by Owner:
 - 1. Owner is entitled to impose a Set-off against payment based on the following:
 - a. Claims made against Owner or costs, losses, or damages incurred by Owner related to:
 - 1) Contractor's conduct in the performance of the Work, including workplace injuries, non-compliance with Laws and Regulations, or patent infringement; or

- 2) Contractor's failure to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site, including workplace injuries, property damage, and non-compliance with Laws and Regulations.
- b. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
- c. Work is Defective, or completed Work has been damaged by Contractor's Team, requiring correction or replacement;
- d. Owner has been required to correct Defective Work or complete Work in accordance with Paragraph 14.07;
- e. The Contract Price has been reduced by Change Orders;
- f. Events have occurred that would constitute a default by Contractor justifying a termination for cause;
- g. Liquidated or other damages have accrued because of Contractor's failure to achieve Milestones, Substantial Completion, or completion of the Work;
- h. Liens have been filed regarding the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of these Liens;
- i. Owner has been notified of failure to make payments to Subcontractors, Suppliers, or Employees;
- j. Failure to submit up-to-date record documents as required by the Contract Documents;
- k. Failure to submit monthly Progress Schedule updates or revised schedules as requested by Construction Manager;
- l. Failure to provide Project photographs required by the Contract Documents;
- m. Failure to provide Certified Payroll required by the Contract Documents;
- n. Compensation for OPT for overtime charges of Construction Manager, third review of Shop Drawings, review of substitutions, re-inspection fees, inspections or designs related to correction of Defective Work, or other services identified as requiring payment by Contractor;
- o. Costs for tests performed by Owner to verify that Work previously tested and found to be Defective has been corrected;
- p. OPT has actual knowledge of the occurrence of events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents with associated cost impacts;
- q. Payment would result in an over-payment of the Contract Price; or
- r. Other items entitling Owner to a Set-off against the amount recommended.
2. Compensation for services of OPT staff is to be at the rates established in the Supplementary Conditions.

3. Construction Manager is to notify Contractor stating the amount and the reasons for an imposed Set-off. Owner is to pay Contractor amounts remaining after deduction of the Set-off. Owner is to pay the Set-off amount agreed to by Owner and Contractor if Contractor remedies the reasons for the Set-off. Contractor may submit a Change Proposal contesting the Set-off.
- C. No payment will be made for Work authorized by a Work Change Directive until the Work Change Directive is incorporated into a Change Order, unless arrangements or interim payments have been included in the Work Change Directive. Payment can be included in an Application for Payment when the Change Order is approved.
- D. Owner is to pay the amount of payment recommended by Construction Manager within 30 days after receipt of the Application for Payment and accompanying documentation from Construction Manager.
- E. Contractor certifies that all Work, including materials, covered by each Application for Payment have been completed or delivered and stored in accordance with the Contract Documents, that all amounts have been paid for Work, materials, and equipment for which previous payment has been made by Owner, and that the current payment amount shown in this Application for Payment is due.

15.02 Contractor's Warranty of Title

- A. Contractor warrants and guarantees that title to the Work, materials, and equipment furnished under the Contract is to pass to Owner free and clear of Liens, title defects, and patent, licensing, copyright, or royalty obligations no later than 7 days after the time of payment by Owner of the Application for Payment which includes these items.

15.03 Substantial Completion

- A. Notify Construction Manager when the Work or portion of the Work to be accepted under Paragraph 15.04 is substantially complete and request a Certificate of Substantial Completion.
- B. OPT is to inspect the Work after Contractor's notification to determine if the Work is substantially complete. Construction Manager is to either issue the Certificate of Substantial Completion which sets the date of Substantial Completion or notify Contractor of the reasons the Project is not considered to be substantially complete.
- C. The OPT and Contractor are to meet to discuss Owner's use or occupancy of the Work following Substantial Completion. Items to be discussed at this meeting include:
 1. Review of insurance policies with respect to the end of the Contractor's coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner;
 2. Owner's assumption of responsibility for security, operation, protection of the Work, maintenance, and utilities upon Owner's use or occupancy of the Work;
 3. Contractor's obligations for operations and maintenance during performance and acceptance testing;
 4. Contractor's access to the Site to complete punch list items; and

5. Procedures for correction of Defective Work during the one-year correction period.

15.04 Partial Utilization

- A. Owner may use or occupy substantially completed parts of the Work which are specifically identified in the Contract Documents, or which OPT and Contractor agree constitutes a separately functioning and usable part of the Work prior to Substantial Completion of the Work. Owner must be able to use that part of the Work for its intended purpose without significant interference with Contractor's performance of the remainder of the Work. Contractor and OPT are to follow the procedures of Paragraph 15.03 for this part of the Work.
- B. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Article 6.

15.05 Final Inspection

- A. OPT is to make a final inspection upon notice from Contractor that the entire Work or portion to be accepted under Paragraph 15.04 is complete. Construction Manager is to notify Contractor of Work determined to be incomplete or Defective. Immediately take corrective measures to complete the Work and correct Defective Work.
- B. Notify Construction Manager when the entire Project and ready for Final Payment under Paragraph 15.06 and request a Certificate of Final Completion.
- C. OPT is to inspect the Work after Contractor's notification to determine if the Project is complete. Construction Manager is to either issue the Certificate of Final Completion which sets the date of Final Completion or notify Contractor of the reasons the Project is not considered to be complete.

15.06 Final Payment

- A. Make application for final payment after completing required corrections identified during the final inspection and delivering items and documents required by the Contract Documents. Provide the following with the final Application for Payment:
 - 1. Consent of Surety to Final Payment acknowledging unsettled disputes; or
 - 2. Affidavit of Payment of Debts and Claims or Affidavit of Release of Liens or furnish receipts or releases from Subcontractors and Suppliers when a payment bond is not required.
- B. Construction Manager is to either recommend payment of the final Application for Payment to Owner if OPT is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled or notify Contractor of OPT's reasons for not recommending final payment.
- C. The Work is complete, subject to surviving obligations, when it is ready for final payment as established by the Construction Manager's recommendation of payment of the final Application for Payment to Owner and the issuance of a Certificate of Final Completion.
- D. Owner is to pay the amount of final payment recommended by Construction Manager within 30 days after receipt of the final Application for Payment and accompanying

documentation from Construction Manager; unless additional time is required for approval of a governing board or entity. Payment will be within 30 days of approval by the governing board or entity.

15.07 Waiver of Claims

- A. The making of final payment does not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from:
 - 1. Unsettled Liens or claims for non-payment;
 - 2. Defective Work appearing after final inspection pursuant to Paragraph 15.05;
 - 3. Contractor's failure to comply with the terms of special guarantees specified in the Contract Documents;
 - 4. Outstanding Claims or express reservation of rights by Owner; or
 - 5. Contractor's continuing obligations under the Contract Documents.
- B. Contractor waives claims and rights against Owner by accepting final payment except for those Claims made in accordance with the provisions of Article 17 and specifically noted in the Certificate of Final Completion.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 Owner May Suspend Work

- A. Owner may suspend the Work or a portion of the Work for a period of not more than 90 consecutive days, at any time and without cause, by notice to Contractor. This notice fixes the date on which Contractor is to resume Work. Contractor is entitled to adjustments in the Contract Price and Contract Times directly attributable to this suspension. Submit a Change Proposal seeking an adjustment no later than 30 days after the date fixed for resumption of Work.

16.02 Owner May Terminate for Cause

- A. The occurrence of one or more of the following events constitutes a default by Contractor and justifies termination for cause:
 - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents, including failure to supply sufficient skilled workers or suitable materials or equipment;
 - 2. Failure to adhere to the Progress Schedule;
 - 3. Failure of Contractor to provide a satisfactory replacement bond or insurance in the event either is lost or canceled;
 - 4. Failure of Contractor to maintain financial solvency to adequately complete the Project as indicated by one or more of the following:
 - a. A petition of bankruptcy is filed by or against Contractor;
 - b. Contractor is adjudged as bankrupt or insolvent;

- c. Contractor or surety makes a general assignment for the benefit of creditors;
 - d. A receiver is appointed for the benefit of Contractor's creditors; or
 - e. A receiver is appointed because Contractor's insolvency;
- 5. Contractor's disregard of Laws or Regulations of public bodies having jurisdiction; or
- 6. Contractor's repeated disregard of the authority of OPT.
- B. Contractor and surety must provide adequate assurance of future performance in accordance with the Contract Documents that is satisfactory to Owner if Contractor is believed to be in financial distress due to the existence of one or more of the indicators listed in Paragraph 16.02.A.4. Owner may terminate this Contract if Contractor and surety fail to provide adequate documentation satisfactory to Owner within 10 days of Construction Manager's request for this information.
- C. Owner may declare Contractor to be in default, give notice to Contractor and surety that the Contract is terminated, and enforce the rights available to Owner under the performance bond after giving Contractor and surety 10 days' notice that one or more of the events identified in Paragraph 16.02.A has occurred.
- D. Owner may exclude Contractor from the Site, take possession of the Work, incorporate the materials and equipment stored and complete the Work as Owner may deem expedient if Owner has terminated the Contract for cause.
- E. Owner may elect not to proceed with termination of the Contract under this Paragraph 16.02 if Contractor begins to cure the cause for termination within 7 days of receipt of notice of intent to terminate.
- F. Contractor is not entitled to receive further payments until the Work is completed if Owner proceeds as provided in this Paragraph 16.02. The amount of the Contract Price remaining is to be paid to Contractor if the unpaid balance exceeds the cost to complete the Work. This cost to complete the Work may include related claims, costs, losses, damages, and the fees and charges of engineers, architects, attorneys, and other professionals retained by Owner. Pay the difference to Owner if the cost to complete the Work including related claims, costs, losses, and damages exceeds the unpaid balance of the Contract Price. Claims, costs, losses, and damages incurred by Owner are to be reviewed as to their reasonableness and incorporated in a Change Order by Construction Manager. Owner is not required to obtain the lowest price for the Work performed when exercising its rights or remedies under this paragraph.
- G. Termination does not affect the rights or remedies of Owner against Contractor or against surety under the payment bond or performance bond. Owner does not release Contractor from liability by paying or retaining money due Contractor.

16.03 Owner May Terminate for Convenience

- A. Owner may terminate the Contract without cause after giving 7 days' notice to Contractor of the effective date of termination. Contractor is to be paid for the following if Owner terminates for convenience:
 - 1. Work completed in accordance with the Contract Documents prior to the effective date of termination;

2. Actual costs sustained prior to the effective date of termination for Work in progress, plus a fair and reasonable amount for overhead and profit; fee calculated in accordance with Paragraph 13.01; and
 3. Reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor will not be paid for loss of anticipated profits or revenue, post termination overhead costs, or other economic loss arising out of or resulting from this termination.

16.04 Contractor May Stop Work or Terminate

- A. Contractor may terminate the Contract and issue a Change Proposal requesting payment from Owner on the same terms as provided in Paragraph 16.03 after 10 days' notice to Construction Manager provided that, through no act or fault of Contractor:
1. The Work is suspended for more than 90 consecutive days by Owner;
 2. Construction Manager fails to act on an Application for Payment within 30 days after it is submitted; or
 3. Owner fails to pay Contractor sums determined to be due, other than the final payment, within 30 days after payment is recommended by Construction Manager; and
 4. OPT does not remedy this suspension or failure within 10 days after receipt of the notice.
- B. Contractor may stop Work, without prejudice to other rights or remedies in lieu of terminating the Contract if Construction Manager has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed to pay Contractor within 30 days after payment is recommended by Construction Manager. 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 for 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. The Owner or Contractor may appeal a Claim, approved or denied in part or in full, by:
1. Electing to invoke the dispute resolution process if one is provided for in the Supplementary Conditions;
 2. Agreeing with the other party to submit the dispute to a dispute resolution process; or
 3. Notifying the other party of the intent to submit the dispute to a court of competent jurisdiction if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to.

ARTICLE 18 – MISCELLANEOUS

18.01 Computation of Times

- A. Exclude the first day and include the last day when determining dates for a period referred to in the Contract Documents by days. The last day of this period is to be omitted from the determination if it falls on a Saturday, Sunday, or a legal holiday.
- B. All references and conditions for a calendar day contract in the Contract Documents apply for a Fixed Date Contract. A fixed date contract is one in which the calendar dates for reaching Substantial Completion and/or Final Completion are specified in lieu of identifying the number of calendar days involved.

18.02 Independent Contractor

- A. Contractor is to perform its duties under this Contract as an independent contractor. Contractor's Team and their personnel are not considered to be employees or agents of Owner. Nothing in this Agreement is to be interpreted as granting Contractor's Team the right or authority to make commitments for Owner. This Agreement does not constitute or create a joint venture, partnership, or formal business organization of any kind.

18.03 Cumulative Remedies

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available to the Owner or Contractor by these General Conditions are in addition to, and are not a limitation of, the rights and remedies which are otherwise imposed or available by:
 - 1. Laws or Regulations,
 - 2. Special warranties or guarantees, or
 - 3. Other provisions of the Contract Documents.
- B. The provisions of this Paragraph 18.03 are as effective as if repeated specifically in the Contract Documents regarding each duty, obligation, right, and remedy to which they apply.

18.04 Limitation of Damages

- A. Owner's Indemnitees are not liable to Contractor for claims, costs, losses, or damages sustained by Contractor's Team associated with other projects or anticipated projects.

18.05 No Waiver

- A. The failure of Owner or Contractor to enforce any provision of this Contract does not constitute a waiver of that provision, affect the enforceability of that provision, or the enforceability of the remainder of this Contract.

18.06 Severability

- A. If a court of competent jurisdiction renders a part of this Contract invalid or unenforceable, that part is to be severed and the remainder of this Contract continues in full force.

18.07 Survival of Obligations

- A. Representations, indemnifications, warranties, guarantees, and continuing obligations required by the Contract Documents survive completion and acceptance of the Work or termination of the Contract.

18.08 No Third-Party Beneficiaries

- A. Nothing in this Contract can be construed to create rights in any entity other than the Owner and Contractor. Neither the Owner nor Contractor intends to create third party beneficiaries by entering into this 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 Assignment of Contract

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights or interests in the Contract will be binding on the other party without the written consent of the other party. 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.

18.11 No Waiver of Sovereign Immunity

- A. Owner has not waived its sovereign immunity by entering into and performing its obligations under this Contract.

18.12 Controlling Law

- A. This Contract is to be governed by the law of the state in which the Project is located.
- B. Venue for legal proceedings lies exclusively in the county in which the Owner's home office is located unless specified elsewhere in the Contract Documents.

END OF SECTION

00 73 00 SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement Section 00 72 00 "General Conditions." 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.

The paragraph numbers used in the Supplementary Conditions correspond to the General Condition paragraphs they modify with the prefix "SC" added—for example, "Paragraph SC-4.05." modifies General Conditions Paragraph 4.05.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC-1.01 *Defined Terms*

- A. The Owner's Project Team as defined in the Paragraph 1.01.A.45 of the General Conditions consists of the following organizations:
 - 1. City of Keller, Texas 1100 Bear Creek Parkway Keller, Texas 76248
 - 2. Freese and Nichols, Inc. 801 Cherry Street, Suite 2800 Fort Worth, Texas 76102

ARTICLE 2 – PRELIMINARY MATTERS

SC-2.02 *Copies of Documents*

- A. Delete Paragraph 2.02.A in its entirety and insert the following in its place:
 - "A. Owner will furnish printed one copy in electronic portable document format (PDF) of the Contract Documents (including one fully executed counterpart of the Agreement). Printed copies will be furnished upon request at the cost of reproduction."

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

SC-5.03 *Subsurface and Physical Conditions*

- A. This Supplementary Condition identifies the reports and drawings referenced in Paragraph 5.03 of the General Conditions related to subsurface and physical conditions.
 - 1. 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	Report Date	Technical Data
N/A	N/A	N/A

- 2. 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:

Drawing Title	Drawing Date	Technical Data
Civil Sheets		

3. Copies of reports and drawings may be downloaded from the procurement website.

SC-5.06 Hazardous Environmental Conditions at Site

- A. This Supplementary Condition identifies the reports and drawings referenced in Paragraph 5.06 of the General Conditions related to Hazardous Environmental Conditions at the Site.

1. 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	Report Date	Technical Data
N/A	N/A	N/A

2. 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:

Drawing Title	Drawing Date	Technical Data
N/A	N/A	N/A

3. Copies of reports and drawings may be downloaded from the procurement website.

ARTICLE 6 – BONDS AND INSURANCE

SC-6.01 Performance, Payment, and Other Bonds

- A. Supplement Paragraph 6.01.D of the General Conditions by adding the following subparagraph(s):

- “1. Contractor must provide a warranty bond for equipment as specified. Surety company providing the warranty bond may be the same surety company that provides the performance bond for the Project. The term and amount of the bond will be as specified in the bond form. Bond must be written to cover the interest of the Contractor and Owner and be transferable to Owner at Final Completion.”
- “2. Contractor must provide a process performance bond in the full amount of the equipment cost as indicated in the amount shown for the equipment listed below and as described in the noted Specification Sections. This bond is to become effective the date of Substantial Completion for the equipment so designated in accordance with Paragraph 15.03, and will remain in effect for a period of **2** years after the date of Substantial Completion, except as provided otherwise by Laws or Regulations. Surety for the process performance bond must meet the same requirements as for performance and payment bonds set forth in Article 6. Specific requirements for these process performance bonds must be as established in the noted Specification Sections.”

Specification Section	Description of Equipment	Bond Amount	Bond Duration

ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES

SC-7.15 Indemnification

- A. Supplement Paragraph 7.15 by adding the following paragraph:
 - “C. Contractor’s obligations to indemnify or hold Owner’s Indemnitees harmless against losses, damages, or expenses specified in these General Conditions shall be subject to the applicable limitations of Chapter 130 of the Texas Civil Practice and Remedies Code.”

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

SC-13.01 Cost of the Work

- A. Supplement Paragraph 13.01.C.4.d.1) 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 Equipment Watch Cost Recovery Rental Rate Blue Book: <https://equipmentwatch.com/blue-book-cost-recovery/>.”

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; FINAL COMPLETION

SC-15.03 Substantial Completion

- A. The project is considered Substantially Complete when the ATS and Generator are operational.

END OF SECTION

00 73 17 TEXAS WORKERS' COMPENSATION INSURANCE

ARTICLE 1 – REQUIRED NOTICE

1.01 Workers' Compensation Insurance Coverage

A. Definitions:

1. Certificate of coverage ("certificate") - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the division, or a coverage agreement (DWC Form 81, DWC Form 82, DWC Form 83, or DWC Form 84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.
2. Duration of the project - includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.
3. Persons providing services on the project ("subcontractor" in §406.096) - includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

- B. The contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the contractor providing services on the project, for the duration of the project.
- C. The contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.
- D. If the coverage period shown on the contractor's current certificate of coverage ends during the duration of the project, the contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.
- E. The contractor shall obtain from each person providing services on a project, and provide to the governmental entity:
 1. a certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project; and
 2. no later than 7 days after receipt by the contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

- F. The contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.
- G. The contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.
- H. The contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Department of Insurance, Division of Workers' Compensation, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.
- I. The contractor shall contractually require each person with whom it contracts to provide services on a project, to:
 - 1. provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project;
 - 2. provide to the contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project;
 - 3. provide the contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
 - 4. obtain from each other person with whom it contracts, and provide to the contractor:
 - a. a certificate of coverage, prior to the other person beginning work on the project; and
 - b. a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
 - 5. retain all required certificates of coverage on file for the duration of the project and for one year thereafter;
 - 6. notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and
 - 7. contractually require each person with whom it contracts, to perform as required by paragraphs 1-7, with the certificates of coverage to be provided to the person for whom they are providing services.
- J. By signing this contract or providing or causing to be provided a certificate of coverage, the contractor is representing to the governmental entity that all employees of the contractor who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the

division. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

- K. The contractor's failure to comply with any of these provisions is a breach of contract by the contractor which entitles the governmental entity to declare the contract void if the contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

END OF SECTION

CITY OF KELLER
ACKNOWLEDGEMENT OF INSURANCE REQUIREMENTS

I acknowledge that by submitting a bid for this project, I am aware of the insurance requirements outlined in these specifications. If I am awarded the bid, I will comply with all insurance requirements within 10 working days of the bid award, including providing proof that I have insurance which may include, but not be limited to, true and accurate copies of the policies. If I fail to forward all insurance requirements within the 10 working days of the award of the bid, I understand my bid bond will be forfeited.

Signature

Printed name

Name of Company: _____

Address of Company: _____

City, State & Zip: _____

Telephone Number: (____) _____ Date: _____

****THIS PAGE MUST BE COMPLETED OR BID WILL BE REJECTED****

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: PHONE (A/C, No, Ext): E-MAIL: ADDRESS:	
	INSURER(S) AFFORDING COVERAGE	NAIC #
INSURED	INSURER A :	
	INSURER B :	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES

CERTIFICATE NUMBER:

REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
	GENERAL LIABILITY <input type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE <input type="checkbox"/> OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POLICY <input type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC						EACH OCCURRENCE \$ DAMAGE TO RENTED PREMISES (Ea occurrence) \$ MED EXP (Any one person) \$ PERSONAL & ADV INJURY \$ GENERAL AGGREGATE \$ PRODUCTS - COMP/OP AGG \$ \$
	AUTOMOBILE LIABILITY <input type="checkbox"/> ANY AUTO <input type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> SCHEDULED AUTOS <input type="checkbox"/> HIRED AUTOS <input type="checkbox"/> NON-OWNED AUTOS						COMBINED SINGLE LIMIT (Ea accident) \$ BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$ \$
	UMBRELLA LIAB <input type="checkbox"/> OCCUR EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE DED \$ RETENTION \$						EACH OCCURRENCE \$ AGGREGATE \$ \$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) <input type="checkbox"/> Y/N If yes, describe under DESCRIPTION OF OPERATIONS below		N/A				<input type="checkbox"/> WC STATUTORY LIMITS <input type="checkbox"/> OTHER E.L. EACH ACCIDENT \$ E.L. DISEASE - EA EMPLOYEE \$ E.L. DISEASE - POLICY LIMIT \$

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

00 73 43 WAGE RATE REQUIREMENTS

ARTICLE 1 – PAYMENT OF PREVAILING WAGE RATES

- 1.01 Contractor and Subcontractors employed on this Project must pay not less than the rates established by the Owner as required by Tex. Gov't Code Chapter 2258.
- 1.02 The minimum wage rates for various labor classifications as established by the Owner are included in Section 00 73 46 "Wage Determination Schedule."

ARTICLE 2 – PENALTY

- 2.01 In accordance with Section 2258.023(b), any Contractor or Subcontractor who violates the requirements of Chapter 2258 shall pay the Owner \$60 for each worker employed or each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the Contract.
- 2.02 Failure to comply with the requirements of Chapter 2258 may subject the Owner, Contractor, or Subcontractor(s) to additional civil and criminal penalties.

ARTICLE 3 – RECORDS

- 3.01 In accordance with Section 2258.024, the Contractor and its Subcontractors, if any, shall keep a record showing:
 - A. The name and occupation of each worker employed by the Contractor or Subcontractor in the construction of the Work; and
 - B. The actual per diem wages paid to each worker.
- 3.02 This record shall be open at all reasonable hours to inspection by the officers and agents of the OPT.

ARTICLE 4 – ENFORCEMENT

- 4.01 Owner will enforce the provisions related to the payment of prevailing wage rates as required by Chapter 2258, Subchapter C.
- 4.02 Owner may be required to withhold money forfeited or required to be withheld under Chapter 2258 from the payments to the Contractor. If required, these amounts will be withheld from payments to the Contractor through a Set-off in accordance with the General Conditions.

END OF SECTION

00 73 46 WAGE DETERMINATION SCHEDULE

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Duct, Pipe and Mechanical System Insulation)	\$ 31.32	7.52

BOIL0074-003 07/01/2023		
	Rates	Fringes
BOILERMAKER	\$ 37.00	24.64

CARP1421-002 10/01/2023		
	Rates	Fringes
MILLWRIGHT	\$ 32.02	11.27

* ELEV0021-006 01/01/2024		
	Rates	Fringes
ELEVATOR MECHANIC	\$ 49.71	37.885+a+b
FOOTNOTES:		
A. 6% under 5 years based on regular hourly rate for all hours worked. 8% over 5 years based on regular hourly rate for all hours worked.		
B. New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Veterans Day.		

ENGI0178-005 06/01/2020		
	Rates	Fringes
POWER EQUIPMENT OPERATOR		
(1) Tower Crane	\$ 32.85	13.10
(2) Cranes with Pile Driving or Caisson Attachment and Hydraulic		

Crane 60 tons and above	\$ 28.75	10.60
(3) Hydraulic cranes 59 Tons and under	\$ 32.35	13.10

IRON0263-005 06/01/2023

	Rates	Fringes
IRONWORKER (ORNAMENTAL AND STRUCTURAL	\$ 27.89	7.93

* PAIN0053-004 04/01/2014

	Rates	Fringes
PAINTER (Brush, Roller, and Spray (Excludes Drywall Finishing/Taping))	\$ 16.40 **	5.45

* PLUM0146-003 05/01/2024

	Rates	Fringes
PIPEFITTER (Excludes HVAC Pipe Installation)	\$ 39.78	12.06

* SUTX2014-048 07/21/2014

	Rates	Fringes
BRICKLAYER	\$ 20.66	0.00
CARPENTER, Excludes Drywall Hanging, Form Work, and Metal Stud Installation	\$ 15.47 **	1.82

CEMENT MASON/CONCRETE FINISHER	\$ 13.44 **	0.00
DRYWALL FINISHER/TAPER	\$ 16.24 **	3.94
DRYWALL HANGER AND METAL STUD INSTALLER	\$ 16.20 **	3.40
ELECTRICIAN (Alarm Installation Only)	\$ 18.00	0.38
ELECTRICIAN (Low Voltage Wiring Only)	\$ 14.88 **	2.15
ELECTRICIAN (Sound and Communication Systems Only)	\$ 17.79	2.41
ELECTRICIAN, Excludes Low Voltage Wiring and Installation of Alarms/Sound and Communication Systems	\$ 20.59	3.98
FORM WORKER	\$ 12.35 **	0.00
GLAZIER	\$ 16.61 **	2.96
HVAC MECHANIC (HVAC Unit Installation Only)	\$ 22.39	7.10
INSTALLER - SIDING (METAL/ALUMINUM/VINYL)	\$ 15.77 **	0.00
IRONWORKER, REINFORCING	\$ 12.19 **	0.00
LABORER: Common or General	\$ 11.30 **	0.00
LABORER: Mason Tender - Brick	\$ 10.50 **	0.00
LABORER: Mason Tender - Cement/Concrete	\$ 10.81 **	0.00
LABORER: Pipelayer	\$ 13.00 **	0.35

LABORER: Roof Tearoff	\$ 11.28 **	0.00
LABORER: Landscape and Irrigation	\$ 10.00 **	0.00
OPERATOR: Backhoe/Excavator/Trackhoe	\$ 13.09 **	0.00
OPERATOR: Bobcat/Skid Steer/Skid Loader	\$ 13.93 **	0.00
OPERATOR: Bulldozer	\$ 18.29	1.31
OPERATOR: Drill	\$ 17.60	0.50
OPERATOR: Forklift	\$ 14.20 **	0.00
OPERATOR: Grader/Blade	\$ 12.95 **	0.00
OPERATOR: Loader	\$ 12.89 **	1.19
OPERATOR: Mechanic	\$ 17.52	3.33
OPERATOR: Paver (Asphalt, Aggregate, and Concrete)	\$ 18.44	0.00
OPERATOR: Roller	\$ 15.04 **	0.00
PIPEFITTER (HVAC Pipe Installation Only)	\$ 21.28	4.45
PLASTERER	\$ 15.30 **	0.00
PLUMBER, Excludes HVAC Pipe Installation	\$ 22.10	4.17
ROOFER	\$ 15.70 **	0.58

SHEET METAL WORKER (HVAC Duct Installation Only)	\$ 21.54	5.59
SHEET METAL WORKER, Excludes HVAC Duct Installation	\$ 18.63	0.65
SPRINKLER FITTER (Fire Sprinklers)	\$ 19.27	3.68
TILE FINISHER	\$ 11.22 **	0.00
TILE SETTER	\$ 12.00 **	0.00
TRUCK DRIVER: Dump Truck	\$ 12.39 **	1.18
TRUCK DRIVER: Flatbed Truck	\$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck	\$ 12.50 **	0.00
TRUCK DRIVER: Water Truck	\$ 12.00 **	4.11

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

END OF SECTION

CERTIFICATE OF INTERESTED PARTIES**FORM 1295**

Complete Nos. 1 - 4 and 6 if there are interested parties.
Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.

OFFICE USE ONLY

1 Name of business entity filing form, and the city, state and country of the business entity's place of business.

2 Name of governmental entity or state agency that is a party to the contract for which the form is being filed.

3 Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the goods or services to be provided under the contract.

4 Name of Interested Party	City, State, Country (place of business)	Nature of Interest (check applicable)	
		Controlling	Intermediary

5 Check only if there is NO Interested Party.

☐**6 AFFIDAVIT**

I swear, or affirm, under penalty of perjury, that the above disclosure is true and correct.

Signature of authorized agent of contracting business entity

AFFIX NOTARY STAMP / SEAL ABOVE

Sworn to and subscribed before me, by the said _____, this the _____ day
of _____, 20 _____, to certify which, witness my hand and seal of office.

Signature of officer administering oath

Printed name of officer administering oath

Title of officer administering oath

ADD ADDITIONAL PAGES AS NECESSARY

FOR DISADVANTAGED BUSINESS ENTERPRISES ONLY

Disadvantaged Business Enterprises (DBE) are encouraged to participate in the City of Keller BID process. The City of Keller will provide additional clarification of specifications, assistance with BID Proposal Forms, and further explanation of bidding procedures to those DBEs who request it.

Representatives from DBE companies should identify themselves as such and submit a copy of the Certification.

The City recognizes the certifications of both the State of Texas Building and Procurement Commission HUB Program and the North Central Texas Regional Certification Agency. All companies seeking information concerning DBE certification are urged to contact:

State of Texas HUB Program
Texas Building & Procurement Commission
P O Box 13047
Austin, TX 78711-3047
(512) 463-5872

OR

North Central Texas Regional
Certification Agency
616 Six Flags Drive, #416-LB24
Arlington, TX 76011
(817) 640-0606

If your company is already certified, attach a copy of your certification to this form and return with BID.

COMPANY NAME: _____

REPRESENTATIVE: _____

ADDRESS: _____

CITY, STATE, ZIP: _____

TELEPHONE NO. _____ FAX NO. _____

INDICATE ALL THAT APPLY:

_____ Minority-Owned Business Enterprise
_____ Women-Owned Business Enterprise
_____ Disadvantaged Business Enterprise

Form TCG 2270
VERIFICATION REQUIRED BY TEXAS GOVERNMENT CODE CHAPTER 2279

Contract identifier: _____

Department: _____

By signing below, Company hereby verifies the following:

1. Company does not boycott Israel; and
2. Company will not boycott Israel during the term of the contract.

SIGNED BY: _____

Print Name of Person: _____

Signing, Title, and Company _____

Date signed: _____

STATE OF TEXAS §
COUNTY OF _____ §

BEFORE ME, the undersigned Notary Public on this day personally appeared _____ (Name), on behalf of _____ (Company) who being duly sworn, stated under oath that he/she has read the foregoing verification required by Texas Government Code Section 2270.002 and said statements contained therein are true and correct..

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

NOTARY OF PUBLIC,
FOR THE STATE OF TEXAS

My Commission Expires:

Government Code § 2270.002. Provision Required in Contract

Effective: September 1, 2017

A governmental entity may not enter into a contract with a company for goods or services unless the contract contains a written verification from the company that it:

- (1) does not boycott Israel; and
- (2) will not boycott Israel during the term of the contract.

The following definitions apply:

(1) "Boycott Israel" means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes.

(2) "Company" means a for-profit sole proprietorship, organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, or limited liability company, including a wholly owned subsidiary, majority-owned subsidiary, parent company, or affiliate of those entities or business associations that exists to make a profit.

(3) "Governmental entity" means a state agency or political subdivision of this state.

State law requires verification from a Company for contracts involving goods or services (regardless of the amount) before the City can enter into the contract.

01 11 00 SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Construct Work as described in the Contract Documents.
 - 1. Provide the materials, equipment, and incidentals required to make the Project completely and fully operable.
 - 2. Provide the labor, equipment, tools, and consumable supplies required for a complete Project.
 - 3. Provide the civil, structural, electrical, instrumentation, and all other Work required for a complete and operable Project.
 - 4. Test and place the completed Project in operation.
 - 5. Provide the special tools, spare parts, lubricants, supplies, or other materials as indicated in the Contract Documents for the operation and maintenance of the Project.
 - 6. The Contract Documents do not indicate or describe all Work required to complete the Project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Construction Manager.

1.02 DESCRIPTION OF WORK

- A. Work is described in general, non-inclusive terms as:

Install a backup generator, transformer, and transfer switch to power the Pearson Lower Pump Station.

1.03 WORK UNDER OTHER CONTRACTS

- A. Owner has no knowledge of work, other than the Work included in this Contract, which may impact construction scheduling, testing, and startup.

1.04 WORK BY OWNER

- A. Owner has no knowledge of work, other than the Work included in this Contract that may impact construction scheduling, testing, and startup.

1.05 CONSTRUCTION OF UTILITIES

- A. Existing utilities will be used for this Project. Coordinate with others performing Work associated with this Project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 26 00 CHANGE MANAGEMENT

PART 1 - GENERAL

1.01 REQUESTS FOR CHANGE PROPOSAL

- A. Construction Manager will initiate Modifications by issuing a Request for Change Proposal (RCP).
 - 1. Construction Manager and Design Professional will prepare a description of proposed Modifications.
 - 2. Construction Manager will issue the Request for Change Proposal form to Contractor. A number will be assigned to the Request for a Change Proposal when issued.
 - 3. Return a Change Proposal in accordance with Paragraph 1.02 for evaluation by the OPT.

1.02 CHANGE PROPOSALS

- A. Submit a Change Proposal (CP) to the Construction Manager for Contractor initiated changes in the Contract Documents or in response to a Request for Change Proposal. Submit the Change Proposal and attach the forms provided by the Construction Manager.
 - 1. Use the Change Proposal form provided by the Construction Manager.
 - 2. Include with the Change Proposal:
 - a. A complete description of the proposed Modification if Contractor initiated or proposed changes to the OPT's description of the proposed Modification.
 - b. The reason the Modification is requested, if not in response to a Request for a Change Proposal.
 - c. A detailed breakdown of the cost of the change if the Modification requires a change in Contract Price. The itemized breakdown is to include:
 - 1) List of materials and equipment to be installed;
 - 2) Man hours for labor by classification;
 - 3) Equipment used in construction;
 - 4) Consumable supplies, fuels, and materials;
 - 5) Royalties and patent fees;
 - 6) Bonds and insurance;
 - 7) Overhead and profit;
 - 8) Field office costs;
 - 9) Home office cost; and
 - 10) Other items of cost.
 - d. Provide the level of detail outlined in the paragraph above for each Subcontractor or Supplier actually performing the Work if Work is to be provided by a

Subcontractor or Supplier. Indicate appropriate Contractor mark ups for Work provided through Subcontractors and Suppliers. Provide the level of detail outlined in the paragraph above for self-performed Work.

- e. Submit Change Proposals that comply with the General Conditions for Cost of Work.
 - f. Provide a revised schedule. Show the effect of the change on the Project Schedule and the Contract Times.
- B. Submit a Change Proposal to the Construction Manager to request a Field Order.
 - C. A Change Proposal is required for all substitutions or deviations from the Contract Documents.
 - D. Request changes to products in accordance with Section 01 33 02 "Shop Drawings."

1.03 CONSTRUCTION MANAGER WILL EVALUATE THE REQUEST FOR A MODIFICATION

- A. Construction Manager will issue a Modification per the General Conditions if the Change Proposal is acceptable to the Owner. Construction Manager will issue a Change Order or Contract Amendment for any changes in Contract Price or Contract Times.
 - 1. Change Orders and Contract Amendments will be sent to the Contractor for execution with a copy to the Owner recommending approval. A Work Change Directive may be issued if Work needs to progress before the Change Order or Contract Amendment can be authorized by the Owner.
 - 2. Work Change Directives, Change Orders, and Contract Amendments can only be approved by the Owner.
 - a. Work performed on the Change Proposal prior to receiving a Work Change Directive or approval of the Change Order or Contract Amendment is performed at the Contractor's risk.
 - b. No payment will be made for Work on Change Orders or Contract Amendments until approved by the Owner.
- B. Contractor may be informed that the Change Proposal is not approved and construction is to proceed in accordance with the Contract Documents.

1.04 EQUAL NON-SPECIFIED PRODUCTS

- A. The products of the listed manufacturers are to be furnished where the Specifications list several manufacturers and do not specifically list "or equal" or "or approved equal" products. Use of any products other than those specifically listed is a substitution. Follow the procedures in Paragraph 1.05 for a substitution.
- B. Contractor may submit other manufacturers' products that are in full compliance with the Specifications where Specifications list one or more manufacturers followed by the phrase "or equal" or "or approved equal."
 - 1. Submit a Shop Drawing as required by Section 01 33 02 "Shop Drawings" to document that the proposed product is equal or superior to the specified product.

2. Prove that the product is equal. It is not the OPT's responsibility to prove the product is not equal.
 - a. Indicate on a point-by-point basis for each specified feature that the product is equal to the Contract Document requirements.
 - b. Make a direct comparison with the specified manufacturer's published data sheets and available information. Provide this printed material with the Shop Drawing.
 - c. The decision of the Design Professional regarding the acceptability of the proposed product is final.
 3. Provide a certification that, in furnishing the proposed product as an equal, the Contractor:
 - a. Has thoroughly examined the proposed product and has determined that it is equal or superior in all respects to the product specified.
 - b. Has determined that the product will perform in the same manner and result in the same process as the specified product.
 - c. Will provide the same warranties and/or bonds as for the product specified.
 - d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the product into the construction and will waive all claims for additional Work which may be necessary to incorporate the product into the Project which may subsequently become apparent.
 - e. Will maintain the same time schedule as for the specified product.
- C. A Change Proposal is not required for any product that is in full compliance with the Contract Documents. If the product is not in full compliance, it may be offered as a Substitution.

1.05 SUBSTITUTIONS

- A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product. Submit a Change Proposal per Paragraph 1.02 along with documents required for a Shop Drawing as required by Section 01 33 02 "Shop Drawings" to request approval of a substitution.
- B. Prove that the product is acceptable as a substitute. It is not the Design Professional's responsibility to prove the product is not acceptable as a substitute.
 1. Indicate on a point-by-point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.
 2. Make a direct comparison with the specified Suppliers published data sheets and available information. Provide this printed material with the Shop Drawing.
 3. The decision of the Design Professional regarding the acceptability of the proposed substitute product is final.

- C. Provide a certification that, in making the substitution request, the Contractor:
1. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product;
 2. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the manufacturer of the specified product;
 3. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the substituted product into the Project and will waive all claims for additional Work which may be necessary to incorporate the substituted product into the Project which may subsequently become apparent; and
 4. Will maintain the same time schedule as for the specified product.
- D. Pay for review of substitutions in accordance with Section 01 33 02 "Shop Drawings."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 29 00 APPLICATION FOR PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Submit Applications for Payment for completed Work and for materials and equipment in accordance with the General Conditions, the Supplementary Conditions, the Agreement, and this Section. The Contract Price is to include costs for:
 - 1. Providing the Work in accordance with the Contract Documents;
 - 2. Installing Owner furnished equipment and materials, if any;
 - 3. Providing Work for alternates and allowances, if any;
 - 4. Providing Work for extra work items, if any and if authorized
 - 5. Commissioning, startup, training, and initial maintenance and operation;
 - 6. Acceptance testing at the manufacturer's facilities or at the Site;
 - 7. All home office overhead costs and expenses, including profit made directly or indirectly from the Project;
 - 8. Project management, contract administration, and field office and field operations staff including supervision, clerical support, and technology system support;
 - 9. Professional services including design fees, legal fees, and other professional services;
 - 10. Bonds and insurance;
 - 11. Permits, licenses, patent fees, and royalties;
 - 12. Taxes;
 - 13. Providing all documentation and Samples required by the Contract Documents;
 - 14. Facilities and equipment at the Site including:
 - a. Field offices, office furnishings, and all related office supplies, software, and equipment,
 - b. Storage facilities for Contractor's use and storage facilities for stored materials and equipment including spare parts storage,
 - c. Shops, physical plant, construction equipment, small tools, vehicles, and technology and telecommunications equipment,
 - d. Safety equipment and facilities to provide safe access and working conditions for workers and for others working at the Site,
 - e. Temporary facilities for power and communications,
 - f. Potable water and sanitation facilities, and
 - g. Mobilization and demobilization for all these facilities and equipment.
 - 15. Products, materials, and equipment stored at the Site or other suitable location in accordance with Section 01 31 00 "Project Management and Coordination";

16. Products, materials, and equipment permanently incorporated into the Project;
 17. Temporary facilities for managing water including facilities for pumping, storage, and treatment as required for construction and protection of the environment;
 18. Temporary facilities for managing environmental conditions and Constituents of Concern;
 19. Temporary facilities such as sheeting, shoring, bracing, formwork, embankments, storage facilities, working areas, and other facilities required for construction of the Project;
 20. Temporary and permanent facilities for protection of all overhead, surface, or underground structures or features;
 21. Temporary and permanent facilities for removal, relocation, or replacement of any overhead, surface, or underground structures or features;
 22. Products, materials, and equipment consumed during the construction of the Project;
 23. Contractor labor and supervision to complete the Project including that provided through Subcontractors or Suppliers;
 24. Correcting Defective Work during the Contract Times, during the Correction Period, or as required to meet any warranty provision of the Contract Documents;
 25. Risk associated with weather and environmental conditions, startup, and initial operation of facilities including equipment, processes, and systems;
 26. Contractor safety programs, including management, administration, and training;
 27. Maintenance of facilities including equipment, processes, and systems until operation is transferred to Owner;
 28. Warranties, extended or special warranties, or extended service agreements;
 29. Cleanup and disposal of any and all surplus materials; and
 30. Demobilization of all physical, temporary facilities not incorporated into the Project.
- B. Include the cost not specifically set forth as an individual payment item but required to provide a complete and functional system in the Contract Price.
 - C. Provide written approval of the surety company providing performance and payment bonds for the Schedule of Values, Application for Payment form, and method of payment prior to submitting the first Application for Payment. Submit approval using the "Consent of Surety Company to Payment Procedures" form provided by the Construction Manager. Payment will not be made without this approval.
 - D. Construction Manager may withhold processing the Applications for Payment if any of the following processes or documentation is not up to date:
 1. Progress Schedule per Section 01 33 05 "Construction Progress Schedule."
 2. Project videos and photographs per Section 01 33 06 "Graphic Documentation."
 3. Record Documents per Section 01 31 13 "Project Administration."

1.02 SCHEDULE OF VALUES

- A. Divide the Contract Price into an adequate number of line items to allow more accurate determination of the earned value for each line item when evaluating progress payments. Submit a detailed Schedule of Values for the Project at least 10 days prior to submitting the first Application for Payment using forms provided by the Construction Manager.
- B. Do not apply for payment until the Schedule of Values has been approved by the Construction Manager.
- C. Divide the cost associated with each line item in the Schedule of Values into installation and materials components.
 - 1. Installation cost is to include all cost associated with the line item except materials cost.
 - 2. Materials cost is the direct cost (as verified by invoice values) for products, materials, and equipment to be permanently incorporated into the Project associated with the line item.
 - 3. Installation cost is to include all direct costs and a proportionate amount of the indirect costs for the Work associated with each line item. Include costs not specifically set forth as an individual payment item but required to provide a complete and functional system.
 - 4. The sum of materials and installation costs for all line items must equal the Contract Price.
- D. Use each unit price line item in the Agreement as a line item in the Schedule of Values. The sum of materials and installation costs for each line item for unit price contracts must equal the value of the line item in the Agreement. In addition to the installation cost described in Paragraph 1.02.C.3, installation costs for unit price items are to include costs for waste and overages.
 - 1. Installation and materials cost may be left as a single installation component if:
 - a. Contractor does not intend to request payment for stored materials for that line item; or
 - b. Work in the line item will be completed within a single payment period.
 - 2. Provide adequate detail to allow a more accurate determination of the earned value for installation costs, expressed as a decimal fraction of Work completed, for each line item.
 - 3. Installation cost line items may not exceed \$50,000.00. Items that are not subdivided into smaller units may only be included in the Application for Payment when Work on the entire unit is complete.
 - 4. Lump sum items may be divided into an estimated number of units to estimate earned value. The estimated number of units times the cost per unit must equal the lump sum amount for that line item.
 - 5. Include Contractor's overhead and profit in the installation costs each line item in proportion to the value of the line item to the Contract Price.

6. Include cost not specifically set forth as an individual payment item but required to provide a complete and functional system in the Contract Price for each item.
 7. Line items may be used to establish the value of Work to be added or deleted from the Project.
- E. Include a breakdown of both mobilization and demobilization costs in the Schedule of Values. The total cost for both mobilization and demobilization may not exceed 5% percent of the total Contract Price. Payment for mobilization and demobilization will be based on the earned value of Work completed. Payment for these costs will only be made for Work completed for the following:
1. Bonds and insurance;
 2. Transportation and setup for equipment;
 3. Transportation and/or erection of all field offices, sheds, and storage facilities;
 4. Salaries for preparation of documents required before the first Application for Payment; and
 5. Salaries for field personnel directly related to the mobilization of the Project.

1.03 SCHEDULE OF ANTICIPATED PAYMENTS

- A. Submit a schedule of the anticipated Application for Payments showing the anticipated application numbers, submission dates, and the amount to be requested for each Application for Payment on the form provided by the Construction Manager.
- B. Update the schedule of anticipated payments as necessary to provide a reasonably accurate indication of the funds required to make payments each month to the Contractor for Work performed.

1.04 ALTERNATES, ALLOWANCES, AND EXTRA WORK ITEMS

- A. Include line items and amounts for specified alternate Work and allowances for Work in the Agreement, if any, and as described in Section 01 23 10 "Alternates and Allowances."
- B. Include line items and amounts for Extra Work items in the Agreement, if any, and as described in Section 01 29 01 "Measurement and Basis for Payment."

1.05 RETAINAGE AND SET-OFFS

- A. Retainage will be withheld from each Application for Payment per the Agreement.
- B. Reduce payments for set-offs per the General Conditions as directed by the Construction Manager.

1.06 PROCEDURES FOR SUBMITTING AN APPLICATION FOR PAYMENT

- A. Submit a draft Application for Payment to the Construction Manager each month at least **20** days before the date established in the Agreement for Owner to make progress payments. Do not submit Applications for Payment more often than monthly. Review the

draft Application for Payment with the Construction Manager to determine concurrence with:

1. Values requested for materials and equipment, stored or incorporated into the Project as documented by invoices;
 2. The earned value for installation costs for each line item in the Application for Payment form expressed as a percent complete for that line item;
 3. The quantity of Work completed for each unit price item;
 4. Amount of retainage to be withheld; and
 5. Set-offs included in the Application for Payment.
- B. Submit Applications for Payment to the Construction Manager after agreement has been reached on the draft Application for Payment with the Construction Manager.
- C. Provide all information requested in the Application for Payment form. Do not leave any blanks incomplete. If information is not applicable, enter "N/A" in the space provided.
1. Number each application sequentially and include the dates for the application period.
 2. Complete the "Contract Time Summary" section on the Application for Payment form. If the Final Completion date shows the Project is more than 30 days behind schedule, revise the Schedule of Anticipated Payments to correspond to the updated schedule required per Section 01 33 05 "Construction Progress Schedule."
 3. Complete the "Summary of Earned Value and Set-offs" section on the Application for Payment form. Show the total amounts for earned value of original Contract performed, earned value for Work on approved Contract Amendments and Change Orders, retainage and set-offs.
 4. Sign and date the Contractor's Certification on the Application for Payment form that all Work, including materials, covered by this Application for Payment have been completed or delivered and stored in accordance with the Contract Documents, that all amounts have been paid for Work, materials, and equipment for which previous Payment has been made by the Owner, and that the current payment amount shown in this Application for Payment is now due.
 5. Include "Attachment A - Tabulation of Earned Value of Original Contract Performed" to show the value of materials stored and successfully incorporated into the Project and the earned value for installation of the Work for each line item in the Application for Payment for Work. Attachment A includes Work on the original Contract Price and on approved Contract Amendments and Change Orders.
 6. Include "Attachment B - Tabulation of Values for Materials and Equipment" to track invoices used to support amounts requested as materials in Attachment A. Enter materials to show the amount of the invoice assigned to each item in Attachment A if an invoice includes materials used on several line items.
 7. Include "Attachment C - Summary of Set-offs" to document set-offs made per the Contract Documents. Show each set-off as it is applied. Show a corresponding line item to reduce the set-off amount if a payment held by a set-off is released for payment.

8. Include "Attachment D - Retainage Calculation" to show method for calculating retainage. The amount of retainage with respect to progress payments is stipulated in the Agreement. Any request for a reduction in retainage must be accompanied by a Consent of Surety to Reduction or Partial Release of Retainage.
 9. Include "Attachment E - EVA Calculation" and the EVA Chart showing the anticipated and actual total earned value of fees, Work, and materials. Create a graphic representation (curve) of the anticipated progress on the Project each month. Compare the anticipated cumulative total earned value of fees, Work, and materials to the actual total earned value of fees, Work, and materials to determine performance on budget and schedule. Adjust the table and curve to incorporate Modifications.
- D. Submit attachments in Portable Document Format (PDF).
1. Generate attachments to the Application for Payment using the Excel spreadsheet provided by the Construction Manager.
 2. Submit PDF documents with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 paper.

1.07 ADJUSTMENTS TO THE SCHEDULE OF VALUES IN THE APPLICATION FOR PAYMENT

- A. Submit a Change Proposal to request any changes to the Schedule of Values incorporated into the Application for Payment once approved. A Field Order will be issued by the Construction Manager to modify the Application for Payment form if approved.
- B. Payment for materials and equipment shown in the Application for Payment will be made for the total of associated invoice amounts, up to the value shown for materials in the Application for Payment for that line item.
 1. If the total amount for invoices for materials and equipment for a line item are less than the amount shown for the materials component of that line item in the Application for Payment, and it can be demonstrated that no additional materials or equipment are required to complete Work described in that item, the difference between the total invoice for materials and equipment and the materials component for that line item can be added to the installation component of that Work item.
 2. Costs for material and equipment in excess of the value shown in the Schedule of Values may not be paid for under other line items.

1.08 CONSTRUCTION MANAGER'S RESPONSIBILITY

- A. Construction Manager will review each draft Application for Payment with Contractor to reach an agreement on the amount to be recommended to Owner for payment. Contractor is to revise the Application for Payment to incorporate changes, if any, resulting from this review process.
- B. Construction Manager will review the Application for Payment to determine that the Application for Payment has been properly submitted and is in accordance with the agreed to draft Application for Payment.
- C. Construction Manager will either recommend payment of the Application for Payment to Owner or notify the Contractor of the reasons for not recommending payment. Contractor

may make necessary corrections and resubmit the Application for Payment. Construction Manager will review resubmitted Application for Payment and reject or recommend payment of the Application for Payment to Owner as appropriate.

- D. Construction Manager's recommendation of the Application for Payment constitutes a representation that based on its experience and the information available:
 - 1. The Work has progressed to the point indicated;
 - 2. The quality of the Work is generally in accordance with the Contract Documents; and
 - 3. Requirements prerequisite to payment have been met.
- E. This representation is subject to:
 - 1. Further evaluation of the Work as a functioning whole;
 - 2. The results of subsequent tests called for in the Contract Documents; or
 - 3. Any other qualifications stated in the recommendation.
- F. Construction Manager does not represent by recommending payment that:
 - 1. Inspections made to check the quality or the quantity of the Work as it was performed were exhaustive or extended to every aspect of the Work in progress; or
 - 2. Other matters or issues that might entitle Contractor to additional compensation or entitle Owner to withhold payment to Contractor exist.
- G. Neither Construction Manager's review of Contractor's Work for the purposes of recommending payments nor Construction Manager's recommendation of payment imposes responsibility on the Construction Manager or Owner:
 - 1. To supervise, direct, or control the Work;
 - 2. For the means, methods, techniques, sequences, or procedures of construction, or safety precautions and programs;
 - 3. For Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
 - 4. To make examinations to ascertain how or for what purposes Contractor has used the monies paid on account of the Contract Price; or
 - 5. To determine that title to the Work, materials, or equipment has passed to Owner free and clear of Liens.

1.09 FINAL APPLICATION FOR PAYMENT

- A. Include adjustments to the Contract Price in the final Application for Payment for:
 - 1. Approved Change Orders and Contract Amendments;
 - 2. Allowances not previously adjusted by Change Order;
 - 3. Deductions for Defective Work that have been accepted by the Owner;
 - 4. Penalties and bonuses;
 - 5. Deduction for all final set-offs; and

6. Other adjustments if needed.
- B. Construction Manager will prepare a final Change Order reflecting the approved adjustments to the Contract Price which have not been covered by previously approved Change Orders and, if necessary, to reconcile estimated unit price quantities with actual quantities.
- C. Submit the final Application for Payment per the General Conditions, including the final Change Order. Provide the following with the final Application for Payment:
 1. Evidence of payment or release of Liens on the forms provided by the Construction Manager and as required by the General Conditions.
 2. Consent from surety to final payment.
- D. Final payment will also require additional procedures and documentation per Section 01 70 00 "Execution and Closeout Requirements."

1.10 PAYMENT BY OWNER

- A. Owner is to pay the amount recommended for monthly payments within 30 days after receipt of the Construction Manager's recommended Application for Payment.
- B. Final payment may take longer than 30 days since Owner's board must approve final payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 29 01 MEASUREMENT AND BASIS FOR PAYMENT

PART 1 - GENERAL

1.01 PAYMENT FOR MATERIALS AND EQUIPMENT

- A. Payment will be made for materials and equipment materials properly stored and successfully incorporated into the Project less the specified retainage.
- B. Provide a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of Liens. Provide documentation of payment for materials and equipment with the next Application for Payment. Remove items from the tabulation of materials and equipment if this documentation is not provided with the next Application for Payment.
- C. Provide evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest.
- D. The Work covered by progress payments becomes the property of the Owner at the time of payment. The Contractor's obligations with regard to proper care and maintenance, insurance, and other requirements are not changed by this transfer of ownership until final acceptance in accordance with the General Conditions.
- E. Payment for materials and equipment does not constitute acceptance of the product.

1.02 MEASUREMENT AND BASIS FOR PAYMENTS ON LUMP SUM ITEMS

- A. Measurement for progress payments is the invoice value for stored materials and the earned value for all other cost for constructing each item. Earned value is expressed as the value of the Work completed divided by the total value of installation cost. The total amount paid will be equal to the total lump sum amount for that item.

1.03 MEASUREMENT AND BASIS FOR PAYMENTS ON UNIT PRICE ITEMS

- A. Measure the Work using the unit of measure indicated in this Section for each unit price line item. Payment will be made only for the actual measured unit and/or computed length, area, solid contents, number, and weight unless other provisions are made in the Contract Documents. Payment on a unit price basis will not be made for Work outside dimensions shown in the Contract Documents.
- B. Payment will be made for the actual quantity of Work completed and for materials and equipment stored during the payment period. Payment amount is the Work quantity measured per Paragraph A above multiplied by the unit price for that line item in the Agreement.

1.04 MEASUREMENT AND BASIS FOR PAYMENT FOR BASE ITEMS

- A. Item - Mobilization:
 - 1. Measuring for payment is on a lump sum basis. Payment for mobilization will be based on the earned value of Work completed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish resources required to complete the Project in accordance with the Contract Documents and within the Contract Times.
- B. Construct Project in accordance with current safety practices.
- C. Manage Site to allow access to Site and control construction operations.
- D. Construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.
- E. Provide temporary controls for pollution, management of water, and management of excess earth as required in Section 01 57 00 "Temporary Controls."

1.02 STANDARDS

- A. Perform Work to comply with:
 - 1. Requirements of the Contract Documents;
 - 2. Laws and Regulations; and
 - 3. Specified industry standards.

1.03 DOCUMENTATION

- A. Provide documents in accordance with Section 01 33 00 "Document Management."
- B. Provide copies of Supplier's printed storage instructions prior to furnishing materials or products and installation instructions prior to beginning the installation.
- C. Incorporate field notes, sketches, recordings, and computations made by the Contractor in Record Drawings per Section 01 31 13 "Project Administration."

1.04 PERMITS

- A. Obtain building permits for the Project from the local authorities having jurisdiction. Pay building permit fees and include these costs in the Contract Price.
- B. Obtain environmental permits required for construction at the Site.
- C. Provide required permits for transporting heavy or oversized loads.
- D. Provide other permits required to conduct any part of the Work.
- E. Arrange for inspections and certification by agencies having jurisdiction over the Work and include the cost for these inspections and certifications in the Contract Price.
- F. Make arrangements with private utility companies and pay fees associated with obtaining services or inspections.
- G. Retain copies of permits and licenses at the Site and comply with all regulations and conditions of the permit or license.

1.05 SAFETY REQUIREMENTS

- A. Manage safety to protect the safety and welfare of persons at the Site.
- B. Provide safe access to move through the Site. Provide protective devices to warn and protect from hazards at the Site.
- C. Provide safe access for those performing tests and inspections.
- D. Maintain a supply of personal protective equipment for visitors to the Site.
- E. Comply with latest provisions of the Occupational Health and Safety Administration (OSHA) and other Laws and Regulations.
- F. Cooperate with accident investigations. Provide two copies of all reports, including insurance company reports, prepared concerning accidents, injuries, or deaths related to the Project to the Construction Manager as Record Data per Section 01 31 13 "Project Administration."

1.06 ACCESS TO THE SITE

- A. Maintain access to the facilities at all times. Do not obstruct roads, pedestrian walks, or access to the various buildings, structures, stairways, or entrances. Provide safe access for normal operations during construction.
- B. Provide adequate and safe access for inspections. Leave ladders, bridges, scaffolding, and protective equipment in place until inspections have been completed. Construct additional safe access if required for inspections.
- C. Use roadways for construction traffic only with written approval of the appropriate representatives of each entity. Roadways may not be approved for construction traffic. Obtain written approval to use roads to deliver heavy or oversized loads to the Site. Furnish copies of the written approvals to the Construction Manager as Record Data per Section 01 31 13 "Project Administration."

1.07 CONTRACTOR'S USE OF THE SITE

- A. Limit the use of Site for Work and storage to those areas designated on the Drawings or approved by the Construction Manager. Coordinate the use of the Site with the Construction Manager.
- B. Provide security at the Site as necessary to protect against vandalism and loss by theft.
- C. Park construction equipment in designated areas only and provide spill control measures as discussed in Section 01 57 00 "Temporary Controls."
- D. Park employees' vehicles in designated areas only.
- E. Obtain written permission of the property owner before entering privately-owned land outside of the Owner's property, rights-of-way, or easements.
- F. Cooperate with public and private agencies with facilities operating within the limits of the Project. Provide 48 hours' notice to any applicable agency when Work is anticipated to proceed in the vicinity of any facility by using 811.

G. Conduct of Contractor's or Subcontractor's Employees:

1. Do not permit alcoholic beverages or illegal substances on the Site. Do not allow persons under the influence of alcoholic beverages or illegal substances to enter or remain on the Site at any time. Persons on Site under the influence of alcoholic beverages or illegal substances will be permanently prohibited from returning to the Site. Criminal or civil penalties may also apply.
2. Do not allow the use of offensive language or sexual harassment in any form. These actions will cause immediate and permanent removal of the offender from the premises. Criminal or civil penalties may apply.
3. Require workers to wear clothing that is inoffensive and meets safety requirements. Do not allow sleeveless shirts, shorts, or any exceedingly torn, ripped, or soiled clothing to be worn on the Site.
4. Do not allow the use, possession, concealment, transportation, promotion, or sale of the following prohibited items anywhere on the Site:
 - a. Firearms (including air rifles and pistols and BB or pellet guns) and ammunition;
 - b. Bows, crossbows, arrows, bolts, or any other projectile weapons;
 - c. Explosives of any kind, including fireworks;
 - d. Illegal knives;
 - e. Other weapons prohibited by state Laws and Regulations; and
 - f. Any other item that has been designed or intended to be used as a weapon.

No exceptions will be made for the possession of a firearm by a person that has a valid state-issued license to carry a firearm. Remove any of the prohibited items listed above from the Site immediately and permanently. Any person found to be in possession of any prohibited item must also be removed from the Site and may be reported to local law enforcement.

1.08 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. Examine the Site and review the available information concerning the Site. Locate utilities, underground facilities, and existing structures. Verify the elevations of the structures adjacent to excavations. Report any discrepancies from information in the Contract Documents to the Construction Manager before beginning construction.
- B. Determine if existing structures, poles, piping, or other utilities at excavations will require relocation or replacement. Prepare a Plan of Action per Section 01 31 13 "Project Administration." Coordinate Work with local utility company and others for the relocation or replacement.
- C. Protect utilities, underground facilities and existing structures unless they are shown to be replaced or relocated on the Drawings. Restore damaged items to the satisfaction of the Owner and utility or property owner.
- D. Carefully support and protect all structures and/or utilities so that there will be no failure or settlement where excavation or demolition endangers adjacent structures and utilities. Do not take existing utilities out of service unless required by the Contract Documents or

approved by the Construction Manager. Notify and cooperate with the utility owner if it is necessary to move services, poles, guy wires, pipelines, or other obstructions.

- E. Protect existing trees and landscaping at the Site. Mark trees that may be removed during construction and review with the Construction Manager for approval before removing. Protect trees to remain from damage limiting activity, including stockpiling of materials within the drip line of the tree.
- F. Protect buildings from damage when handling material or equipment. Protect finished surfaces, including floors, doors, and jambs. Remove doors and install temporary wood protective coverings over jambs, if needed.

1.09 DISRUPTION TO SERVICES/CONTINUED OPERATIONS

- A. Owner's facilities are to continue in service as usual during the construction unless noted otherwise. Owner or utilities must be able to operate and maintain the facilities. Keep disruptions to existing utilities, piping, process piping, or electrical services to a minimum.
 - 1. Do not restrict access to critical valves, operators, or electrical panels.
 - 2. Do not store material or products inside structures unless authorized by the Construction Manager.
 - 3. Limit operations to the minimum amount of space needed to complete the specified Work.
 - 4. Maintain storm sewers and sanitary sewers in service at all times. Provide temporary service around the construction or otherwise construct the Work in a manner that flow is not restricted.
- B. Provide a Plan of Action in accordance with Section 01 35 00 "Special Procedures" if facilities must be taken out of operation.

1.10 FIELD VERIFICATION

- A. Perform complete field measurements prior to purchasing products or beginning construction for products required to fit existing conditions.
- B. Verify property lines, control lines, grades, and levels indicated on the Drawings.
- C. Verify pipe class, equipment capacities, existing electrical systems, and power sources for existing conditions.
- D. Check Shop Drawings and indicate the actual dimensions available where products are to be installed.
- E. Include field measurements in Record Documents as required in Section 01 31 13 "Project Administration."

1.11 REFERENCE DATA AND CONTROL POINTS

- A. Construction Manager will provide the following control points:
 - 1. Base line or grid reference points for horizontal control.
 - 2. Benchmarks for vertical control.

- B. Locate and protect control points prior to starting the Work and preserve permanent reference points during construction. Designated control points may be on an existing structure or monument. Do not change or relocate points without prior approval of the Construction Manager. Notify Construction Manager when a reference point is lost, destroyed, or requires relocation. Replace Project control points on the basis of the original survey. Control points or benchmarks damaged, disturbed or destroyed as a result of the Contractor's negligence will be restored by the Construction Manager. Owner will impose a set-off as compensation for the effort required.
- C. Provide complete engineering layout of the Work needed for construction.
 - 1. Provide competent personnel. Provide equipment including accurate surveying instruments, stakes, platforms, tools, and materials.
 - 2. Provide Record Data per Section 01 31 13 "Project Administration" and measurements per standards.

1.12 DELIVERY AND STORAGE

- A. Deliver products and materials to the Site in time to prevent delays in construction.
- B. Deliver packaged products to Site in original undamaged containers with identifying labels attached. Open cartons as necessary to check for damage and to verify invoices. Reseal cartons and store properly until used. Leave products in original packages or other containers until installed. If original packages or containers are damaged, repackage in containers and include packing slips, labels and other information from the original packaging.
- C. Deliver products that are too large to fit through openings to the Site in advance of the time enclosing walls and roofs are erected. Set in place, raised above floor on cribs or pallets.
- D. Assume full responsibility for the protection and safekeeping of products stored at the Site.
- E. Store products at locations acceptable to the Construction Manager and to allow Owner access to maintain and operate existing facilities.
- F. Store products in accordance with the Supplier's storage instructions immediately upon delivery. Leave seals and labels intact. Arrange storage to allow access for maintenance of stored items and for inspection. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.
- G. Provide additional storage areas as needed for construction. Store products subject to damage by elements in substantial weather-tight enclosures or storage sheds. Provide and maintain storage sheds as required for the protection of products. Provide temperature, humidity control, and ventilation within the ranges stated in the Supplier's instructions. Remove storage facilities at the completion of the Project.
- H. Protect the pipe interior. Keep all foreign materials such as dirt, debris, animals, or other objects out of the pipe during the Work.
- I. Provide adequate exterior storage for products that may be stored out-of-doors.
 - 1. Provide substantial platforms, blocking, or skids to support materials and products above ground which has been sloped to provide drainage. Protect products from soiling or staining.

2. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet materials. Provide ventilation to prevent condensation below covering.
 3. Store loose, granular materials on clean, solid surfaces, or on rigid sheet materials, to prevent mixing with foreign matter.
 4. Provide surface drainage to prevent erosion and ponding of water.
 5. Prevent mixing of refuse or chemically injurious materials or liquids with stored materials.
 6. Pipes and conduits stored outdoors are to have open ends sealed to prevent the entrance of dirt, moisture, and other injurious materials. Protect PVC pipe from ultraviolet light exposure.
 7. Store products to prevent wind damage.
- J. Protect and maintain mechanical and electrical equipment in storage.
1. Provide Supplier's service instructions on the exterior of the package.
 2. Service equipment on a regular basis as recommended by the Supplier. Maintain a log of maintenance services. Submit the log as Record Data per Section 01 31 13 "Project Administration" when Owner assumes responsibility for maintenance and operation.
 3. Provide power to and energize space heaters for all equipment for which these devices are provided.
 4. Provide temporary enclosures for all electrical equipment, including electrical systems on mechanical devices. Provide and maintain heat in the enclosures until equipment is energized.
- K. Maintain storage facilities. Inspect stored products on a weekly basis and after periods of severe weather to verify that:
1. Storage facilities continue to meet specified requirements;
 2. Supplier's required environmental conditions are continually maintained; and
 3. Products that can be damaged by exposure to the elements are not adversely affected.
- L. Replace any stored item damaged by inadequate protection or environmental controls.
- M. Payment may be withheld for any products not properly stored.

1.13 CLEANING DURING CONSTRUCTION

- A. Provide positive methods to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from discharging into the atmosphere. Control dust and dirt from demolition, cutting, and patching operations.
- B. Clean the Site as Work progresses and dispose of waste materials, keeping the Site free from accumulations of waste or rubbish. Provide containers at the Site for waste collection. Do not allow waste materials or debris to blow around or off of the Site. Control dust from waste materials. Transport waste materials with as few handlings as possible.

- C. Comply with Laws and Regulations. Do not burn or bury waste materials. Remove waste materials, rubbish, and debris from the Site and legally dispose of these at public or private disposal facilities.

1.14 MAINTENANCE OF ROADS, DRIVEWAYS, AND ACCESS

- A. Maintain roads and streets in a manner that is suitable for safe operations of public vehicle during all phases of construction unless the Owner approves a street closing. Do not close public roads overnight. Coordinate and arrange for emergency vehicle access when streets are to be closed.
- B. Submit a Notification by Contractor for Owner's approval of a street closing. The request must state:
 - 1. The reason for closing the street.
 - 2. How long the street will remain closed.
 - 3. Procedures to be taken to maintain the flow of traffic.
- C. Obtain permits and permissions of the entity that owns the road prior to any Work and provide a copy of the permit or permission Record Data per Section 01 31 13 "Project Administration."
- D. Construct temporary detours, including by-pass roads around construction, with adequately clear width to maintain the free flow of traffic at all times. Maintain barricades, signs, and safety features around the detour and excavations. Maintain barricades, signs, and safety features around the Work in accordance with all provisions of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).
- E. Assume responsibility for any damage resulting from construction along roads or drives.

1.15 BLASTING

- A. Blasting is not allowed for any purpose.

1.16 ARCHAEOLOGICAL REQUIREMENTS

- A. Cease operations immediately and contact the Owner for instructions if historical or archaeological artifacts are found during construction.
- B. Conduct all construction activities to avoid adverse impact of the sites where significant historical or archaeological artifacts are found or identified as an area where other artifacts could be found.
 - 1. Obtain details for working in these areas from regulatory agencies.
 - 2. Maintain confidentiality regarding the site(s) of artifacts.
 - 3. Adhere to the requirements of applicable local, state, and federal Laws and Regulations.
 - 4. Notify the Construction Manager and any local, state, or federal agency as required by applicable Laws and Regulations.
- C. Do not disturb archaeological sites.

1. Obtain the services of a qualified archaeological specialist to instruct construction personnel on how to identify and protect archaeological finds on an emergency basis.
2. Coordinate activities to permit archaeological work to take place within the area.
 - a. Attempt to archaeologically clear areas needed for construction as soon as possible.
 - b. Provide a determination of priority for such areas.
- D. Assume responsibility for any unauthorized destruction that might result to such sites by construction personnel, and pay all penalties assessed by state or federal agencies for non-compliance with these requirements.
- E. Contract Times will be modified to compensate for delays caused by such archaeological finds. No additional compensation will be paid for delays.

1.17 ENDANGERED SPECIES RESOURCES

- A. Do not perform any activity that is likely to destroy or adversely modify the habitat or jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA) or applicable state Laws and Regulations.
- B. Cease Work immediately in the area of the encounter and notify the Construction Manager if a threatened or endangered species is encountered during construction. Construction Manager will implement actions in accordance with the ESA and applicable state statutes. Resume construction in the area of the encounter when authorized to do so by the Construction Manager.

1.18 OCCUPANCY

- A. Owner has the right to occupy or operate any portion of the Project that is ready for use after notifying the Contractor of its intent to do so.
- B. Testing of equipment and appurtenances including specified test periods, training, and startup does not constitute acceptance for operation.
- C. Owner may accept the facility for continued use after startup and testing at the option of the Owner. If acceptance is delayed at the option of the Owner, shut down facilities per approved operation and maintenance procedures.
- D. The execution of bonds is understood to indicate the consent of the surety to these provisions for occupancy of the structures and use of equipment.
- E. Provide an endorsement from the insurance carrier permitting occupancy of the structures and use of equipment during the remaining period of construction.
- F. Conduct operations to ensure the least inconvenience to the Owner and general public.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 31 13 PROJECT ADMINISTRATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Administer contract requirements to construct the Project. Provide documentation per the requirements of this Section. Provide information as requested by the OPT.

1.02 DOCUMENTATION

- A. Provide documents in accordance with Section 01 33 00 "Document Management."

1.03 COMMUNICATION DURING THE PROJECT

- A. Construction Manager is to be the first point of contact for all parties on matters concerning this Project.
- B. Construction Manager will coordinate correspondence concerning:
 - 1. Contract administration;
 - 2. Clarification and interpretation of the Contract Documents;
 - 3. Contract modifications;
 - 4. Observation of Work and testing; and
 - 5. Claims.
- C. Construction Manager will normally communicate only with the Contractor. Any required communication with Subcontractors or Suppliers will only be with the direct involvement of the Contractor.
- D. Direct written communications to the Construction Manager at the address indicated at the pre-construction conference. Include the following with communications as a minimum:
 - 1. Name of the Owner;
 - 2. Project name;
 - 3. Contract title;
 - 4. Project number;
 - 5. Date; and
 - 6. A reference statement.
- E. Submit communications on the forms referenced in this Section or in Section 01 33 00 "Document Management."

1.04 PROJECT MEETINGS

- A. Pre-Construction Conference:
 - 1. Attend a pre-construction conference;
 - 2. The location of the conference will be determined by the Construction Manager;

3. The time of the conference will be determined by the Construction Manager, but will be after the Notice of Award is issued and not later than 15 days after the Notice to Proceed is issued;
 4. OPT, Contractor's project manager and superintendent, representatives of utility companies, and representatives from major Subcontractors and Suppliers may attend the conference; and
 5. Provide and be prepared to discuss:
 - a. Preliminary construction schedule per Section 01 33 05 "Construction Progress Schedule";
 - b. Preliminary Schedule of Documents per Section 01 33 00 "Document Management";
 - c. Schedule of Values and anticipated schedule of payments per Section 01 29 00 "Application for Payment Procedures";
 - d. List of Subcontractors and Suppliers;
 - e. Contractor's organizational chart as it relates to this Project; and
 - f. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents, contract modifications, and payment requests.
- B. Progress Meetings:
1. Attend meetings with the Construction Manager, Design Professional, and Owner.
 - a. Meet monthly or as requested by the Construction Manager to discuss the Project.
 - b. Meet at the Site or other location as designated by the Construction Manager.
 - c. Contractor's superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.
 - d. Notify the Construction Manager of any specific items to be discussed a minimum of 1 week prior to the meeting.
 2. Provide information as requested by the Construction Manager, Design Professional or Owner concerning this Project. Prepare to discuss:
 - a. Status of overall project schedule;
 - b. Contractor's detailed schedule for the next month;
 - c. Anticipated delivery dates for equipment;
 - d. Coordination with the Owner;
 - e. Status of documents;
 - f. Information or clarification of the Contract Documents;
 - g. Claims and proposed modifications to the Contract;
 - h. Field observations, problems, or conflicts; and
 - i. Maintenance of quality standards.

3. Construction Manager will prepare a record of meeting proceedings. Review the record of the meeting and notify the Construction Manager of any discrepancies within 10 days of the date the record of the meeting is provided. The record will not be corrected after the 10 days have expired. Corrections will be reflected in the record of the following meeting.
- C. Pre-Documentation and Pre-Installation Meetings:
1. Conduct pre-documentation and pre-installation meetings as required in the individual technical Specifications or as determined necessary by the Construction Manager (for example, instrumentation, roofing, concrete mix design, etc.).
 2. Set the time and location of the meetings when ready to proceed with the associated Work. Submit a Notification by Contractor in accordance with Paragraph **[1.07]** for the meeting 2 weeks before the meeting. OPT must approve of the proposed time and location.
 3. Attend the meeting and require the participation of appropriate Subcontractors and Suppliers in the meeting.
 4. Construction Manager will prepare a record of meeting proceedings. Review the record of the meeting and notify the Construction Manager of any discrepancies within 10 days of the date the record of the meeting is provided. The record will not be corrected after the 10 days have expired. Corrections will be reflected in the record of the following meeting.
- D. Weekly Coordination Meetings: Meet on a weekly basis with the Construction Manager or designated on-site representative of the OPT to discuss Work planned for the following week, review coordination issues, testing required, or other issues. Records of these meetings are not required.

1.05 REQUESTS FOR INFORMATION

- A. Submit a Request for Information to the Construction Manager to obtain additional information or clarification of the Contract Documents.
1. Submit a separate Request for Information for each item on the form provided by the Construction Manager.
 2. Attach adequate information to permit a response without further clarification. Construction Manager will return requests that do not have adequate information to the Contractor for additional information. Contractor is responsible for all delays resulting from multiple reviews due to inadequate information.
 3. A response will be made when adequate information is provided. The response will be made on the Request for Information form provided by the Construction Manager.
- B. Response to a Request for Information is given to provide additional information, interpretation, or clarification of the requirements of the Contract Documents, and does not modify the Contract Documents.
1. Submit a Change Proposal per Section 01 26 00 "Change Management" if a contract modification is suggested or required.

- C. Use the Decision Register to document decisions made at meetings and actions to be taken in accordance with Paragraph 1.06.
- D. Use the Action Item Register to document assignments for actions to be taken in accordance with Paragraph 1.06.

1.06 DECISION AND ACTION ITEM REGISTER

- A. Construction Manager will maintain a Decision Register to document key decisions made during meetings, telephone conversations, or visits to the Site using the format provided by the Construction Manager:
 - 1. Review the Decision Register prior to each regular meeting.
 - 2. Report any discrepancies to the Construction Manager for correction or discussion at the next monthly meeting.
- B. Construction Manager will maintain an Action Item Register in conjunction with the Decision Register to track assignments made during meetings, telephone conversations or visits to the Site using the format provided by the Construction Manager:
 - 1. Review the Action Item Register prior to each regular meeting.
 - 2. Report actions taken after the previous progress meeting on items in the register assigned to the Contractor or through the Contractor to a Subcontractor or Supplier to the Construction Manager. Report on status of progress 1 week prior to each progress meeting established in Paragraph 1.04 to allow Construction Manager to update the register prior to the Progress Meetings.
 - 3. Be prepared to discuss the status at each meeting.
- C. Decisions or action items in the register that require a change in the Contract Documents will have the preparation of a Modification as an action items if appropriate. The Contract Documents can only be changed by a Modification.

1.07 NOTIFICATION BY CONTRACTOR

- A. Notify the Construction Manager of:
 - 1. Need for testing;
 - 2. Intent to work outside regular working hours;
 - 3. Request to shut down facilities or utilities;
 - 4. Proposed utility connections;
 - 5. Required observation by Construction Manager, Engineer, or inspection agencies prior to covering Work; and
 - 6. Training.
- B. Provide notification a minimum of 2 weeks in advance to allow OPT time to respond appropriately to the notification.
- C. Use the Notification by Contractor form provided by the Construction Manager.

1.08 REQUESTS FOR MODIFICATIONS

- A. Submit requests for Modifications per Section 01 26 00 "Change Management."

1.09 PLAN OF ACTION

- A. Submit a written Plan of Action for approval for shutting down essential services. These include:
 - 1. Electrical power;
 - 2. Control power;
 - 3. Process piping;
 - 4. Process equipment;
 - 5. Communications equipment; and
 - 6. Other designated functions.
- B. Describe the following in the Plan of Action:
 - 1. Scheduled dates for construction;
 - 2. Work to be performed;
 - 3. Utilities, piping, or services affected;
 - 4. Length of time the service or utility will be disturbed;
 - 5. Procedures to be used to carry out the Work;
 - 6. Plan of Action to handle emergencies;
 - 7. List of manpower, equipment, and ancillary supplies;
 - 8. Backups for key pieces of equipment and key personnel; and
 - 9. Contingency plan that will be used if the original schedule cannot be met.
- C. Submit plan 1 month prior to beginning the Work.

1.10 RECORD DATA

- A. Submit information required by the Contract Documents that is not related to a product as Record Data using the form provided by the Construction Manager.

1.11 RECORD DOCUMENTS

- A. Maintain one complete set of printed Record Documents at the Site including:
 - 1. Drawings;
 - 2. Specifications;
 - 3. Addenda;
 - 4. Modifications;
 - 5. Product Data and approved Shop Drawings;

6. Construction photographs;
 7. Test Reports;
 8. Clarifications and other information provided in Request for Information responses; and
 9. Reference standards.
- B. Store printed Record Documents and Samples in the Contractor's field office.
1. Record Documents are to remain separate from documents used for construction.
 2. Provide files and racks for the storage of Record Documents.
 3. Provide a secure storage space for the storage of Samples.
 4. Maintain Record Documents in clean, dry, legible conditions, and in good order.
 5. Make Record Documents and Samples available at all times for inspection by the OPT.
- C. Maintain an electronic record of Specifications and Addenda to identify products provided in PDF format.
1. Reference the Product Data number, Shop Drawing number, and O&M manual number for each product and item of equipment furnished or installed.
 2. Reference Modifications by type and number for all changes.
- D. Maintain an electronic record of Drawings in PDF format.
1. Reference the Product Data number, Shop Drawing number, and O&M manual number for each product and item of equipment furnished or installed.
 2. Reference Modifications by type and number for all changes.
 3. Record information as construction is being performed. Do not conceal any Work until the required information is recorded.
 4. Mark drawings to record actual construction.
 - a. Depths of various elements of the foundation in relation to finished first floor datum or the top of walls.
 - b. Horizontal and vertical locations of underground utilities and appurtenances constructed, and existing utilities encountered during construction.
 - c. Location of utilities and appurtenances concealed in the Work. Refer measurements to permanent structures on the surface. Include the following equipment:
 - 1) Piping;
 - 2) Ductwork;
 - 3) Equipment and control devices requiring periodic maintenance or repair;
 - 4) Valves, unions, traps, and tanks;
 - 5) Services entrance;
 - 6) Feeders; and
 - 7) Outlets.

- d. Changes of dimension and detail.
 - e. Changes by Modifications.
 - f. Information in Requests for Information or included in the Decision Register.
 - g. Details not on the original Drawings. Include field verified dimensions and clarifications, interpretations, and additional information issued in response to Requests for Information.
5. Mark Drawings with the following colors:
- a. Highlight references to other documents, including Modifications in blue.
 - b. Highlight mark ups for new or revised Work (lines added) in yellow.
 - c. Highlight items deleted or not installed (lines to be removed) in red.
 - d. Highlight items constructed per the Contract Documents in green.
6. Submit Record Documents to Construction Manager for review and acceptance 30 days prior to Final Completion of the Project.
- E. Applications for Payment will not be recommended for payment if Record Documents are found to be incomplete or not in order. Final payment will not be recommended without complete Record Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 00 DOCUMENT MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Submit documentation as required by the Contract Documents and as requested by the Construction Manager.
- B. Use the Project Management Information System (PMIS) provided by the Construction Manager. Software for the PMIS is FNiManager which has the following system requirements:
 - 1. Operating Systems: Windows 7 or later and OS X v10.8 or later.
 - 2. Supported Internet Browsers: Internet Explorer 11.0 or later, Google Chrome 70.0 or later, Firefox 63.0 or later, Safari 11.0 or later, and Microsoft Edge 17.0 or later.
 - 3. Screen Resolution: The recommended screen resolution is 1280 x 1024 or higher. The minimum screen resolution required to support all features is 1024 x 768.

1.02 QUALITY ASSURANCE

- A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Documents not meeting these criteria will be returned without review as “Not Approved.”

1.03 CONTRACTOR’S RESPONSIBILITIES

- A. Review documents prior to submission. Make certifications as required by the Contract Documents and as indicated on Construction Manager provided forms.
- B. Provide a Schedule of Documents to list the documents that are to be submitted and the dates on which documents are to be sent to the Construction Manager for review. Use the form provided by the Construction Manager for this list.
- C. Incorporate the dates for processing documents into the Progress Schedule required by Section 01 33 05 “Construction Progress Schedule.”
 - 1. Provide documents in accordance with the schedule so construction of the Project is not delayed.
 - 2. Allow a reasonable time for the review of documents when preparing the Progress Schedule. Assume a 14-day review cycle for each document unless a longer period of time is indicated in the Contract Documents or agreed to by Construction Manager and Contractor.
 - 3. Schedule delivery of review documents to provide all information for interrelated Work at one time.
 - 4. Allow adequate time for processing documents so construction of the Project is not delayed.

1.04 FORMS AND WORKFLOWS

- A. Use the forms or workflow process provided by the Construction Manager for project documentation.

1.05 DOCUMENT PREPARATION AND DELIVERY PROCEDURES

- A. Deliver documents in electronic format as directed by the Construction Manager.
 - 1. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
 - 2. Deliver all documents in Portable Document Format (PDF).
 - a. Create PDF document using Bluebeam Revu software.
 - b. Create PDF documents from native format files unless files are only available from scanned documents.
 - c. Rotate pages so that the top of each document appears at the top of the monitor screen when opened in PDF viewing software.
 - d. Provide PDF document with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 paper.
 - e. Submit color PDF documents where color is required to interpret the document.
 - f. Create or convert documents to allow text to be selected for comments or searched using text search features. Run scanned documents through Optical Character Recognition (OCR) software if necessary.
 - g. Flatten markups in documents to prevent markups made by Contractor from being moved or deleted. Flatten documents to allow markup recovery.
 - h. Use Bluebeam Revu software to reduce file size using default settings except the option for "Drop Metadata". Uncheck the "Drop Metadata" box when reducing file size.
 - i. Add footers to each document with the name of the Project.

1.06 DOCUMENTATION

- A. Furnish documents as indicated in Section 01 33 01 "Document Register" or in the individual Specification Sections. Submit documents per the procedures described in the Contract Documents.
- B. Submit documents per the Specification Sections shown in the following table:

Document Type	Specification Section
Application for Payment	01 29 00
Certified Test Report	01 33 02 for approval of product 01 40 00 to demonstrate compliance
Change Management	01 26 00
Equipment Installation Report	01 75 00
Graphic Documentation	01 33 06

Document Type	Specification Section
Notification by Contractor	01 31 13
Operation & Maintenance Manuals	01 33 04
Product Data	01 33 03
Progress Schedules	01 33 05
Record Data	01 31 13
Request for Information	01 31 13
Schedule of Values	01 29 00
Shop Drawing	01 33 02
Substitutions	01 26 00
Suppliers and Subcontractors	01 31 13 01 33 03

1.07 Electronic Documents Protocol

- A. The parties shall follow the provisions in this Section, referred to as the Electronic Documents Protocol ("EDP"), for exchange of electronic transmittals.
- B. Basic Requirements:
 1. Except as otherwise stated elsewhere in the Contract Documents, the OPT and Contractor will send and accept Electronic Documents sent by Electronic Means using the protocols provided in this Section.
 2. The contents of the information in any Electronic Document will be the responsibility of the transmitting party. Electronic Documents may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, and are subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.
 3. Provisions of this Contract regarding Electronic Documents must be incorporated into other agreements or subcontracts on the Project. Nothing in this paragraph reduces or eliminates requirements:
 - a. to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations;
 - b. to comply with any applicable Law or Regulation governing the signing and sealing of design documents and related Modifications or the signing and electronic transmission of any other documents; or
 - c. to comply with the notice requirements.
 4. When sending Electronic Documents by Electronic Means the sending 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 sending Electronic Documents.

C. System Infrastructure for Electronic Document Exchange:

1. Contractor will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost. System Infrastructure must comply with these requirements.
2. The maximum size of an email attachment for exchange of Electronic Documents under this EDP is 100 MB. Attachments larger than that may be exchanged in parts or by using large file transfer functions or physical media.
3. Contractor assumes full and complete responsibility for its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software.
4. Contractor is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.
5. Contractor will operate and maintain industry-standard, industry-accepted, ISO standard, commercial-grade security software and systems that are intended to protect others from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. Contractor will not be liable to others for any breach of system security to the extent that Contractor maintains and operates required security software and systems.
6. In the case of disputes, conflicts, or modifications to the use of Electronic Documents required to address issues affecting System Infrastructure, Contractor and OPT will cooperatively resolve the issues; but, failing resolution, OPT is authorized to make and require reasonable and necessary changes meet its original intent. Contractor may submit a Change Proposal if the changes cause additional cost or time to Contractor that could not have reasonably been anticipated.
7. Contractor and OPT are both responsible for their own back-up and archive of documents sent and received during the term of the contract. Contractor and OPT remain solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract as each party deems necessary for its own purposes.
8. If a Contractor or OPT receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.
9. OPT will operate a project information management system (Project Website) for use of OPT and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this Contract, use of

the Project Website will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information.

D. Software Requirements:

1. OPT and Contractor will each acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the following software formats:

Document	Document Format
Email	.htm, .rtf, or .txt without formatting that impair legibility of content on screen or in printed copies
Submittals	Bluebeam PDF
Applications for Payment	Bluebeam PDF and Microsoft® Excel
Progress Schedules	PDF and Schedule in Schedule in Native Format
Layouts and drawings to be submitted to Owner for future use and modification	Autodesk® AutoCAD .dwg format
Document submitted to OPT for future word processing use and modification	Microsoft® Word
Spreadsheets and data submitted to OPT for future data processing use and modification	Microsoft® Excel
Photographs	.jpg or .jpeg
Videos	.mp4, .mpeg, or .avi

2. Software will be the version currently published at the time Contract is signed, unless a specific software version is listed in the Supplementary Conditions. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or convert to comply with this Section.
3. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

E. Requests by Contractor for Electronic Documents in Other Formats:

1. Release of any Electronic Documents developed during the design process (including Contract Documents, Technical Data, Drawings, and computer models) in formats other than those identified in this Section will be at the discretion of the OPT.
2. To the extent determined by OPT, release of Electronic Documents and other project information requested by Contractor ("Request") in formats other than those identified

in this Section will be subject to the provisions of Owner's response to the Request, and to the following conditions:

- a. The content included in the Electronic Documents covered by the Request was prepared by Design Professional as an internal working document or electronic computer model solely for Design Professional's purposes and not for any construction processes and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, any implied warranties of fitness for any purpose. Contractor is advised and acknowledges that the content may not be suitable for Contractor's application or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.
 - b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Design Professional to Contractor under the Request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and Contractor waives any claims against the Design Professional or Owner arising from use of data in Electronic Documents covered by the Request.
 - c. CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE OWNER AND DESIGN PROFESSIONAL AND THEIR SUBCONSULTANTS FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES, INCLUDING ATTORNEYS' FEES AND DEFENSE COSTS ARISING OUT OF OR RESULTING FROM THE CONTRACTOR'S USE, ADAPTATION, OR DISTRIBUTION OF ANY ELECTRONIC DOCUMENTS PROVIDED UNDER THE REQUEST.
 - d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Design Professional, unless such distribution is specifically identified in the Request and is limited to the Contractor's subcontractors. Contractor warrants that subsequent use by the Contractor's subcontractors complies with all terms of the Contract Documents and the Owner's response to Request.
3. In the event that Owner elects to provide or directs Design Professional to provide to Contractor any Contractor-requested Electronic Document versions of project information that is not explicitly identified in the Contract Documents as being available to Contractor, Owner shall be reimbursed by Contractor on an hourly basis for any costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Design Professional in accordance with the General Conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 01 DOCUMENT REGISTER

[illegible]

01 33 02 SHOP DRAWINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Shop Drawings are required for those products that cannot adequately be described in the Contract Documents to allow fabrication, erection, or installation of the product without additional detailed information from the Supplier.
- B. Submit Shop Drawings as required by the Contract Documents and as reasonably requested by the Construction Manager to:
 - 1. Record the products incorporated into the Project;
 - 2. Provide detailed information for the products proposed for the Project regarding their fabrication, installation, commissioning, and testing; and
 - 3. Allow the Design Professional to advise the Owner if products proposed for the Project by the Contractor conform, in general, to the design concepts of the Contract Documents.
- C. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the review of Shop Drawings, Samples, or mockups.
- D. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be approved by Change Order or Field Order.

1.02 QUALITY ASSURANCE

- A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Shop Drawings not meeting these criteria will not be approved.
- B. Demonstrate that the proposed products are in full compliance with the design criteria and requirements of the Contract Documents, or will be if deviations requested per Paragraph 1.11 are approved.
- C. Furnish and install products that fully comply with the information included in the Shop Drawings.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Furnish Shop Drawings for products as indicated in Section 01 33 01 "Document Register" or in the individual Specification Sections.
- B. Include Shop Drawings in the Document Register required by Section 01 33 00 "Document Management" to indicate the Shop Drawings to be submitted, the dates on which Shop Drawings are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.
- C. Incorporate the dates for processing Shop Drawings into the Progress Schedule required by Section 01 33 05 "Construction Progress Schedule."

1. Submit Shop Drawings in accordance with the schedule so construction of the Project is not delayed.
 2. Submit Shop Drawings for interrelated Work at one time.
 3. Allow adequate time for ordering, fabricating, delivering, and installing products so construction of the Project is not delayed.
- D. Complete the following before submitting a Shop Drawing or Sample:
1. Prepare and review the Shop Drawing or Sample. Coordinate the Shop Drawing or Sample with other Shop Drawings and Samples, with the requirements of the Work, and the Contract Documents;
 2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to Shop Drawings and Samples;
 3. Determine and verify the suitability of 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
 4. Determine and verify information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- E. Determine and verify:
1. Field measurements, quantities, and dimensions are shown on the Shop Drawing and are accurate;
 2. Location of existing structures, utilities, and equipment related to the Shop Drawing have been shown and conflicts between the products, existing structures, utilities, and equipment have been identified;
 3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;
 4. Shop Drawing is complete for its intended purpose; and
 5. Conflicts between the Shop Drawing related to the various Subcontractors and Suppliers have been resolved.
- F. Review Shop Drawings prior to submitting to the Construction Manager. Certify that all Shop Drawings have been reviewed by the Contractor and are in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Shop Drawings except for deviations specifically brought to the Construction Manager's attention on an attached Shop Drawing Deviation Request form in accordance with Paragraph 1.11.
- G. Fabrication or installation of any products prior to the approval of Shop Drawings is done at the Contractor's risk. Defective products may be rejected at the Owner's option.
- H. Payment will not be made for products for which Shop Drawings or Samples are required until these are approved by the Construction Manager and Design Professional.

1.04 DOCUMENTATION

- A. Provide adequate information in Shop Drawings and with Samples so the Design Professional can:
 - 1. Assist the Owner in selecting colors, textures, or other aesthetic features.
 - 2. Compare the proposed features of the product with the specified features and advise Owner that the product does, in general, conform to the Contract Documents.
 - 3. Compare the performance features of the proposed product with those specified and advise the Owner that the product does, in general, conform to the performance criteria specified in the Contract Documents.
 - 4. Review required certifications, guarantees, warranties, and service agreements for compliance with the Contract Documents.
- B. Include a complete description of the material or equipment to be furnished, including:
 - 1. Type, dimensions, size, arrangement, model number, and operational parameters of the components;
 - 2. Weights, gauges, materials of construction, external connections, anchors, and supports required;
 - 3. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components;
 - 4. All applicable standards;
 - 5. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;
 - 6. Wiring and piping diagrams and related controls;
 - 7. Mix designs for concrete, asphalt, or other materials proportioned for the Project; and
 - 8. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.
- C. Submit Shop Drawings that require coordination with other Shop Drawings for fabrication at the same time. Shop Drawings requiring coordination with other Shop Drawings will not be approved until a complete package is submitted, unless approved by the Construction Manager.
- D. Submit information for all of the components and related equipment required for a complete and operational system in one Submittal.
 - 1. Include electrical, mechanical, and other information required to indicate how the various components of the system function together as a system.
 - 2. Provide certifications, warranties, and written guarantees and service contracts with the document package for review when these are required.

1.05 SPECIAL CERTIFICATIONS AND REPORTS

- A. Provide all required special certifications, reports, and other documentation with the Shop Drawings as specified in the individual Specification Sections which may include:
 - 1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications. This report is to demonstrate that the product, when installed, will meet the requirements of the Contract Documents and is part of the Shop Drawing. Field tests may be performed by the Owner to determine that in place materials or products meet the same quality as indicated in the CTR submitted as part of the Shop Drawing.
 - 2. Certification of Local Field Service (CLS): A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300-mile radius of the Site. Include the names, addresses, and telephone numbers of approved service organizations with the certificate.
 - 3. Certification of Adequacy of Design (CAD): A certified letter from the manufacturer of the equipment stating that the equipment has been designed to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter must state that mechanical and electrical components have been adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
 - 4. Certification of Applicator/Subcontractor (CSQ): A certified letter stating that the applicator or subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

1.06 WARRANTIES AND SERVICE AGREEMENTS

- A. Provide warranties and service agreements per Section 01 78 36 "Warranties and Service Agreements."

1.07 EXTENDED SERVICE AGREEMENTS

- A. Provide Extended Service Agreements and related documents with the Product Data. An Extended Service Agreement is a contract between the Owner and an approved Subcontractor or Supplier to provide service and or maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period beyond the one-year correction period specified in the General Conditions.
- B. An Extended Service Agreement does not relieve the Contractor from obligations under the one-year correction period or warranty provisions specified in the General Conditions.
- C. An Extended Service Agreement does not relieve the Contractor from obligations under the maintenance bond, if a maintenance bond is required by the Contract.
- D. Requirements for the Extended Service Agreement are described in the Specification Sections for each piece of equipment or system requiring an Extended Service Agreement.
- E. Enter into a contract with the service provider and assign the service contract to the Owner on the date Substantial Completion. Once assigned to the Owner, Contract requirements for

the Extended Service Agreement will be complete and will not extend the Contract between the Owner and Contractor.

- F. Owner may require that a performance bond be provided for the Extended Service Agreement. Provide a separate bond meeting the same requirements as those for the Contractor's performance bond if required. The bond will be in the amount of the Extended Service Agreement.
- G. Include an additional copy of Extended Service Agreements in operation and maintenance manuals.
- H. Provide a copy of Extended Service Agreements in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.08 SHOP DRAWING SUBMITTAL PROCEDURES

- A. Submit Shop Drawings to the Construction Manager. Send all documents in digital format for processing.
 - 1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
 - 2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Shop Drawing. Provide Samples and color charts per Paragraph 1.10.
 - 3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Shop Drawings for more than one independent system in the same Submittal.
 - 4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.
 - 5. Define abbreviations and symbols used in Shop Drawings.
 - a. Use terms and symbols in Shop Drawings consistent with the Contract Drawings.
 - b. Provide a list of abbreviations and their meaning as used in the Shop Drawings.
 - c. Provide a legend for symbols used on Shop Drawings.
 - 6. Mark Shop Drawings to reference:
 - a. Related Specification Sections;
 - b. Drawing number and detail designation;
 - c. Equipment designation or name;
 - d. Schedule references;
 - e. System into which the product is incorporated; and
 - f. Location where the product is incorporated into the Project.

- B. Use the following conventions to markup Shop Drawings for review:
1. Make comments and corrections in the color blue. Add explanatory comments to the markup.
 2. Highlight items in black (redact) that are not being furnished when the Supplier's standard drawings or information sheets are provided so that only the products to be provided are in their original color.
 3. Make comments in yellow where selections or decisions by the Design Professional are required, but such selections do not constitute a deviation from the Contract Documents. Add explanatory comments to the markup to indicate the action requested of the Design Professional.
 4. Make comments in orange that are deviation requests. Include the deviation request number on the Shop Drawing that corresponds to the deviation request on the Shop Drawing Deviation Request form. Include explanatory comments in the Shop Drawing Deviation Request form.
 5. Mark dimensions with the prefix "FD" to indicate field verified dimensions on the Shop Drawings.
- C. Designate a document as requiring priority treatment to place the review of the Shop Drawing ahead of other Shop Drawings previously delivered. Shop Drawings are typically reviewed in the order received, unless Contractor requests that a different priority be assigned. Priority Shop Drawings will be reviewed before other Shop Drawings already received but not yet reviewed. Use of this priority designation for Shop Drawings may delay the review of Shop Drawings previously submitted. Contractor is responsible for delays resulting from the use of the priority designation status on Shop Drawings.
- D. Complete the certification required by Paragraph 1.03.G.

1.09 SAMPLE AND MOCKUP SUBMITTAL PROCEDURES

- A. Submit color charts and Samples for every product requiring color, texture, or finish selection.
1. Submit color charts and Samples only after Shop Drawings for the products have been approved.
 2. Deliver all color charts and Samples at one time.
 3. Provide Samples of adequate size to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices.
 4. Indicate the full range of color, texture, and patterns.
 5. Deliver color charts and Samples to the field office and store for the duration of the Project.
 6. Notify the Construction Manager that color charts and Samples have been delivered for approval using the Notification by Contractor form.
 7. Submit color charts and Samples not less than 30 days prior to when these products are to be ordered or released for fabrication to comply with the Project schedule.

8. Remove Samples that have not been approved. Submit new Samples following the same process as for the initial Sample until Samples are approved.
 9. Dispose of Samples when related Work has been completed and approved and disposal is approved by the Construction Manager. At Owner's option, Samples will become the property of the Owner.
- B. Construct mockups for comparison with the Work being performed.
1. Construct mockups from the actual products to be used in construction per the detailed specifications.
 2. Construct mockups of the size and in the area indicated in the Contract Documents.
 3. Construct mockups complete with texture and finish to represent the finished product.
 4. Notify the Construction Manager that mockups have been constructed and are ready for approval using the Notification by Contractor form. Allow 2 weeks for Construction Manager to approve of the mockup before beginning the Work represented by the mockup.
 5. Remove mockups that have not been approved. Construct new mockups following the same process as for the initial mockup until mockup is approved.
 6. Protect mockups until Work has been completed and accepted by the Construction Manager.
 7. Dispose of mockups when related Work has been completed and disposal is approved by the Construction Manager.

1.10 REQUESTS FOR DEVIATION

- A. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures.
- B. Provide a Shop Drawing with the Change Proposal that clearly identifies deviations for any product or component of the product that does not fully comply with the Contract Documents using the Shop Drawing Deviation Request form provided by the Construction Manager. Mark deviations on the Shop Drawing per Paragraph 1.09.B.
- C. Include a description of why the deviation is required and the impact on Contract Price or Contract Times. Include the amount of any cost savings to the Owner for deviations that result in a reduction in cost.
- D. Identify each deviation request as a separate item. Include all requested deviations that must be approved as a group together and identify them as a single item.
- E. Construction Manager will issue a Field Order or Change Order to approve acceptable deviations. Approval of a requested Shop Drawing deviation by the Design Professional on the Shop Drawings Deviation Request form indicates approval of the requested deviation only on its technical merits as generally conforming to the Contract Documents. Deviations from the Contract Documents can only be approved by a Modification issued by the Construction Manager.

1.11 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

- A. Shop Drawings will be received by the Construction Manager. Construction Manager will log the documents and forward to the Design Professional for review per this Section for general conformance with the Contract Documents.
 - 1. Design Professional's review and approval will be only to determine if the products described in the Shop Drawing or Sample will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 - 2. Design Professional'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. Design Professional's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
- B. Comments will be made on items called to the attention of the Design Professional for review and comment. Any marks made by the Design Professional do not constitute a blanket review of the document or relieve the Contractor from responsibility for errors or deviations from the Contract requirements.
 - 1. Design Professional will respond to Contractor's markups by either making markups directly in the Shop Drawing file using the color red or by attaching a Document Review Comments form with review comments keyed to the Drawings or Shop Drawing Deviation Request.
 - 2. Shop Drawings that are reviewed will be returned with one or more of the following status designations:
 - a. Approved: Shop Drawing is found to be acceptable as submitted.
 - b. Approved as Noted: Shop Drawing is approved so long as corrections or notations made by Design Professional are incorporated into the Shop Drawing.
 - c. Not Approved: Shop Drawing or products described are not acceptable.
 - d. Cancelled: This action indicates that for some reason, the Shop Drawing is to be removed from consideration and all efforts regarding the processing of that document are to cease.
 - 3. Shop Drawings will also be designated for one of the following actions:
 - a. Documents Filed: Shop Drawing is acceptable without further action and has been filed as a record document.
 - b. Shop Drawing Not Required: A Shop Drawing was not required by the Contract Documents. Resubmit the document per Section 01 33 03 "Product Data."
 - c. Cancelled: This action indicates that for some reason, the Shop Drawing is to be removed from consideration and all efforts regarding the processing of that document are to cease.

- d. Revise and Resubmit: Shop Drawing has deviations from the Contract Documents, significant errors, or is inadequate and must be revised and resubmitted for subsequent review.

Actions “a” through “c” will close out the Shop Drawing review process and no further action is required as a Shop Drawing. Action “d” requires follow up action to close out the review process.

- 4. Drawings with a significant or substantial number of markings by the Contractor may be marked “Approved as Noted.” These drawings are to be revised to provide a clean record of the document. Proceed with ordering products as the documents are revised.
 - 5. Dimensions or other data that do not appear to conform to the Contract Documents will be marked as “At Variance With” (AVW) the Contract Documents or other information provided. The Contractor is to make revisions as appropriate to comply with the Contract Documents.
- C. Bring deviations to the Shop Drawings to the attention of the Design Professional for approval by using the Shop Drawing Deviation Request form. Use a single line for each requested deviation so the Status and Action for each deviation can be determined for that requested deviation. If approval or rejection of a requested deviation will impact other requested deviation, then all related deviations should be included in that requested deviation line so the status and action can be determined on the requested deviation as a whole.
- D. Requested deviations will be reviewed as a possible Modification to the Contract Documents.
- 1. A requested deviation will be marked as “Not Approved” if the requested deviation is unacceptable. Contractor is to revise and resubmit the Shop Drawing with corrections for approval.
 - 2. A Field Order will be issued by the Construction Manager for deviations approved by the Design Professional if the requested deviation is acceptable and if the requested deviation will not result in a change in Contract Price or Contract Times. Requested deviations from the Contract Documents may only be approved by Field Order.
 - 3. A requested deviation will not be approved if the requested deviation is acceptable but the requested deviation will or should result in a change in Contract Price or Contract Times. Submit any requested deviation that requires a change in Contract Price or Contract Times as a Change Proposal for approval prior to resubmitting the Shop Drawing.
- E. Contractor is to resubmit a complete Shop Drawing incorporating revisions until it is acceptable and marked “Approved” or “Approved as Noted” and is assigned an action per Paragraph 1.12.B.3 that indicates that the Shop Drawing process is closed.
- F. Information that is submitted as a Shop Drawing that should be submitted as Product Data or other type of document, or is not required may be returned without review, or may be deleted. No further action is required and the Shop Drawing process for this document will be closed.

1.12 RESUBMISSION REQUIREMENTS

- A. Make all corrections or changes required by the Design Professional in the document and resubmit to the Construction Manager until approved.
- B. Resubmit a complete Shop Drawing for each resubmittal. The last approved Shop Drawing must not rely on previous submissions. The final Shop Drawing is to provide a complete record for the Owner's records.
- C. Revise initial drawings or data and resubmit as specified for the reviewed document.
 - 1. Highlight or cloud in green those revisions which have been made in response to the previous reviews by the Design Professional. This will include changes previously highlighted or clouded in yellow to direct attention to Design Professional to items requiring selections, decisions by the Design Professional or highlighted or clouded in orange for a requested deviation from the Contract Documents, or comments in red made by the Construction Manager.
 - 2. Highlight and cloud new items in yellow where selections or decisions by the Design Professional are required, but such selections do not constitute a deviation from the Contract Documents. Add explanatory comments to the markup to indicate the action to be taken by the Design Professional.
 - 3. Highlight and cloud new items in orange that are deviation requests. Include the deviation request number on the Shop Drawing that corresponds to the deviation request on the Shop Drawing Deviation Request form. Numbering for these new items is to start with the next number following the last Shop Drawing deviation requested. Include explanatory comments in the Shop Drawing Deviation Request form.
- D. Pay for excessive review of Shop Drawings.
 - 1. Excessive review of Shop Drawings is defined as any review required after the original review has been made and the first resubmittal has been checked to see that corrections have been made.
 - 2. Review of Shop Drawings or Samples will be an additional service requiring payment by the Contractor if the Contractor submits a substitution for a product for which a Shop Drawing or Sample has previously been approved, unless the need for such change is beyond the control of Contractor.
 - 3. Cost for additional review time will be billed to the Owner by the Design Professional for the actual hours required for the review of Shop Drawings by Design Professional and in accordance with the rates listed in Section 00 73 00 "Supplementary Conditions."
 - 4. A set-off will be included in each Application for Payment to pay the cost for the additional review. The set-off will be based on invoices submitted to the Owner for these services.
 - 5. Need for more than one resubmission or any other delay in obtaining Design Professional's approval of Shop Drawings will not entitle the Contractor to an adjustment in Contract Price or an extension of Contract Times.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 03 PRODUCT DATA

PART 1 - GENERAL

1.01 SUMMARY

- A. Submit Product Data as required by the Contract Documents and as reasonably requested by the Construction Manager. Provide Product Data for all products unless a Shop Drawing is required for the same item.
- B. Submit Product Data to provide documents that allow the Owner to:
 - 1. Record the products incorporated into the Project;
 - 2. Record detailed information about products regarding their fabrication, installation, commissioning, and testing; and
 - 3. Provide replacement or repair of products at some future date.
- C. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the receipt or cursory review of Product Data.
- D. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be made by an approved Change Order or Field Order.

1.02 QUALITY ASSURANCE

- A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Product Data not meeting these criteria will not be accepted and must be resubmitted.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Furnish Product Data for products as indicated in Section 01 33 01 "Document Register" or in the individual Specification Sections.
- B. Include Product Data in the Document Register required by Section 01 33 00 "Document Management" to indicate the Product Data to be submitted, the dates on which documents are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.
- C. Complete the following before submitting Product Data:
 - 1. Prepare Product Data and coordinate with Shop Drawings, Samples, Product Data for related products, and with the requirements of the Contract Documents;
 - 2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information;
 - 3. Determine and verify the suitability of 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

4. Determine and verify information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- D. Determine and verify:
1. Field measurements, quantities, and dimensions are shown on the Product Data and are accurate;
 2. Location of existing structures, utilities, and equipment related to the Product Data have been shown and conflicts between the products, existing structures, utilities, and equipment have been brought to the attention of the Construction Manager;
 3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;
 4. Product Data is complete for its intended purpose; and
 5. Conflicts between the Product Data related to the various Subcontractors and Suppliers have been resolved.
- E. Review Product Data prior to submitting to the Construction Manager. Certify that all Product Data has been reviewed by the Contractor and is in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Product Data.

1.04 DOCUMENTATION

- A. Include a complete description of the material or equipment to be furnished, including:
1. Type, dimensions, size, arrangement, model number, and operational parameters of the components;
 2. Weights, gauges, materials of construction, external connections, anchors, and supports required;
 3. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components;
 4. All applicable standards;
 5. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;
 6. Wiring and piping diagrams and related controls;
 7. Mix designs for concrete, asphalt, or other materials proportioned for the Project; and
 8. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.
- B. Submit information for all components and related equipment required for a complete and operational system in one submittal.
1. Include electrical, mechanical, and other information required to indicate how the various components of the system function together as a system.

2. Provide certifications, warranties, and written guarantees and service contracts with the document package for review when these are required.

1.05 SPECIAL CERTIFICATIONS AND REPORTS

- A. Provide all required certifications with the Product Data as specified in the individual Specification Sections:
 1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications. This report is to demonstrate that the product when installed will meet the requirements of the Contract Documents and is part of the Product Data. Field tests may be performed by the Owner to determine that in place materials or products meet the same quality as indicated in the CTR submitted as part of the Product Data.
 2. Certification of Local Field Service (CLS): A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300-mile radius of the Site. Include the names, addresses, and telephone numbers of approved service organizations with the certificate.
 3. Certification of Adequacy of Design (CAD): A certified letter from the manufacturer of the equipment stating that the equipment has been designed to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter must state that mechanical and electrical components have been adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
 4. Certification of Applicator/Subcontractor (CSQ): A certified letter stating that the applicator or subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

1.06 WARRANTIES AND SERVICE AGREEMENTS

- A. Provide warranties and service agreements per Section 01 78 36 "Warranties and Service Agreements."

1.07 EXTENDED SERVICE AGREEMENTS

- A. Provide Extended Service Agreements and related documents with the Product Data. An Extended Service Agreement is a contract between the Owner and an approved Subcontractor or Supplier to provide service and or maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period beyond the one-year correction period specified in the General Conditions.
- B. An Extended Service Agreement does not relieve the Contractor from obligations under the one-year correction period or Warranty provisions specified in the General Conditions.
- C. An Extended Service Agreement does not relieve the Contractor from obligations under the maintenance bond, if a maintenance bond is required by the Contract.
- D. Requirements for the Extended Service Agreement are described in the Specification Sections for each piece of equipment or system requiring an Extended Service Agreement.

- E. Enter into a contract with the service provider and assign the service contract to the Owner on the date of Substantial Completion. Once assigned to the Owner, Contract requirements for the Extended Service Agreement will be complete and will not extend the Contract between the Owner and Contractor.
- F. Owner may require that a performance bond be provided for the Extended Service Agreement. Provide a separate bond meeting the same requirements as those for the Contractor's performance bond if required. The bond will be in the amount of the Extended Service Agreement.
- G. Include an additional copy of Extended Service Agreements in operation and maintenance manuals.
- H. Provide a copy of Extended Service Agreements in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.08 PRODUCT DATA SUBMITTAL PROCEDURES

- A. Submit Product Data to the Construction Manager. Send all documents in digital format for processing.
 - 1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
 - 2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Product Data.
 - 3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Product Data for more than one system in the same Submittal.
 - 4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.
 - 5. Define abbreviations and symbols used in Product Data.
 - a. Use terms and symbols in Product Data consistent with the Contract Drawings.
 - b. Provide a list of abbreviations and their meaning as used in the Product Data.
 - c. Provide a legend for symbols used on Product Data.
 - 6. Mark Product Data to reference:
 - a. Related Specification Sections;
 - b. Drawing number and detail designation;
 - c. Equipment designation or name;
 - d. Schedule references;
 - e. System into which the product is incorporated; and
 - f. Location where the product is incorporated into the Project.
- B. Complete the certification required by Paragraph 1.03.F.

1.09 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

- A. Product Data will be received by the Construction Manager, logged, and provided to Owner as the Project record.
 - 1. Product Data may be reviewed to see that the information provided is adequate for the purpose intended. Product Data not meeting the requirements of Paragraph 1.02 may not be approved.
 - 2. Product Data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.
 - 3. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the review of Product Data. Contract modifications can only be approved by a Change Order or Field Order.
- B. Construction Manager may take the following action in processing Product Data:
 - 1. File Product Data as received if the cursory review indicates that the document meets the requirements of Paragraph 1.02. Document will be marked "Filed as Received" and "Documents Filed." No further action is required on that Product Data.
 - 2. Not approve the Product Data for one of the following reasons:
 - a. The documentation requirements of the Contract Documents indicate that the document submitted as Product Data should have been submitted as a Shop Drawing. The Product Data will be marked "Not Approved" and "Submit as Shop Drawing." No further action is required on this document as Product Data and the Product Data process will be closed. Resubmit the document as a Shop Drawing per Section 01 33 02 "Shop Drawings."
 - b. The cursory review indicates that the document does not meet the requirements of Paragraph 1.02. The Product Data will be marked "Not Approved" and "Revise and Resubmit." Contractor is to resubmit the Product Data until it is acceptable and marked "Filed as Received." When Product Data is filed, no further action is required and the Product Data process will be closed.
 - c. The Product Data is not required by the Contract Documents nor is applicable to the Project. The Product Data will be marked "Not Approved" and "Cancelled." No further action is required and the Product Data process will be closed.
- C. Contractor is to resubmit the Product Data until it is acceptable and marked "Filed as Received."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 04 OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

- A. Prepare a complete and detailed operation and maintenance manual (manual) for each type and model of equipment or product furnished and installed under this Contract.
- B. Prepare manuals in the form of an instruction manual for the Owner. The manuals are to be suitable for use in providing the operation and maintenance instructions required by Section 01 79 00 "Training of Operation and Maintenance Personnel."
- C. Provide complete and detailed information specifically for the products or systems provided for this Project. Include the information required to operate and maintain the product or system.
- D. Manuals are to be provided in addition to any information packed with or attached to the product when delivered. Remove information packed with or attached to the product and include this information as an attachment to the manual.
- E. Include cost for manuals provided by Suppliers and Subcontractors as described in this Section in the Cost of Work for that equipment item.

1.02 DOCUMENTATION

- A. Submit manuals in accordance with Section 01 33 00 "Document Management." Attach a copy of the Operation and Maintenance Manual Review Report form provided by the Construction Manager to each manual with pertinent information completed.
- B. Provide one preliminary electronic copy of the manual to the Construction Manager for review within 15 days after review of any equipment submittal by the OPT.
- C. Provide one electronic copy and three printed copies of the final manual after:
 - 1. Preliminary manuals have been approved;
 - 2. Field test records have been incorporated into the manual; and
 - 3. Record Documents per Section 01 31 13 "Project Administration" have been approved and have been incorporated in the final manual.
- D. Provide copies of the manufacturer's warranties, guarantees, or service agreements in accordance with Section 01 70 00 "Execution and Closeout Requirements."

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide digital files for each manual as specified in Paragraph 2.02.
 - 1. Use filenames that correspond to the equipment designation shown in the Contract Documents or other equipment designations provided by the OPT.
 - 2. Submit a preliminary version of the electronic manual for review. Provide a final version of the manual incorporating OPT's comments.

- B. Provide printed copies of each manual as specified in Paragraph 2.03.

2.02 ELECTRONIC MANUAL FORMAT

- A. Manual contents are to be submitted in electronic format to the Construction Manager.
- B. Provide individual electronic files for each manual.
 - 1. Maximum file size is 75 MB. If manual is greater than maximum allowable file size, provide individual files for each major section of manual.
 - 2. Acceptable file types for written documents are Portable Document File (PDF) or provide manual text in Microsoft Word. Provide drawings in native format and PDF format. All files must be compatible with the latest software version available.
 - 3. Filename must identify the equipment location, equipment manufacturer, and date equipment placed in service, e.g. JCC1-Pump Room-Manufacturer-200503.pdf.
 - 4. Each electronic file must contain a table of contents at the beginning of the file which includes hypertext links or bookmarks to navigate the file contents per section/chapter.
 - 5. Scanned images of written documents are not acceptable. Document must allow character selection. Text within a file must be transferable to other documents.
 - 6. Drawing files must have the ability to turn on/off drawing layers within the file.

2.03 PRINTED MANUAL FORMAT

- A. Printed copies of each manual are to be submitted as follows:
 - 1. Print manuals on heavy, first quality 8-1/2 x 11 paper.
 - a. Reduce drawings and diagrams to 8-1/2 x 11 paper size.
 - b. When reduction is not practical, fold drawings and place each separately in a clear, super heavy weight, top loading polypropylene sheet protector designed for three-ring binder use. Provide a typed identification label on each sheet protector.
 - c. Punch paper for standard three-ring binders.
 - 2. Place manuals in heavy duty presentation, d-ring binders with clear front, back, and spine covers.
 - 3. Identify each manual by placing a printed cover sheet in the front cover of the binder and as the first page in the manual. The first page is to be placed in a clear polypropylene sheet protector. The information on first page and the cover page are to include:
 - a. Name of Owner;
 - b. Project name;
 - c. Volume number; and
 - d. Table of contents.
 - 4. Insert the name of the Project and volume number into the spine covers.
 - 5. Sheet lifters are to be provided.

6. Minimum size is 2-inch capacity. Maximum size is 3-inch capacity. Fill binders to only three-fourths of its indicated capacity to allow for addition of materials to each binder by the Owner.
7. Provide index tabs for each section of the manual. Indexes are to be constructed of heavy-duty paper with a reinforced binding edge. The designation on each index tab is to correspond to the number and letter assigned in the Table of Contents.
8. Manuals for several products or systems may be provided in the same binder. Correlate the data into related groups when multiple products or systems are included in the same binder.
 - a. Sections for each product or system must be included in the same binder.
 - b. Sections must be in numerical order from volume to volume.

PART 3 - EXECUTION

3.01 MANUAL ORGANIZATION AND CONTENTS

- A. Provide a table of contents listing each section of the manual for each product or system.
 1. Assign a number and letter to each section in the manual.
 - a. The number is to correspond to the Owner's equipment numbering system or other system designated in the Contract Documents.
 - b. The letter assigned will represent the part of the manual, consistent with the manual contents as required by this Section.
 2. Identify each product or system using the nomenclature shown in the Contract Documents. Provide a cross reference to the Owner's numbering system and designations for equipment indicated in the Contract Documents if these are different.
- B. Include only the information that pertains to the product described. Annotate each sheet to:
 1. Clearly identify the specific product or component installed;
 2. Clearly identify the data applicable to the installation; and
 3. Delete or strike through references to inapplicable information.
- C. Supplement manual information with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.
- D. Manuals for several products or systems may be provided in the same binder.
- E. Fill binders to only three-fourths of its indicated capacity to allow for addition of information by the Owner.

3.02 EQUIPMENT AND SYSTEMS MANUAL CONTENT

- A. Provide the following information in the first tabbed section of each manual:
 1. A description of the unit and component parts and how it functions.
 2. Operating instructions for pre-startup, startup, normal operations, regulation, control, shutdown, emergency conditions, and limiting operating conditions.

3. The sequence of operation by the controls manufacturer. Provide control diagrams by the manufacturer, modified to reflect the as-built, as-installed condition.
 4. Include general assembly contract drawings, sections, and photographic views as necessary to completely depict and properly identify the equipment. Indicate the dimensions, weight, capacity, and design conditions for the equipment.
- B. Include detailed information to allow for the proper installation, calibration, testing, preventative, and corrective maintenance procedures in the second section of the manual or of each section of the manual information if the manual covers a multi-component equipment system. This information should include the following:
1. Maintenance instructions including assembly, installation, alignment, clearances, tolerances, and interfacing equipment requirements, adjustment, and checking instructions. Include any special rigging required to place the equipment into place, and any special test equipment required to place the equipment in service.
 2. A safety subsection which addresses all safety and tag-out procedures necessary to safely operate and maintain the equipment.
 3. Lubrication schedule and lubrication procedures. Include a cross reference for recommended lubrication products.
 4. Troubleshooting guide.
 5. A table showing the schedule of routine maintenance requirements and seasonal work which is not performed at a set frequency. Preventative maintenance tasking must address:
 - a. Daily/weekly inspections performed by operations personnel;
 - b. Routine preventative maintenance scheduled weekly, monthly, quarterly, semi-annually, or annually through major overhauls by maintenance personnel; and
 - c. Predictive maintenance work such as alignment, analysis of the equipment, vibration, flow, oil sampling, etc.
 6. Description of sequence of operation by the control manufacturer.
 7. Warnings for detrimental maintenance practices.
 8. Detailed corrective maintenance procedures including:
 - a. Detail equipment for complete disassembly and assembly;
 - b. Cross-sectional drawings or exploded views with all parts numbered to correspond with the numbers in the parts list to permit identification of the various parts;
 - c. A table of normal clearances, diameters, thickness of new parts, and limits permissible for wearing parts; and
 - d. List torque settings for nuts, bolts, and fasteners when critical to the equipment's performance.
- C. Include all necessary diagrammatic piping and wiring diagrams and miscellaneous contract drawings and equipment in the third section of the manual or of each section of the manual if the manual covers a multi-component equipment system.

- D. Provide spare parts information in the fourth section of the manual including:
 - 1. Part numbers for ordering new parts;
 - 2. Assembly illustrations showing an exploded view of the complex parts of the product;
 - 3. Predicted life of parts subject to wear;
 - 4. List of the manufacturer's recommended spare parts, current prices with effective date, and number of parts recommended for storage;
 - 5. Directory of a local source of supply for parts with company name, address, and telephone number;
 - 6. Complete nomenclature and list of commercial replacement parts; and
 - 7. Complete list of spare parts, spare equipment, tools, and materials that are turned over to the Owner.
- E. Provide statistical information from the original equipment manufacturer as to performance such as pump curves, flow charts insulation resistance, calibration, or test data sheets in the fifth section of the manual, including all field testing records used to verify actual performance.
- F. Provide equipment name plate data installed on equipment and valves and equipment data sheets as required and furnished by the Owner in the sixth section of the manual.
- G. Provide a copy of warranties and the date the warranty expires for equipment in the seventh section of the manual.

3.03 ELECTRICAL AND ELECTRONICS SYSTEMS MANUAL

- A. Provide all of the information listed in Paragraph 3.02 as appropriate and include the following information:
 - 1. Control schematics and point to point wiring diagrams prepared for field installation;
 - 2. Circuit directories of panel boards and terminal strips and as installed color coded wiring diagrams; and
 - 3. Other information as may be required by the individual Specification Sections.

3.04 ARCHITECTURAL PRODUCTS MANUAL

- A. Provide the following information:
 - 1. Information required for ordering replacement products;
 - 2. Instructions for care and maintenance;
 - 3. List of the manufacturer's recommended lubricants;
 - 4. The manufacturer's recommendations for types of cleaning agents and methods;
 - 5. Cautions against cleaning agents and methods that are detrimental to the product; and
 - 6. Recommended maintenance and cleaning schedule.
- B. Final balancing reports for mechanical systems.

C. Other information as may be required by the individual Specification Sections.

3.05 LIST OF SERVICE ORGANIZATIONS

A. Provide a directory of authorized service organizations with company name, address, telephone number, email address, and the contact person for warranty repair.

END OF SECTION

01 33 05 CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.01 SUMMARY

- A. Prepare and submit a Progress Schedule for the Work and update the schedule on a monthly basis for the duration of the Project.
- B. Provide Progress Schedule in adequate detail to allow Owner to monitor progress and to relate submittal processing to sequential activities of the Work.
- C. Incorporate Contract Milestones into the schedule and show activities leading to achievement of these milestones.
- D. Assume complete responsibility for maintaining the progress of the Work per the Progress Schedule submitted.

1.02 DOCUMENTATION

- A. Submit the schedules to the Construction Manager. Send all documents in digital format for processing.
- B. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
- C. Provide schedules, schedule updates and revisions to the Construction Manager in electronic format in its originating software and in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management."
- D. Submit a preliminary Progress Schedule at the pre-construction conference.
- E. Submit a detailed Progress Schedule at least 10 days prior to the first payment request.
- F. Submit Progress Schedule updates monthly within 10 days after submitting Applications for Payment to indicate the progress made on the Project to the closing date for the Application for Payment. Failure to submit Progress Schedules will cause delay in the review and approval of subsequent Applications for Payment.

1.03 PROGRESS SCHEDULE REQUIREMENTS

- A. Progress Schedule is to be in adequate detail to:
 - 1. Ensure adequate planning, scheduling, and reporting during the execution of the Work;
 - 2. Ensure the coordination of the Work of the Contractor and the various Subcontractors and Suppliers;
 - 3. Monitor the progress of the Work; and
 - 4. Evaluate the impact of proposed changes to the Contract Times and Project Schedule.
- B. Provide personnel with 5 years' minimum experience in scheduling construction work comparable to this Project. Prepare the Progress Schedule using acceptable scheduling software.

- C. Provide the Progress Schedule in the form of a computer-generated critical path schedule which includes Work to be performed on the Project. It is intended that the Progress Schedule accomplish the following:
 - 1. Give early warning of delays in time for correction.
 - 2. Provide detailed plans for the execution of the Work in the form of future activities and events in sequential relationships.
 - 3. Establish relationships of significant planned Work activities and provide a logical sequence for planned Work activities.
 - 4. Provide continuous current status information.
 - 5. Allow analysis of the Contractor's program for the completion of the Project.
 - 6. Permit schedules to be revised when the existing schedule is not achievable.
 - 7. Log the progress of the Work as it actually occurs.
- D. Provide a time-scaled horizontal bar chart which indicates graphically the Work scheduled at any time during the Project. The chart is to indicate:
 - 1. Complete sequence of construction by activity;
 - 2. Identification of the activity by structure, location, and type of Work;
 - 3. Chronological order of the start of each item of Work;
 - 4. The activity start and stop dates;
 - 5. The activity duration; and production rates used to determine the duration;
 - 6. Successor and predecessor relationships for each activity;
 - 7. A clearly indicated single critical path; and
 - 8. Projected percentage of completion, based on dollar value of the Work included in each activity as of the first day of each month.
- E. Provide a Progress Schedule for Submittals:
 - 1. Indicate the specific dates each document is to be delivered to the Construction Manager.
 - 2. Allow a reasonable time to review each document, taking into consideration the size and complexity of the document, other documents being processed, and other factors that may affect review time.
 - 3. Include time for making revisions to the Shop Drawings and resubmitting the Shop Drawing for at least a second review.
 - 4. Assume a 14-day review cycle for each time a Shop Drawing is submitted for review unless a longer period is indicated in the Contract Documents or provided by the Construction Manager.
 - 5. Contractor is responsible for delays associated with additional time required to review incomplete or erroneous documents and for time lost when documents are submitted for products that do not meet specification requirements.

1.04 PROGRESS SCHEDULE REVISIONS

- A. Revise the Progress Schedule if it appears that the schedule no longer represents the actual progress of the Work.
 - 1. Submit a Plan of Action for schedule recovery if the Progress Schedule or earned value analysis indicates that the Project is more than 30 days behind schedule. The report is to include:
 - a. Number of days behind schedule;
 - b. Narrative description of the steps to be taken to bring the Project back on schedule; and
 - c. Anticipated time required to bring the Project back on schedule.
 - 2. Submit a revised Progress Schedule indicating the action that the Contractor proposes to take to bring the Project back on schedule.
- B. Revise the Progress Schedule to indicate any adjustments in Contract Times approved by a Modification.
 - 1. Include a revised Progress Schedule with Change Proposals if a change in Contract Times is requested.
 - 2. Construction Manager will deem any Change Proposal that does not have a revised Progress Schedule and request for a change in Contract Times as having no impact on the ability of the Contractor to complete the Project within the Contract Times.
- C. Updating the Progress Schedule to reflect actual progress is not considered a revision to the schedule.
- D. Applications for Payment will not be recommended for payment without a revised Progress Schedule and if required, the report indicating the Contractor's plan for bringing the Project back on schedule.

1.05 FLOAT TIME

- A. Define float time as the amount of time between the earliest start date and the latest start date of a chain of activities on the construction schedule.
- B. Float time is not for the exclusive use or benefit of either the Contractor or Owner.
- C. Where several subsystems each have a critical path, the subsystem with the longest time of completion is the critical path and float time is to be assigned to other subsystems.
- D. Schedule completion date must be the same as the Contract completion date. Time between the end of construction and the Contract completion date is float time.

1.06 MODIFICATION OF CONTRACT TIMES

- A. Contract Times cannot be changed by the submission of a Progress Schedule. Contract Times can only be modified by a Change Order or Contract Amendment.
- B. Submit a Change Proposal for any proposed change in Contract Times, and include justification for the change in accordance with the provisions of the Contract Documents.

1.07 NEAR-TERM LOOK AHEAD SCHEDULES

- A. Provide a near-term look ahead schedule (NTLA Schedule) every 30 days, typically at periodic coordination meetings, using the form provided by the Construction Manager which shows the days of planned activity for the following:
 - 1. Submittals to be provided and day of anticipated return;
 - 2. Equipment and material deliveries;
 - 3. Arrival and departure of key construction equipment; and
 - 4. Activities for the Contractor and each Subcontractor.
- B. Coordinate NTLA Schedule with Project Schedule. Submit a report with each NTLA Schedule identifying deviations from the Project Schedule.
- C. Submit a report of near-term work planned in the previous NTLA Schedule that was delayed or not executed by marking actual activity on the previous near term look ahead schedule. Provide explanation of why planned work was not executed and plan to execute in the future and regain time lost.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 06 GRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish an adequate number of photographs of the Site to clearly depict the completed Project.
 - 1. Provide aerial photographs of the completed Project from an angle and height to include the entire Site.
 - 2. Provide a minimum of four different views.
 - 3. Photograph a panoramic view of the entire Site.
 - 4. Photograph all significant areas of completed construction.
 - 5. Do not take completion photographs until all construction trailers, excess materials, trash, and debris have been removed.
 - 6. Employ a professional photographer approved by the Construction Manager to photograph the Project.
- B. Provide video recordings of the Site.
 - 1. Record the condition of all existing facilities in or abutting the construction area (right-of-way) including streets, curb and gutter, utilities, driveways, fencing, landscaping, etc., prior the beginning of construction. Provide one copy of the dated and labeled recording to the Construction Manager before the start of construction. Provide additional recording as directed by the Construction Manager if the recording provided is not considered suitable for the purpose of recording pre-existing conditions.
 - 2. Provide a video recording of the Site after the Project is complete and all construction trailers, excess materials, trash, and debris have been removed. Provide a 360-degree view of the Project from a consistent height and angle.
 - 3. Format must allow photographic still shots to be extracted from the video recording.
- C. All photographs and video recordings are to become the property of the Owner. Photographs or recordings may not be used for public or private publication or display without the written consent of the Owner.
- D. Unmanned Aerial Vehicles used for aerial photography must be registered and piloted by licensed individuals in accordance with Laws and Regulations.

1.02 DOCUMENTATION

- A. Submit photographic documentation in accordance with Section 01 33 00 "Document Management."

1.03 QUALITY ASSURANCE

- A. Provide clear photographs and video recordings taken with proper exposure. View photographs and video recordings in the field and take new photographs or video recordings immediately if photos of an adequate print quality cannot be produced or video quality is

not adequate. Provide photographs with adequate quality and resolution to permit enlargements.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHS

- A. Provide photographs in digital format with a minimum resolution of 1280x960, accomplished without a digital zoom.
- B. Take photographs at locations acceptable to the Construction Manager.
- C. Provide a digital copy of each photograph taken.
- D. Identify each photograph with:
 - 1. Name of the Project.
 - 2. Date, time, location, and orientation of the exposure.
 - 3. Description of the subject of photograph.

2.02 VIDEO RECORDING

- A. Provide video recordings in digital format that can be played with Windows Media Player in full screen mode without loss of resolution.
- B. Identify Project on video by audio or visual means.
- C. Provide video with file size that does not exceed 1 GB.
- D. Provide video resolution of at least 1080p.
- E. The quality of the video must be adequate to determine the existing conditions of the construction area. Camera panning must be performed while at rest; do not pan the camera while walking or driving. Camera pans should be performed at intervals to clearly view the entire construction area.
- F. Construction stationing is to be annotated in the video.
- G. The entire construction area recording must be submitted at once. Sections submitted separately will not be accepted.
- H. Site components must be video recorded in an organized sequential order with major components identified.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 34 00 BUY AMERICAN REQUIREMENTS

PART 1 - GENERAL

1.01 REQUIREMENTS TO BUY AMERICAN

- A. Funding for this Project is derived in part or entirely from the Federal Government under the American Recovery and Reinvestment Act (ARRA) of 2009. Comply with Laws and Regulations related specifically to ARRA. This requirement applies regardless of other Laws and Regulations.

1.02 DOCUMENTATION

- A. Provide documentation of compliance with Buy American provisions.
- B. Provide a tabulation of the manufactured goods to be provided under this Project in the Form provided by the Construction Manager to indicate compliance with Buy American requirements.
- C. Provide information and certifications required by Section 01 33 02 "Shop Drawings" and Section 01 33 03 "Product Data" to demonstrate compliance with the Buy American requirements.

1.03 PROVIDING PRODUCTS

- A. Obtain certifications from Subcontractors and Suppliers to indicate that products offered for incorporation into the Project comply with Buy American Provisions.

1.04 NONCOMPLIANT PRODUCTS

- A. Noncompliant products are Defective. Unless a Late Waiver is obtained, products are to be removed and replaced with products meeting the Buy American Provisions.
- B. Owner may elect to accept the Defective Work under provisions of the General Conditions, provided the Contract Price is reduced to reimburse the Owner for money lost from funding agencies.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 35 00 SPECIAL PROCEDURES

PART 1 - GENERAL

1.01 CONSTRUCTION SEQUENCE

- A. Consider the sequences, duration limitations, and governing factors outlined in this Section to prepare the schedule for the Work.
- B. Perform the Work not specifically described in this Section as required to complete the entire Project within the Contract Times.

1.02 CRITICAL OPERATIONS

- A. Submit a written Plan of Action per Section 01 31 13 "Project Administration" for approval for critical operations.
- B. Work affecting critical operations is to be performed on a 24-hour a day basis until Owner's normal operations have been restored.
- C. Provide additional manpower and equipment as required to complete the Work affecting critical operations within the allotted time.
- D. Liquidated damages will be assessed if Work on critical operations is not completed within the time indicated.
 - 1. These items are critical to the pump station operation.
 - 2. Loss of pump station operation can subject the Owner to loss of revenue, additional operations cost, and fines from regulatory agencies.
 - 3. Liquidated damages have been established for each critical operation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

PART 1 - GENERAL

1.01 OVERVIEW

- A. Quality management refers to the overall process of delivering a completed Project to the Owner that complies with the requirements of the Contract Documents. Quality management applies to documentation, products, services, and the Work.
- B. Contractor is responsible for the quality of documentation, products, services, and the Work provided.
 - 1. Contractor is to integrate quality control procedures into the execution of the Work that are adequate to produce a Project that meets the requirements of the Contract Documents, while minimizing loss of time and increased costs. Contractor is solely responsible for time and cost impacts of correcting Defective Work.
 - 2. Contractor is to provide all testing and inspection required to control the quality of the Work in progress to determine that completed Work will comply with the requirements of the Contract Documents.
 - 3. Contractor is to provide verification or acceptance testing as required by the Contract Documents to demonstrate that the completed Work complies with the requirements of the Contract Documents, except for those test that the Owner has determined are to be conducted independent of the Contractor and identified as Owner testing in the Owner's Quality Management Plan.

1.02 STANDARDS

- A. Provide testing laboratories that comply with the American Council of Independent Laboratories (ACIL) "Recommended Requirements for Independent Laboratory Qualifications."
- B. Perform testing in accordance with the published standards and procedures for testing listed in the Specifications and applicable Laws and Regulations.

1.03 DOCUMENTATION

- A. Provide documentation which includes:
 - 1. Contractor's Quality Management Plan that establishes the methods of ensuring compliance with the Contract Documents. Submit this plan as Product Data per Section 01 31 13 "Project Administration."
 - 2. A statement of qualifications for any proposed testing laboratory that includes a list of the engineers and technical staff that will provide testing services on the Project, descriptions of the qualifications of these individuals, list of tests that can be performed, equipment used with date of last certification, and a list of recent projects for which testing has been performed with references for those projects.
 - 3. Certified Test Reports for products to be incorporated into the Project. Provide reports to indicate that the proposed products comply with the Contract Documents or indicate that the proposed products do not comply with the Contract Documents and why those

products do not comply. Submit Certified Test Reports as part of a Shop Drawing submitted per Section 01 33 02 "Shop Drawings."

4. Certified Test Reports for inspections and testing required in this Section and in other Sections of the Specifications. Provide reports to indicate that the Work complies with the Contract Documents or indicate that the Work does not comply with the Contract Documents and why the Work does not comply. Submit these test reports on forms provided by the Construction Manager per Section 01 33 00 "Document Management."
5. Certified Test Reports of Defective Work and Certified Test Reports documenting that successful corrective action has produced Work that complies with the Contract Documents. Maintain a register listing Defective Work and record when corrective action has produced Work that complies with the Contract Documents. Present this Defective Work register as part of the Quality Report at progress meetings as described in Paragraph 1.05.E. Incorporate this register in the closeout documentation per Section 01 70 00 "Execution and Closeout Requirements" to demonstrate that all Defective Work has been corrected.

1.04 OWNER'S QUALITY MANAGEMENT ACTIVITIES

- A. Owner may perform its own verification testing independent of the Contractor. The Owner's Quality Management Plan describes the Owner's anticipated verification testing program for this Project. The preliminary testing plan is shown in Paragraph 3.04. This plan outlines the anticipated testing in general terms and may not reflect the actual testing performed by the Owner. Actual testing will depend on the Contractor's means, methods, and procedures of construction which will not be known until the Contractor submits the Contractor's Quality Control Plan (CQCP) to the Construction Manager. There is no guarantee that all testing in the preliminary OQMP included in the Bidding/Proposal Documents will be performed by the Owner. Contractor will arrange and pay for all production control testing deemed necessary by the Contractor to produce quality results.
- B. Quality management activities of the Owner are for verifying the results of the Contractor's Work complies with the requirements of the Contract Documents. Performance or non-performance of verification activities by the Owner:
 1. Does not relieve the Contractor of its responsibility to provide Work and furnish products that comply with the requirements of the Contract Documents;
 2. Does not relieve the Contractor of its responsibility to provide adequate quality control measures to produce quality documents, products, services, or Work;
 3. Does not relieve the Contractor of its responsibility for damage to or loss of Work or products before Owner's acceptance; and
 4. Does not affect the continuing rights of the Owner after acceptance of the completed Work.
- C. The Work is subject to observations or testing at any time by the OPT. Products which have been tested or inspected and accepted by the Owner at a supply source or staging area may be inspected or tested again by the OPT before, during, or after incorporation into the Work and rejected if products do not comply with the Contract Documents.

- D. Verification testing performed by the OPT will be paid for by the Owner, except for testing related to Defective Work as discussed in Paragraph 3.03.

1.05 CONTRACTOR'S RESPONSIBILITIES

- A. Review the OQMP and provide a Contractor's Quality Control Plan (CQCP) outlining testing to be provided by the Contractor per Paragraph 1.07.
- B. Implement the CQCP to provide Work that complies with the requirements of the Contract Documents.
 - 1. Provide quality documents meeting the requirements of the Contract Documents.
 - 2. Provide services meeting the requirements of the Contract Documents.
 - 3. Provide the services of a Construction Materials Inspection and Testing (CMIT) provider meeting the requirements of this Section to provide testing required by the Contract Documents to demonstrate that products proposed for the Project in Shop Drawings and Product Data fully comply with the Contract Documents.
 - 4. Inspect and test products to be incorporated into the Project to identify defects before installing them. Do not install Defective products. Conspicuously mark Defective products and remove from the Site. If products are installed before the defect is recognized, remove the Defective products, mark them as Defective and remove them from the Site when the defect is recognized.
 - 5. Integrate production quality control measures into construction activities to produce Work meeting the requirements of the Contract Documents. Inspect self-performed Work and the Work of Subcontractors and Suppliers to identify defects. Correct or replace Defective Work.
 - 6. Provide facilities, equipment, and Samples required for inspections and tests.
 - a. Give the Construction Manager adequate notice before proceeding with Work that would interfere with inspections or testing.
 - b. Notify the Construction Manager and CMIT provider prior to the time that testing is required, providing adequate lead time to allow arrangements for inspections or testing to be performed.
 - c. Do not proceed with Work that would impact the ability to correct defects, or with Work that would require that it be removed to correct defects, until testing is complete, and test results indicate that the corrected Work is acceptable.
 - d. Provide safe access for all CMIT activities, including those to be conducted as part of the Owner's Quality Management Program.
 - e. Cooperate fully with the performance of sampling, inspection, and testing. Provide personnel to assist with sampling or to assist in making inspections and field tests.
 - f. Provide Samples and products in adequate quantities for testing at the Site or at the production source of the product for testing.
 - g. Provide facilities required to store and cure test Samples.
 - h. Provide calibrated scales and measuring devices for OPT's use in performing inspections and testing.

- i. Provide adequate lighting to allow OPT observations.
 - j. Make Contract Documents available to testing agencies when requested.
- C. Perform tests as indicated in Contract Documents. All verification testing is to be observed by the Construction Manager or its designated representative.
- D. Submit test reports to the Construction Manager.
- E. Provide an update on quality control activities performed the previous month and planned for the coming month at monthly progress meetings required by Section 01 31 13 "Project Administration."
- F. Determine testing or inspections required to implement the CQCP. Include costs for additional testing and inspections required to meet the Contractor's quality control obligations in the Contract Price.

1.06 CONTRACTOR'S QUALITY CONTROL MANAGER

- A. Provide a Quality Control Manager for the Project. Quality Control Manager must have authority to reject Defective Work, redirect the efforts of the Contractor, Subcontractor and Suppliers to correct Defective Work, and implement steps to prevent future Defective Work.
- B. The resident superintendent or an approved assistant can serve as Quality Control Manager, provided other duties will allow adequate time to serve in this capacity.

1.07 CONTRACTOR'S QUALITY CONTROL PLAN

- A. Provide a CQCP that describes testing and inspections for Work performed at the Site and at remote locations. Include Work by Subcontractors and Suppliers. The CQCP is to include:
 - 1. A description of the quality control organization, including an organization chart showing lines of authority to control the quality of Work.
 - 2. Documentation describing name, qualifications (in resume format), duties, responsibilities, and level of authority of the Quality Control Manager.
 - 3. The name, qualifications (in resume format), duties, responsibilities, and authorities of other persons assigned a quality control function.
 - 4. Procedures for scheduling, reviewing, certifying, and managing documentation including documentation provided by Subcontractors and Suppliers.
 - 5. Control, verification, and acceptance testing procedures for each specific test. Include:
 - a. Name of tests to be performed;
 - b. Specification paragraph requiring test;
 - c. Parameters of Work to be tested;
 - d. Test frequency;
 - e. Persons responsible for each test; and
 - f. Applicable industry testing standards and laboratory facilities to be used for the test.

6. Incorporate the testing specified in the OQMP into the CQCP, specifically identifying the tests or inspections that will be provided by the OQMP;
 7. Procedures for tracking and documenting quality management efforts per Paragraph 1.03.
 8. Reporting procedures which incorporate the use of forms provided by the Construction Manager.
 9. The name of the proposed testing laboratories along with documentation of qualifications per Paragraph 1.03.
- B. Use the Contractor's Quality Control Plan Checklist provided by the Construction Manager to review the CQCP before submitting and include a copy of the completed checklist with the CQCP. Do not begin Work until the CQCP is accepted. Submit an interim plan covering only the portion of Work to be performed if the Contractor plans to begin Work prior to submitting the complete CQCP for the Project. Do not begin Work on other parts of the Project until the complete CQCP is accepted.
- C. Meet with the OPT 7 days after CQCP is submitted and before start of construction to discuss the CQCP.
- D. Notify the Construction Manager of any changes to the CQCP or quality control personnel.

1.08 CONTRACTOR'S USE OF OWNER'S TEST REPORTS

- A. Contractor will receive copies of all test reports documenting the Owner's verification tests. Contractor is entitled to rely on the accuracy of these tests results and use these as part of its quality control efforts.
- B. Contractor may submit a Change Proposal if the Owner's testing program deviates significantly from the OQMP. Contractor must demonstrate that actual testing and inspection costs were incurred implementing the CQCP as a result of Owner's decision to not provide testing described in the OQMP.

1.09 LIMITATION OF AUTHORITY OF THE TESTING LABORATORY

- A. The testing laboratory representatives are limited to providing testing services and interpreting the results of the test performed.
- B. The testing laboratory is not authorized to:
1. Alter the requirements of the Contract Documents;
 2. Accept or reject any portion of the Work;
 3. Perform any of the duties of the Contractor; or
 4. Direct or stop the Work.

1.10 TEST REPORTS

- A. Certified Test Reports are to be prepared for all tests.

1. Tests performed by testing laboratories may be submitted on their standard test report forms if acceptable to the Owner using the process directed by the Construction Manager. These reports must include the following:
 - a. Name of the Owner, Project title and number, and name of the Contractor;
 - b. Name, address, and telephone number of the laboratory;
 - c. Name and signature of the laboratory personnel performing the test;
 - d. Description of the product being sampled or tested;
 - e. Date and time of sampling, inspection, and testing;
 - f. Date the report was issued;
 - g. Description of the test performed;
 - h. Weather conditions and temperature at time of test or sampling;
 - i. Location at the Site or structure where the test was taken;
 - j. Standard or test procedure used in making the test;
 - k. A description of the results of the test;
 - l. Statement of compliance or non-compliance with the Contract Documents; and
 - m. Interpretations of test results, if appropriate.
 2. Submit reports on tests performed by the Contractor, Subcontractors, or Suppliers as directed by the Construction Manager.
 3. OPT will prepare test reports on tests performed by the OPT.
- B. Submit test reports as directed by the Construction Manager within 24 hours of completing the test. Flag tests reports with results that do not comply with Contract Documents for immediate attention. Notify the Construction Manager, using acceptable means other than the test report, immediately of any test that fails to comply with the Contract Documents.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Handle and protect test specimens of products and construction materials at the Site in accordance with recognized test procedures. Provide facilities for storing, curing, and processing test specimens as required by test standards to maintain the integrity of Samples. Transport test specimens in a manner to prevent damage to specimens while in transit.

PART 2 - PRODUCTS

2.01 TESTING APPARATUS

- A. Furnish testing apparatus and related accessories necessary to perform the tests.

2.02 SAMPLE PRODUCTS

- A. Provide Samples of products in adequate quantity for testing.

PART 3 - EXECUTION

3.01 IMPLEMENTING CONTRACTOR'S QUALITY CONTROL PLAN

- A. Perform quality control observations and testing as required in each Section of the Specifications and where indicated on the Drawings.
- B. Include the phases listed below for each definable work task. A definable work task is one which is separate and distinct from other tasks, has separate control requirements, may be provided by different trades or disciplines, or may be work by the same trade in a different environment.
 - 1. Planning Phase: Perform the following before beginning each definable work task:
 - a. Review the Contract Documents.
 - b. Review documents the Contractor will submit and determine that they are complete in accordance with the Contract Documents.
 - c. Check to ensure that all materials and/or equipment have been tested, submitted, and approved.
 - d. Examine the work area to ensure that all required preliminary Work has been completed and complies with the Contract Documents.
 - e. Examine required materials, equipment, and sample Work to ensure that they are on hand, conform to Contract Documents, Shop Drawings and Product Data, and are properly stored.
 - f. Review requirements for quality control inspection and testing.
 - g. Discuss procedures for controlling quality of the Work. Document construction tolerances and workmanship standards for the work task.
 - h. Check that the portion of the plan for the Work to be performed incorporates document review comments.
 - i. Discuss results of planning phase with the Construction Manager. Conduct a meeting attended by the Construction Manager, Quality Control Manager, superintendent, other quality control personnel as applicable, and the foreman responsible for the work task. Instruct applicable workers as to the acceptable level of workmanship required to meet the requirements of the Contract Documents. Document the results of the planning phase actions by separate meeting minutes prepared by the Quality Control Manager and attached to the quality control report.
 - j. Do not move to the next phase unless results of investigations required for the planning phase indicate that requirements have been met.
 - 2. Work Phase: Complete this phase after the planning phase.
 - a. Notify the Construction Manager at least 1 week in advance of beginning the Work and discuss the review of the planning phase effort to indicate that requirements have been met.
 - b. Check the Work to ensure that it is in full compliance with the Contract Documents.

- c. Verify adequacy of controls to ensure full compliance with the Contract Documents. Verify required control inspection and testing is performed.
 - d. Verify that established levels of workmanship meet acceptable workmanship standards. Compare with required Sample panels as appropriate.
 - e. Repeat the work phase for each new crew to work on-site, or any time acceptable specified quality standards are not being met.
- 3. Follow-Up Phase: Perform daily checks to ensure control activities, including control testing, are providing continued compliance with contract requirements.
 - a. Make checks daily and record observations in the quality control documentation.
 - b. Conduct follow-up checks and correct all defects prior to the start of additional work tasks that may be affected by the Defective Work. Do not build upon nor conceal Defective Work.
 - c. Conduct a review of the Work at least 1 month prior to the expiration of the correction period prescribed in the General Conditions with the OPT. Correct defects as noted during the review.
- C. Conduct additional planning and work phases if:
 - 1. The quality of on-going Work is unacceptable;
 - 2. Changes are made in applicable quality control staff, on-site production supervision, or crews;
 - 3. Work on a task is resumed after a substantial period of inactivity; or
 - 4. Other quality problems develop.

3.02 DEFECTIVE WORK

- A. Immediately correct any Defective Work or notify the Construction Manager why the Work is not to be corrected immediately and when corrective action will be completed.
- B. Work performed that is connected or adjacent to Defective Work or Work that would have to be removed to correct Defective Work is also considered to be Defective. Contractor is responsible for all costs associated with replacing any acceptable Work that must be removed, or might be damaged by corrective actions.
- C. Document Defective Work, corrective actions taken to correct defects, and that corrected Work complies with the Contract Documents.
- D. Implement countermeasures to prevent future Defective Work.
- E. No payment will be made for Defective Work. Remove Work from the Application for Payment if Work paid for on a previous Application for Payment is found to be Defective.
- F. Owner will withhold payment for Defective Work or Work that has not been tested or inspected in accordance with the CQCP, OQCP, or the Contract Documents.

3.03 VERIFICATION TESTING FOR CORRECTED DEFECTS

- A. Provide verification testing on corrected Work when corrective action is complete to demonstrate that the corrected Work complies with the Contract Documents. Conduct the

same tests or inspections used to determine that the original Work was Defective. Different tests or methods may be used if approved by the Owner. Document that Defective Work has been corrected with the Construction Manager.

- B. Pay for verification testing until Work meets quality requirement set forth in the Contract Documents. OPT may perform verification testing as part of the Owner's Quality Management Program and impose a set-off to recover the cost for this testing.

3.04 OWNER'S PRELIMINARY QUALITY CONTROL PLAN

Spec. Section	Test / Frequency	OPT or Contractor
03 30 00	Compressive strength. One set of three cylinders for each concrete placement with one additional set of cylinders for each 50 yards in a single placement.	OPT

END OF SECTION

01 57 00 TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment, and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.
- B. Construct temporary impounding works, channels, diversions, furnishing, and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.

1.02 DOCUMENTATION

- A. Provide Shop Drawings in accordance with Section 01 33 02 "Shop Drawings."
- B. Provide copies of notices, records, and reports required by the Contract Documents or Laws and Regulations as Product Data in accordance with Section 01 31 13 "Project Administration."

1.03 QUALITY ASSURANCE

- A. Construct and maintain temporary controls with adequate workmanship using durable materials to provide effective environmental management systems meeting the requirements of the Contract Documents and Laws and Regulations. Use materials that require minimal maintenance to prevent disruption of construction activities while providing adequate protection of the environment.
- B. Periodically inspect systems to determine that they are meeting the requirements of the Contract Documents.

1.04 POLLUTION CONTROL

- A. Prevent the contamination of soil, water, or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.
- B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.
 - 1. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-site locations in an acceptable manner.
 - 2. Excavate contaminated soil and dispose at an off-site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.
 - 3. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal site.

4. Comply with Laws and Regulations regarding the disposal of pollutants.
- C. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or contaminated soil is considered contaminated. Do not allow contaminated water to enter streams or water courses, leave the Site in a non-contained form, or enter non-contaminated areas of the Site.
 1. Construct temporary holding ponds or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.
 2. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

1.05 EARTH CONTROL

- A. Remove excess soil, spoil materials, and other earth not required for backfill. Control stockpiled materials to eliminate interference with Contractor and Owner's operations.
- B. Dispose of excess earth off the Site. Provide written approval from the property owner for soils deposited on private property as Product Data per Section 01 31 13 "Project Administration." Obtain approval of the OPT if this disposal impacts the use of Site or other easements.

1.06 AIR POLLUTION CONTROL

- A. Air Pollution Watch Days:
 1. Air Pollution Watch Days (APWD) may occur in the following times:
 - a. Typical Ozone Season: May 1 through October 31.
 - b. Critical Emission Time: 6:00 a.m. to 10:00 a.m.
 2. Watch Days:
 - a. State or local environmental regulatory agencies, in coordination with the National Weather Service, may designate the following day as an APWD by 3:00 p.m. on the prior afternoon.
 - b. Begin work after 10:00 a.m. on designated APWD if work requires the use of heavy construction equipment for run times in excess of 1 hour prior to 10:00 a.m. Heavy construction equipment may be used prior to 10:00 a.m. if equipment is certified by EPA as "Low Emitting" or equipment burns Ultra Low Sulfur Diesel (ULSD), diesel emulsions, or alternative fuels such as CNG.
- B. Obtain air permit for construction activities per requirements of Laws and Regulations.

1.07 TEMPORARY STORMWATER POLLUTION CONTROL

- A. Provide temporary stormwater pollution control per Section 01 57 23 "Temporary Stormwater Pollution Control."

1.08 MANAGEMENT OF WATER

- A. Manage water resulting from rains or ground water at the Site. Maintain trenches and excavations free of water at all times.
- B. Lower the water table in the construction area by acceptable means if necessary to maintain a dry and workable condition at all times. Provide drains, sumps, casings, well points, and other water control devices as necessary to remove excess water.
- C. Provide continuous operation of water management actions. Maintain standby equipment to provide proper and continuous operation for water management.
- D. Ensure that water drainage does not damage adjacent property. Divert water into the same natural watercourse in which its headwaters are located, or other natural stream or waterway as approved by the Owner. Assume responsibility for the discharge of water from the Site.
- E. Remove the temporary construction and restore the Site in a manner acceptable to the Construction Manager and to match surrounding material at the conclusion of the Work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide materials that comply with Laws and Regulations.

PART 3 - EXECUTION

3.01 CONSTRUCTING, MAINTAINING, AND REMOVING TEMPORARY CONTROLS

- A. Construct temporary controls in accordance with Laws and Regulations.
- B. Maintain controls in accordance with regulatory requirements where applicable or in accordance with the requirements of the Contract Documents.
- C. Remove temporary control when no longer required, but before the Project is complete. Correct any damage or pollution that occurs as the result of removing controls while they are still required.

END OF SECTION

01 60 00 PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide products for this Project that comply with the requirements of this Section. Specific requirements of the detailed equipment specifications govern in the case of a conflict with the requirements of this Section.
- B. Comply with applicable specifications and standards.

1.02 DOCUMENTATION

- A. Provide documents in accordance with the Contract Documents.

1.03 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. Provide products designed for structural stability and operational capability.
 - 2. Provide members designed to withstand all loads imposed by installation, erection, and operation of the product without deformation, failure, or adversely affecting the operational requirements of the product. Size and strength of materials for structural members are specified as minimums only.
 - 3. Design mechanical and electrical components for all loads, currents, stresses, and wear imposed by startup and normal operations of the equipment without deformation, failure, or adversely affecting the operation of the unit. Mechanical and electrical components specified for equipment are specified as the minimum acceptable for the equipment.
- B. Coordination:
 - 1. Provide coordination of the entire Project, including verification that structures, piping, and equipment components to be furnished and installed for this Project are compatible.
 - 2. Determine that the equipment furnished for this Project is compatible with the requirements of the Contract Documents and with the equipment and materials furnished by others.
 - 3. Provide electrical components for equipment that comply with all provisions of the Contract Documents.
 - 4. Apply protective coatings and paints to equipment in the shop that are fully compatible with the final coatings to be field applied in accordance with the Contract Documents.
- C. Adapting Substitute Products:
 - 1. The Drawings and Specifications are prepared for the specified products. Make modifications to incorporate the products into the Project if a substitution is requested for a product is and approved in accordance with Section 01 26 00 "Change Management."

2. Do not provide a product with a physical size that exceeds the available space. Consideration may be given to the acceptance of these products or equipment if the Contractor assumes all costs necessary to incorporate the item and the OPT approves such revisions.
3. Coordinate electrical requirements for the products to be installed in the Project, including revisions in electrical equipment components wiring and other elements necessary to incorporate the component.

1.04 STANDARDS

- A. The applicable industry standards referenced in the Specifications apply as if written here in their entirety.
- B. Provide equipment manufactured using structural and miscellaneous fabricated steel conforming to the standards of the American Institute of Steel Construction, except where indicated otherwise.

1.05 WARRANTIES AND GUARANTEES

- A. Normal warranty provisions are as stated in the General Conditions and Section 01 78 36 "Warranties and Service Agreements."
- B. Correct Defective Work under the provisions of the General Conditions.
- C. Provide warranties and guarantees for periods as defined in the Contract Documents. Individual Sections of the Specifications may have more stringent warranty requirements than stated in the General Conditions. The most stringent warranty will apply in the event of conflicts within the Contract Documents.
- D. The Contract Documents may require special warranties that guarantee performance at a specified capacity, power consumption, efficiency, or other operating parameter. Correct defects that prevent products from meeting the specified performance parameters. The requirements of the special warranty that guarantee performance will be satisfied when the specified performance parameters have been met for a period of 1 calendar year of operation, unless Owner elects to accept Defective Work under the provisions of the General Conditions.
- E. The Contract Documents may require special warranties for periods extending beyond the one-year correction period specified in the General Conditions. The full warranty provisions and requirements for correction of Defective Work stated in the General Conditions apply throughout the extended warranty period.
- F. Provide a warranty bond to provide the same protection as the Contractor's performance bond for extended special warranties. The warranty bond will become effective on the day the performance bond expires which is 1 year after the date of final payment per the General Conditions. The warranty bond will remain in effect until the extended warranty period has expired.
- G. In the event that products are repaired, modified, or replaced under the warranty bond, then the warranty period will continue on the date of completion of these repairs for a period of 6 months or until the end of the original warranty period, whichever is later. In no event will

the warranty period extend more than 6 months beyond the end of the original warranty period.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide products according to normally accepted engineering and shop practices, except where a higher standard of quality is required by the Contract Documents.
- B. Manufacture like parts of duplicate units to standard sizes and gages that are interchangeable.
- C. Two or more items of the same kind are to be identical and made by the same Supplier.
- D. Provide products suitable for the intended service.
- E. Adhere to the equipment capacities, sizes, and dimensions indicated in the Contract Documents.
- F. Do not use products for any purpose other than that for which they were designed.
- G. Provide new products. Do not provide equipment that has been in service at any time prior to delivery except for testing in accordance with the Contract Documents.
- H. Provide materials suitable for service conditions.
- I. Provide iron castings that are tough, close grained gray iron free from blowholes, flaws, or excessive shrinkage and that conform to ASTM A48.
- J. Design structural members for shock or vibratory loads.
- K. Provide steel that is at least 1/4 inch thick for all elements that will be submerged or subject to splashing all or part of the time during normal operation of the equipment. Chamfer or grind all edges to eliminate sharp exposed edges.

2.02 ELECTRIC MOTORS

- A. Provide equipment with motors that comply with the following requirements unless the detailed equipment specifications have different requirements:
 - 1. Provide motors designed in compliance with NEMA, ANSI, IEEE, and AFBMA standards and the NEC for the specific duty imposed by the driven equipment that are appropriate for the application per these same standards.
 - 2. Provide motors designed for frequent starting duty equivalent to the duty service required by the driven equipment where frequent starting occurs.
 - 3. Provide motors rated for continuous duty at 40 deg. C ambient unless recognized and defined by the standards and codes for intermittent duty as a standard industry practice. Provide motors for which motor temperature rise above 40 deg. C ambient does not exceed the NEMA limit when operating continuously at nameplate horsepower.
 - 4. Provide motors designed to start with an appropriate starter or variable speed drive.

5. Provide motors designed for motor bearing life based upon the actual operating load conditions imposed by the driven equipment.
 6. Provide motors sized for the altitude of the location where the equipment is to be installed.
 7. Provide motors that meet the following service factor requirements:
 - a. Maximum load of 87 percent of the nameplate horsepower for motors with a 1.0 service factor; and
 - b. Maximum load of 100 percent of the nameplate horsepower for motors with a 1.15 service factor.
 8. Provide motors that comply with the latest applicable provisions of NEMA MG1 and are manufactured using the following process when the detailed specifications call for encapsulated motor windings:
 - a. Seal the stator assembly by vacuum pressure impregnation (VPI) with epoxy resin after stator assembly;
 - b. Provide two VPI treatments for stator, with each treatment consisting of a dip followed by an oven bake; and
 - c. Provide a final (third) coating of a durable epoxy varnish suitable for protection against dust, moisture, and chemical degradation after the final cure for the stator assembly.
 9. Provide motors with a clamp type grounding terminals inside the motor conduit box.
 10. Provide oversized conduit boxes for motors with external conduit boxes.
 11. Provide motors with maximum starting current that meets NEMA MG1, Class H.
 12. Provide motors with efficiencies that comply with NEMA MG1 for high efficiency motors.
 13. Provide motors with minimum insulation Type F.
 14. Provide motors that are random wound with copper coils.
 15. Provide motors rated for the appropriate classification when motors are installed in a hazardous location.
- B. Provide the manufacturer's standard motor on integrally constructed motor driven equipment such as appliances, hand tools, etc. if redesign of the complete unit would be required to provide a motor with the specified features.
- C. Provide motors within the horsepower ranges indicated below that are rated and constructed as follows unless otherwise required by the detailed equipment specifications.
1. Below 1/2 hp:
 - a. 115 volts, 60 Hertz, single phase;
 - b. Dripproof in clean and dry locations; TEPF in all other locations;
 - c. Permanently lubricated sealed bearings; and

- d. Built in manual reset thermal protector or furnished with integrally mounted stainless steel enclosed manual motor overload switch.
- 2. 1/2 to 1 hp:
 - a. 230/460 volts, 60 Hertz, 3 phase;
 - b. Dripproof in clean and dry locations, TEFC in all other locations; and
 - c. Permanently lubricated sealed bearings.
- 3. 1-1/2 hp and above:
 - a. 230/460 volts, 60 Hertz, 3 phase;
 - b. Dripproof in clean and dry locations, TEFC in all other locations;
 - c. Oil or grease lubricated anti friction or oil lubricated sleeve bearings; and
 - d. Vertical motors must have 15-year average life thrust bearings.
- D. Provide space heaters operating on 120-volt single-phase service for motors with horsepower ratings of 15 hp or greater.

2.03 EQUIPMENT APPURTENANCES

- A. Provide a safety guard covering all sides on belt or chain drives, fan blades, couplings, and other moving or rotating parts:
 - 1. Fabricate safety guards from 16 US gauge or heavier galvanized or aluminum clad sheet steel or 1/2-inch mesh galvanized expanded metal;
 - 2. Design guards for easy installation and removal;
 - 3. Provide galvanized supports and accessories for each guard;
 - 4. Provide stainless steel bolts and hardware; and
 - 5. Provide safety guards designed to prevent the entrance of rain and dripping water in outdoor locations.

2.04 ANCHOR BOLTS

- A. Provide suitable anchor bolts for each product.
- B. Provide anchor bolts with templates or setting drawings in time to permit casting the anchor bolts in the concrete when concrete is placed.
- C. Provide two nuts for each bolt.
- D. Provide anchor bolts for products mounted on baseplates that are long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Bolts must be long enough to provide full nut engagement and leave three threads exposed. Housekeeping pads are not structural concrete.
- E. Provide stainless steel anchor bolts, nuts, and washers.

2.05 SPECIAL TOOLS AND ACCESSORIES

- A. Furnish tools, instruments, lifting and handling devices, and accessories necessary for proper maintenance and adjustment that are available only from the manufacturer or are not commonly available.

2.06 EQUIPMENT IDENTIFICATION PLAQUES

- A. Provide a plaque for each piece of equipment in accordance with Section 40 05 53 "Identification for Process Piping and Equipment."

2.07 LUBRICATION SYSTEMS FOR EQUIPMENT

- A. Provide equipment lubricated by systems which:
 - 1. Require attention no more frequently than weekly during continuous operation.
 - 2. Do not require attention during startup or shut down.
 - 3. Do not waste lubricants.
- B. Provide lubricants to fill lubricant reservoirs and to replace lubricant consumed during testing, startup, and operation prior to acceptance of equipment by the Owner.

2.08 INSULATION OF PIPING

- A. Insulate all piping on or related to equipment as required to prevent freezing under any condition. Insulate piping per the manufacturer's written instruction or per Section 23 07 19 "HVAC Piping Insulation" whichever is more stringent.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install equipment including equipment pre-selected or furnished by the Owner. Assume responsibility for proper installation, startup, and making the necessary adjustments so that the equipment is placed in proper operating condition per Section 01 75 00 "Starting and Adjusting."

3.02 LUBRICATION

- A. Lubricate all products provided or installed for this Project, including products furnished by the Owner, per the manufacturer's written recommendations until the product is accepted by the Owner.

END OF SECTION

01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

1.01 SUMMARY

- A. Comply with requirements of the General Conditions and specified administrative procedures in closing out the Contract.

1.02 DOCUMENTATION

- A. Submit affidavits and releases on forms provided by the Construction Manager through the PMIS.

1.03 SUBSTANTIAL COMPLETION

- A. The following requirements must be met for the Project or a designated portion of the Work to be Substantially Complete per the General Conditions:
 - 1. Work must be fully functional and able to operate in accordance with the Contract
 - 2. Performance Acceptance Testing (PAT) must be complete and indicated compliance with the requirements of the Contract Documents.
 - 3. Operation and maintenance manuals must be approved and operator training conducted to allow the Owner to assume responsibility for operations.
- B. Conduct inspections with superintendent, Subcontractors, and Suppliers for the Work or a designated portion of the Work prior to calling for a Substantial Completion inspection by the OPT. Create a list of deficiencies in the Work that must be completed for the Project to qualify for Substantial Completion. Review the list with the Construction Manager or the designated member of the OPT. The Construction Manager or the designated member of the OPT may assist the Contractor with this effort; however, it is the Contractor's responsibility to create and manage this list of deficiencies until corrections are made.
- C. Correct the identified deficiencies prior to calling for a Substantial Completion inspection.
- D. Notify the Construction Manager that the Work or a designated portion of the Work is Substantially Complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the Project will be considered for Final Completion.
- E. OPT will visit the Site to observe the Work within a reasonable time after notification is received to determine the status of the Project.
- F. Construction Manager will notify the Contractor that the Work is either Substantially Complete or that additional Work must be performed before the Project will be considered Substantially Complete.
 - 1. Construction Manager will notify the Contractor of items that must be completed before the Project will be considered Substantially Complete.
 - 2. Correct the noted deficiencies in the Work.
 - 3. Notify the Construction Manager when the items of Work in the Construction Manager's notice have been completed.
 - 4. OPT will revisit the Site and repeat the process.

5. Construction Manager will issue a Certificate of Substantial Completion to the Contractor when the OPT considers the Project to be Substantially Complete. The certificate will include a tentative list of items to be corrected before Final Payment will be recommended.
6. Review the list and notify the Construction Manager of any objections to items on the list within 10 days after receiving the Certificate of Substantial Completion.

1.04 TRANSFER OF UTILITIES

- A. Transfer utilities to the Owner when the Certificate of Substantial Completion has been issued.
- B. Submit final meter readings for utilities and similar data as of the date the Owner occupied the Work.

1.05 CLOSEOUT REQUIREMENTS

- A. Provide the following before Final Completion:
 1. Record Documents per Section 01 31 13 "Project Administration";
 2. Keys and keying schedule;
 3. Warranties, bonds, and service agreements;
 4. Equipment Installation Reports;
 5. Shop Drawings, Product Data, operation and maintenance manuals, and other documentation required by the Contract Documents;
 6. Specified spare parts and special tools;
 7. Certificates of occupancy, operating certificates, or other similar releases required to allow the Owner unrestricted use of the Work and access to services and utilities;
 8. Evidence of continuing insurance and bond coverage as required by the Contract Documents; and
 9. Final videos and photographs per Section 01 33 06 "Graphic Documentation."

1.06 WARRANTIES, BONDS, AND SERVICES AGREEMENTS

- A. Provide warranties, bonds, and service agreements required by Section 01 33 00 "Document Management" or by the individual Sections of the Specifications.
- B. The date for the start of warranties, bonds, and service agreements is established per the General Conditions.
- C. Compile warranties, bonds, and service agreements and review these documents for compliance with the Contract Documents.
 1. Each document is to be signed by the respective Supplier or Subcontractor.
 2. Each document is to include:
 - a. The product or Work item description;
 - b. The firm name, with the name of the principal, address, and telephone number;

- c. Scope of warranty, bond, or services agreement;
 - d. Date, duration, and expiration date for each warranty bond and service agreement;
 - e. Procedures to be followed in the event of a failure; and
 - f. Specific instances that might invalidate the warranty or bond.
- D. Submit digital copies of the documents to the Construction Manager for review.
 - E. Submit warranties, bonds, and services agreements within 10 days after equipment or components placed in service.

1.07 FINAL COMPLETION

- A. Conduct inspections with Superintendent, Subcontractors, and Suppliers prior to calling for a Final Completion inspection by the OPT. Create a list of deficiencies in the Work that must be completed for the Project to qualify for the Final Completion inspection. Review the list with the Construction Manager or the designated member of the OPT. The Construction Manager or the designated member of the OPT may assist the Contractor with this effort; however, it is the Contractor's responsibility to create and manage this list of deficiencies until corrections are made.
- B. Identify, list, and correct deficiencies prior to calling for a Final Completion inspection. The Project at the call for Final Completion represents the Contractor's interpretation of a project completed in conformance with the Contract Documents and reflects the Contractor's representation of a quality project meeting the Owner's expectations.
- C. Notify the Construction Manager when:
 - 1. Work has been completed and complies with the Contract Documents;
 - 2. Equipment and systems have been tested per the Contract Documents and are fully operational;
 - 3. Final operation and maintenance manuals have been provided to the Owner and all operator training has been completed;
 - 4. Specified spare parts and special tools have been provided;
 - 5. Work is complete and ready for final inspection;
 - 6. Final documentation for all outstanding Modifications and Claims (other than those listed on the Certificate of Final Completion) have been processed and are ready for incorporation into the final Application for Payment; and
 - 7. Closeout requirements in Paragraph 1.05 have been completed.
- D. OPT will visit the Site to determine if the Project is complete and ready for final payment within a reasonable time after the notice is received.
- E. Construction Manager will notify the Contractor that the Project is complete or will notify the Contractor that Work is Defective.
- F. Take immediate steps to correct Defective Work. Notify the Construction Manager when Defective Work has corrected. OPT will visit the Site to determine if the Project is complete and the Work is acceptable. Construction Manager will issue a Certificate of Final Completion

to the Contractor when the Project is complete or will notify the Contractor that Work is Defective.

- G. Submit the request for final payment with closeout documentation described in Paragraph 1.06 if notified that the Project is complete and the Work is acceptable.

1.08 REINSPECTION FEES

- A. Owner may impose a set-off against the Application for Payment in accordance with the General Conditions to compensate the OPT for additional visits to the Project if additional Work is required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 74 23 FINAL CLEANING

PART 1 - GENERAL

1.01 SUMMARY

- A. Perform a thorough cleaning of the Site, buildings, or other structures prior to Owner occupancy of the buildings, and prior to Final Completion. Leave the Project clean and ready for occupancy.

1.02 DOCUMENTATION

- A. Provide data for maintenance per Section 01 33 04 "Operation and Maintenance Data."

1.03 QUALITY CONTROL

- A. Use experienced workmen or professional cleaners for final cleaning.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Furnish the labor and products needed for cleaning and finishing as recommended by the manufacturer of the surface material being cleaned.
- B. Use cleaning products only on the surfaces recommended by the Supplier.
- C. Use only those cleaning products which will not create hazards to health or property and which will not damage surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. Thoroughly clean the entire Site and make ready for occupancy.
 - 1. Remove construction debris, boxes, and trash from the Site.
 - 2. Remove construction storage sheds and field offices.
 - 3. Restore grade to match surrounding condition and remove excess dirt.
 - 4. Sweep all drives and parking lots clean of dirt and debris. Use water trucks or hose down paved site to like new appearance.
- B. Clean floors and inspect for damage.
 - 1. Remove oil, grease, paint drippings, and other contaminants from floors, then mop repeatedly until thoroughly clean. Replace damaged flooring.
 - 2. Clean resilient flooring with an approved cleaner and provide one coat of liquid floor polish as recommended by the flooring manufacturer. Polish to a buffed appearance with powered floor buffer.
 - 3. Vacuum all carpets with powered floor sweeper to remove dirt and dust. Remove glue or other substances from nap of carpet.

- C. Clean and polish inside and outside glass surfaces. Wash with window cleaner and water, apply a coat of high quality glass polish, and wipe clean. Do not scratch or otherwise mar glass surfaces.
- D. Clean wall surfaces to remove dirt or scuff marks. Remove excess adhesive along top edges of wall base. Remove adhesive from surfaces of vinyl wall coverings.
- E. Align ceiling tile to fit properly in grid and replace cracked or damaged tile. Remove smear marks and other dirt from tile and clean surface of grid system.
- F. Spot paint nicks and other damage. Repaint the wall from inside corner to inside corner if spot-painting does not blend into the existing color and texture of the surrounding surfaces. Touch up damaged surfaces on factory finished equipment using special paint furnished by the manufacturer.
- G. Clean plumbing fixtures, valves, and trim. Clean toilet seats and covers. Remove labels and adhesive from fixtures. Remove floor drains and clean baskets or buckets. Polish strainers and exposed chrome or brass.
- H. Remove dirt, oil, grease, dust, and other contaminants from floors, equipment, and apparatus in mechanical and electrical rooms.
- I. Clean and polish ceramic tile floors and wall surfaces to remove mildew or other stains. Tuck point defective joints.
- J. Inspect exterior painted surfaces. Spot paint any damaged surfaces.
- K. Clean permanent filters and replace disposable filters on heating, ventilating, and air conditioning systems. Clean ducts, blowers, and coils if units were operated without filters during construction.
- L. Clean roof areas of debris; flush roof drainage systems with water until clear.
- M. Broom clean exterior paved surfaces and rake clean other surfaces of the grounds.
- N. Clean and polish all electrical equipment and exposed conduits. Remove paint overspray. Provide a blemish free appearance on all exposed equipment and conduits.

END OF SECTION

01 75 00 STARTING AND ADJUSTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide step-by-step procedures for starting provided systems, including equipment, pumps, and processes.
- B. Provide pre-startup inspections by equipment manufacturers.
- C. Place each system in service and operate the system to prove performance and to provide for initial correction of defects in workmanship, calibration, and operation.
- D. Provide for initial maintenance and operation.
- E. Include costs for starting and adjusting provided by manufacturer's representative in the Cost of Work for the equipment package.
- F. Owner will provide chemicals, if any, required for continued operations.

1.02 STANDARDS

- A. Comply with the specified standards associated with the testing or startup of equipment.

1.03 DOCUMENTATION

- A. Provide the following documents in accordance with Section 01 33 00 "Document Management":
 - 1. A Plan of Action for testing, checking, and starting equipment as Product Data per Section 01 31 13 "Project Administration."
 - 2. Equipment Installation Reports on the form provided by the Construction Manager certifying that the equipment and related appurtenances have been thoroughly examined and approved for startup and operation.
 - 3. Operation and maintenance manuals per Section 01 33 04 "Operation and Maintenance Data." Preliminary operation and maintenance data must be approved before installation, testing, and initial operation of equipment or providing training required by Section 01 79 00 "Training of Operation and Maintenance Personnel."

1.04 SPECIAL JOB CONDITIONS

- A. Do not start or test any equipment until the complete unit has been installed and thoroughly checked.
- B. Provide the services of a qualified representative of the manufacturer to attend the tests and startup procedures as required by this Section.
- C. Do not start or test any equipment until the preliminary operation and maintenance manual per Section 01 33 04 "Operation and Maintenance Data" has been approved.

PART 2 - PRODUCTS

2.01 TESTING INSTRUMENTATION

- A. Provide new instrumentation and testing devices needed to conduct tests for maintenance and operation as recommended in the operation and maintenance manuals. This equipment is to become the property of the Owner and transferred in good working order as a spare part at Substantial Completion. This equipment is to be calibrated and ready for use during the startup procedure and for training provided in accordance with Section 01 79 00 "Training of Operation and Maintenance Personnel."

PART 3 - EXECUTION

3.01 SERVICES OF MANUFACTURER'S REPRESENTATIVES

- A. Provide the services of experienced and technically competent representatives of the manufacturer for inspections, tests, supervision of installation, training, and assistance with placing equipment in operation.
- B. Perform installation, adjustment, and testing of the equipment under the direct supervision of the manufacturer's representative where specified. Certify that the equipment and related appurtenances have been thoroughly examined and approved for startup and operation in the Equipment Installation Reports.
- C. Provide on-site services as necessary for proper and trouble free operation of the equipment.

3.02 INSPECTION AND STARTUP

- A. Inspect equipment prior to placing any equipment or system into operation. Make adjustments as necessary for proper operation. Do not start or test any apparatus until the complete unit has been installed and thoroughly checked.
 - 1. Check for adequate and proper lubrication.
 - 2. Determine that parts or components are free from undue stress from structural members, piping, or anchorage.
 - 3. Adjust equipment for proper balance and operations.
 - 4. Determine that vibrations are within acceptable limits.
 - 5. Determine that equipment operates properly under full load conditions.
 - 6. Determine that the equipment is in true alignment.
 - 7. Ensure that the proper procedure is employed in startup of systems.

3.03 STARTING REQUIREMENTS

- A. Refer to the individual Specification Sections for specific startup procedures or other requirements.

3.04 INITIAL OPERATION

- A. Start, test, and place equipment and systems into operation for 30 days to allow the OPT to observe the operation and overall performance of the equipment and to determine that controls function as intended.
- B. Operate equipment which is used on a limited or part-time basis in the presence of the OPT for a period long enough to demonstrate that controls function as specified.
- C. Perform acceptance test as specified in individual Specification Sections. Demonstrate that equipment and systems meet the specified performance criteria.
- D. Equipment and systems may be considered as substantially complete at the end of this initial operation period if the equipment is placed in continuous beneficial use by the Owner, unless specifically stated otherwise in the individual equipment Specifications.

3.05 INITIAL MAINTENANCE

- A. Maintain equipment in accordance with the operation and maintenance manuals until Project is substantially complete and provisions have been made by the Owner for accepting responsibility for equipment operation in accordance with the General Conditions.
- B. Service equipment in accordance with the operation and maintenance manuals immediately before releasing the equipment to the Owner.

END OF SECTION

01 78 36 WARRANTIES AND SERVICE AGREEMENTS

PART 1 - GENERAL

1.01 WARRANTY REQUIREMENTS

- A. Provide products for this Project that comply with the requirements of this Section.

1.02 WARRANTIES AND GUARANTEES

- A. Guarantee and warrant products furnished by the Contractor against:
 - 1. Faulty or inadequate design;
 - 2. Improper assembly or erection;
 - 3. Defective workmanship or materials; and
 - 4. Leakage, breakage, or other failure.
- B. Guarantee and warrant the products installed under this Contract, including Goods furnished by the Owner, against leakage, breakage, or other failure due to improper assembly or erection and against improper installation of the equipment. The correction period is as defined in the General Conditions. Individual Specification Sections may have more stringent warranty requirements than those stated in the General Conditions. The most stringent warranty will be provided in the event of conflicts.
- C. Provide all required warranties, guarantees, and related documents with the Shop Drawing. The effective date of warranties and guarantees will be the date of Substantial Completion.
- D. Include an additional copy of equipment warranties in operation and maintenance manuals.
- E. Provide a copy of all warranties in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.03 EXTENDED WARRANTIES

- A. Extended Warranties are defined as any guarantee of performance for the product or system beyond the one-year correction period described in the General Conditions.
- B. Issue the warranty certificate in the name of the Owner.
- C. Provide a warranty bond for Extended Warranties as required by the individual Specification Sections.

1.04 SERVICE AGREEMENTS

- A. Provide Extended Service Agreements (ESA) and related documents with the Shop Drawing. An Extended Service Agreement is a contract between the Owner and an approved Subcontractor or Supplier to provide service and or maintenance beyond that required to fulfill requirements for warranty repairs or to perform routine maintenance for a definite period beyond the one-year correction period specified in the General Conditions.
- B. Requirements for the Extended Service Agreement are described in the Specification Sections for each piece of equipment or system requiring an Extended Service Agreement.

- C. Enter into a contract with the service provider and assign the service contract to the Owner on the date of Substantial Completion. Once assigned to the Owner, Contract requirements for the Extended Service Agreement will be complete and will not extend the Contract between the Owner and Contractor.
- D. Owner may require that a performance bond be provided for the Extended Service Agreement. Provide a separate bond meeting the same requirements as those for the Contractor's performance bond if required. The bond will be in the amount of the Extended Service Agreement.
- E. Include an additional copy of Extended Service Agreements in operation and maintenance manuals.
- F. Provide a copy of Extended Service Agreements in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 79 00 TRAINING OF OPERATION AND MAINTENANCE PERSONNEL

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide services of Supplier's operation and maintenance training specialists to instruct Owner's personnel in recommended operation and maintenance procedures for equipment furnished. Details for training may be established in the specifications for that equipment.
- B. Provide a combination of classroom and hands on training.
- C. Training may be conducted at Contractor's or Supplier's facilities provided Contractor pays for travel, lodging, and per diem costs of the Owner.
- D. Record training sessions on video and submit to the Owner on DVD disk in MPEG-4 format for Owner's later use in instructing Owner's personnel. Include this recording as part of the final operation and maintenance manual. Provide legal releases or pay additional fees required to allow training by the manufacturer to be recorded.
- E. Include the cost for training and startup in the Cost of the Work for each equipment package.

1.02 DOCUMENTATION

- A. Provide documentation in accordance with Section 01 33 00 "Document Management" and include:
 - 1. Equipment Installation Reports in accordance with Section 01 75 00 "Starting and Adjusting" on forms provided by the Construction Manager;
 - 2. A lesson plan for training in accordance with Paragraph 3.01.C;
 - 3. Credentials of Supplier's proposed operation and maintenance instructors demonstrating compliance with requirements of Paragraph 1.04; and
 - 4. Operation and maintenance manuals per Section 01 33 04 "Operation and Maintenance Data." Preliminary operation and maintenance data must be approved before installation, testing, and initial operation of equipment or providing training required by the Section.

1.03 SCHEDULING OF TRAINING

- A. Coordinate training services with startup and initial operation of equipment on days and times Owner is available.
- B. Training may be required outside of normal business hours to accommodate schedules of operation and maintenance personnel.
- C. Provide training of Owner's personnel after acceptable preliminary operation and maintenance manuals have been approved.
- D. Coordinate training with equipment startup and testing and availability of Owner's personnel.
- E. Provide a proposed training schedule for review and acceptance by OPT showing all training required in the Contract Documents. Demonstrate compliance with specified training

requirements relative to number of hours of training, number of training sessions, and scheduling.

- F. Submit initial training schedule at least 60 days before scheduled start of first training session. Submit final training schedule, incorporating revisions in accordance with OPT's comments, no later than 30 days prior to starting the first training session.
- G. Owner reserves the right to modify personnel availability for training in accordance with process or emergency needs.
- H. Schedule for training is to be approved by Owner.
 - 1. Schedule training and startup operations for no more than one piece of equipment or system at a time.
 - 2. Owner may require re-scheduling of training if operations personnel are not available for training on a scheduled date.
 - 3. Provide a minimum of 2 weeks' notice if training must be rescheduled.
 - 4. Training is to be limited to 24 hours per week.
 - 5. Time required for training is to be included in the development of the Project schedule.
- I. Schedule and coordinate training for equipment or systems which depend upon other equipment or systems for proper operation so that trainees can be made familiar with the operation and maintenance of the entire operating system.

1.04 SERVICES OF SUPPLIER'S REPRESENTATIVE

- A. Supplier's instructors must be factory-trained by the equipment manufacturer.
- B. Instructors must have knowledge of the theory of operation and practical experience with the equipment or system.
- C. Instructors must be proficient and experienced in conducting training of the type required and must have successfully conducted similar training courses.
- D. Qualifications of instructors are subject to acceptance by OPT. Provide services of replacement instructor with acceptable qualifications if OPT does not accept qualifications of proposed instructor. Include each instructor's résumé and specific details of instructor's operating, maintenance, and training experience relative to the specific equipment for which instructor will provide training to demonstrate their qualifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 OPERATOR TRAINING

- A. Provide classroom and hands-on training of the care and operation of the equipment to the Owner's personnel.
- B. Provide training in adequate detail to ensure that the trainees who complete the program will be qualified and capable of operating and maintaining the equipment, products, and systems provided.

- C. Provide a training plan that indicates the schedule and sequence of the training programs. The training plan is to include for each course:
 - 1. Number of hours for the course;
 - 2. Agenda and narrative description, including the defined objectives for each lesson;
 - 3. Draft copy of training handbooks;
 - 4. A descriptive listing of suggested reference publications;
 - 5. Audio-visual equipment required for training; and
 - 6. Type and number of tools or test equipment required for each training session.
- D. Provide and use training aids to complement the instruction and enhance learning.
 - 1. Provide training handbooks for use in both the classroom and the hands-on phases of training for each course.
 - 2. Instructional materials must include references to the operation and maintenance manuals and identify and explain the use of the manual.
 - 3. Provide a copy of all audio/visual training materials used in the presentations to the Owner.
- E. Operations training is to include:
 - 1. Orientation to provide an overview of system/subsystem configuration and operation;
 - 2. Terminology, nomenclature, and display symbols;
 - 3. Operations theory;
 - 4. Equipment appearance, functions, concepts, and operation;
 - 5. Operating modes, practices, and procedures under normal, diminished, and emergency conditions;
 - 6. Startup and shutdown procedures;
 - 7. Safety precautions;
 - 8. On-the-job operating experience for monitoring functions, supervisory, or command activities. Include functions and activities associated with diminished operating modes, failure recognition, and responses to system/subsystem and recovery procedures; and
 - 9. Content and use of operation and maintenance manuals and related reference materials.
- F. Provide training for performing on-site routine, preventive, and remedial maintenance of the equipment or system. Maintenance training is to include:
 - 1. Orientation to provide an overview of system/subsystem concept, configuration, and operation;
 - 2. Operations theory and interfaces;
 - 3. Instructions necessary to ensure a basic theoretical and practical understanding of equipment appearance, layout, and functions;
 - 4. Safety precautions;

5. Use of standard and special tools and test equipment;
6. Adjustment, calibration, and use of related test equipment;
7. Detailed preventive maintenance activities;
8. Troubleshooting, diagnostics, and testing;
9. Equipment assembly and disassembly;
10. Repair and parts replacement;
11. Parts ordering practices and storage;
12. Failure and recovery procedures;
13. Cabling and/or interface connectors;
14. Content and use of operation and maintenance manuals and related reference materials;
15. Procedures for warranty repairs;
16. Lubrication; and
17. Procedures, practices, documentation, and materials required to commence system maintenance.

END OF SECTION

DIVISION 03

CONCRETE

03 30 00.01 CAST-IN-PLACE CONCRETE (LIMITED APPLICATIONS)

1.00 GENERAL

1.01 SUMMARY

- A. This Section specifies normal weight, cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 SUBMITTALS

- A. Product Data and Material Certifications: For each product or material indicated in Part 2.00 "Products," excluding formwork.
- B. Design Mixture: For each concrete mixture submit:
 - 1. Mix design proportions and characteristics.
 - 2. Certifications indicating conformance of aggregate and cementitious materials.
 - 3. Admixture data sheets.
 - 4. Field test data or trial batch mixture data to validate specified compressive strength in accordance with ACI 301, latest edition.
- C. Reinforcing bar layout drawing with bar lists clearly marked and referenced to the Drawings.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
- B. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- C. Comply with ACI 301, "Specification for Structural Concrete," including the following sections, unless modified by requirements in the Contract Documents:
 - 1. "General Requirements."
 - 2. "Formwork and Formwork Accessories."
 - 3. "Reinforcement and Reinforcement Supports."
 - 4. "Concrete Mixtures."
 - 5. "Handling, Placing, and Constructing."
- D. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

2.00 PRODUCTS

2.01 FORMWORK

- A. Furnish formwork and formwork accessories according to ACI 301.
 - 1. Form ties shall leave no material within 1-1/2 inches of concrete surface.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A1064, fabricated from as-drawn steel wire into flat sheets.
- C. Supports:
 - 1. Unexposed Surface: CRSI Class 3 – No Protection.
 - 2. Exposed Surface: CRSI Class 1 – Maximum Protection – uniform high density polyethylene (plastic) or fiberglass reinforced plastic (FRP). Plastic protected wire bar supports are not allowed.

2.03 CONCRETE MATERIALS

- A. Cementitious Material:
 - 1. Cement:
 - a. Type II or I/II Portland cement, conforming to ASTM C150.
 - b. Type IL(MS) blended hydraulic cement, conforming to ASTM C595.
 - c. Type MS hydraulic cement, conforming to ASTM C1157.
 - 2. Fly Ash: ASTM C618, Class F/C. No more than 25 percent of the cement may be replaced with fly ash.
- B. Coarse Aggregate:
 - 1. In conformance with ASTM C33, uniformly graded, with a maximum size as indicated in "Concrete Mixtures."
 - 2. Class: Moderate weathering region, but not less than 3M.
- C. Fine Aggregate: Washed and screened natural sands or sands manufactured by crushing stones; conforming to ASTM C33.
- D. Water: Potable and complying with ASTM C1602 and ASTM C1602 Table 2.

2.04 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

2.05 RELATED MATERIALS

- A. Repair Materials: Pre-packaged, low-shrink, non-slump, non-metallic, quick setting patching mortar, as approved by the manufacturer for each application.
 1. Sikatop 123 by Sika Corporation.
 2. Five Start Structural Concrete by Five Star Products, Inc.
 3. Approved equal.
- B. Non-Shrink Grout: Pre-packaged, non-metallic, precision, non-shrink grout conforming to ASTM C1107/C1107M.
- C. Normal Shrinkage Grout: One part cement to three parts of ASTM C33 fine aggregate; proportioning on a volumetric basis. Install for grouted areas not required to be non-shrink grout.
- D. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion.

2.06 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Waterproof Sheet: In accordance with ASTM C171.
- D. Water: Potable and complying with ASTM C1602 and ASTM C1602 Table 2.
- E. Membrane-Curing Compound: ASTM C309, Type 1, Class B.

2.07 CONCRETE MIXTURES

- A. Comply with ACI 301 requirements for concrete mixtures.
- B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

Use	Min. 28-Day Compressive Strength (psi)	Max. Size of Coarse Aggregate	Max. Water/Cement Ratio	Max Slump +/- 1 (in.)
General	4000	1-1/2"	0.5	5*
Lean Concrete Backfill and Duct Banks	1500	1-1/2"	.70	4
*Slump may be increased to 8 inches with the addition of a HRWR.				

C. Air Content:

1. Air entrain exposed concrete within range permitted by ACI 301 for Exposure Class F1.
2. Do not allow entrapped air to exceed 3 percent in floor slabs to receive troweled finish.

2.08 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.

3.00 EXECUTION

3.01 FORMWORK

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.02 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Fabricate reinforcement steel to provide lapped connections, bends, and transitions in reinforcement as required for continuity of the typical reinforcement specified on the Drawings.
2. Unless otherwise detailed, intersecting wall and/or beam reinforcement shall extend to the far face and terminate in a standard hook. Reinforcement at the outside face of corners shall be continuous or provide tension lap splices at each side of the corner.

- B. Do not weld reinforcement.

3.03 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Purposefully roughen joints to a 1/4-inch amplitude and clean.
- B. Construction Joints: Locate joints as indicated or as approved by Owner's Representative.
- C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, and as indicated.
1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.04 CONCRETE PLACEMENT

- A. Comply with ACI 301 for measuring, batching, mixing, transporting, and placing concrete.
- B. Additional water may only be added to concrete prior to placement and only at Project Site. Slump shall be evaluated prior to and after the addition of all water. Do not take strength cylinders until after addition of all water.

1. Quantity of water shall not exceed the amount withheld at the batch plant. Quantity withheld shall be indicated on the batch ticket. Addition of water shall not result in a slump or water-cement ratio greater than that specified.
- C. Do not allow concrete to free fall more than 5 feet. With HRWR concrete may free fall a maximum of 10 feet.
- D. Consolidate concrete with mechanical vibrating equipment.

3.05 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface. Do not further disturb surfaces before starting finishing operations.
- C. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete sidewalk and ramp surfaces. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.06 FINISHING FORMED SURFACES

- A. No Finish: After forms are removed, repair or patch tie-holes and defects. Otherwise, no additional finish is required. Apply to surfaces which are not visible from the inside or outside of the completed structure or less than 12 inches below finish grade (i.e. back of retaining walls below embankment, etc.).
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.07 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301. Additionally, comply with ACI 306.1 for cold-weather protection and with ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

- D. Curing Methods: Cure formed and unformed concrete for at least 7 days by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
 - a. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.08 MISCELLANEOUS CONCRETE ITEMS

- A. Non-Shrink Grout: Install and cure as recommended by manufacturer, and as required here:
1. Clean and roughen exposed concrete surface; remove laitance. Saturate the foundation 24 hours before installation. Surface shall be clear of standing water. Baseplates shall be free of oil, grease, and other objectionable substances.
 2. Steel trowel exposed edges.
 3. Moist cure as specified by manufacturer, but not less than 3 days.
- B. Normal Shrinkage Grout:
1. Clean and roughen exposed concrete surface, remove laitance. Saturate the foundation 24 hours before installation. Surface shall be clear of standing water. Apply scrub coat of grout immediately prior to grout placement. While scrub coat is still moist install grout.
 2. Wet cure as specified for concrete.

3.09 REPAIRS

- A. Remove and replace concrete that does not comply with requirements in this Section.
- B. Repair materials and surface preparation shall be completed in accordance with manufacturer recommendations. Coordinate with Owner's Representative prior to beginning any demolition of defective area.

END OF SECTION

DIVISION 05

METALS

05 51 00 METAL STAIRS AND PLATFORMS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Industrial-type stairs and platforms with metal bar grating treads at generator.
- B. Related Sections:
 - 1. Section 05 52 13 "Pipe and Tube Railings" for pipe and tube railings.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal stairs and platforms, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Stairs and Platforms: Metal stairs and platforms shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Uniform Live Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.
 - 6. Platform shall be designed so that all doors can open approximately 180 degrees. The platform with guardrails shall extend the full length of the generator enclosure with access stairs and handrails on each end of the platform.

1.04 ACTION SUBMITTALS

- A. Product Data: For metal stairs and platforms and the following:
 - 1. Grout.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Welding certificates.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Industrial-Type Stairs: Industrial class.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2/D1.2M, "Structural Welding Code - Aluminum"

1.07 COORDINATION

- A. Coordinate installation of anchorages for metal stairs and platforms. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

2.00 PRODUCTS

2.01 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.02 NONFERROUS METALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.
- B. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.03 FASTENERS

- A. General: Provide Type 304 stainless-steel fasteners complying with ASTM A153/A153M.
- B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
 - 1. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

2.04 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.05 FABRICATION, GENERAL

- A. Provide complete stair and platform assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.06 ALUMINUM-FRAMED STAIRS AND PLATFORMS

- A. Stair and Platform Framing:

1. Fabricate stringers of aluminum channels.
 - a. Provide closures for exposed ends of channel stringers.
 2. Construct platforms of aluminum channel headers and miscellaneous framing members as needed to comply with performance requirements.
 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
 - B. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
 1. Fabricate treads and platforms from pressure-locked aluminum grating with 1-1/4-by-3/16-inch bearing bars at 1-3/16 inch o.c. and crossbars at 4 inches (100 mm) o.c.
 2. Surface: Serrated.
 3. Finish: Mill.
 4. Provide toeplates at open-sided edges of grating platforms. Bolt or weld grating to platform framing.
- 2.07 STAIR RAILINGS
- A. Comply with applicable requirements in Section 05 52 13 "Pipe and Tube Railings."
- 2.08 FINISHES
- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 3.00 EXECUTION**
- 3.01 INSTALLATION, GENERAL
- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
 - B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
 - C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
 - D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 - E. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- 3.02 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
- B. Set stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonmetallic, nonshrink grout unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

END OF SECTION

05 52 13 PIPE AND TUBE RAILINGS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Aluminum pipe and tube railings.
- B. Related Requirements:
 - 1. Section 05 51 00 "Metal Stairs and Platforms" for metal stairs and platforms to receive pipe and tube railings.

1.03 COORDINATION

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project Site in time for installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout and anchoring cement products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.06 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.08 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum Pipe and Tube Railings:
 - 1. Hollaender Mfg. Co.
 - 2. Kee Safety, Inc.
 - 3. Superior Aluminum Products, Inc.
 - 4. Kattsafe
 - 5. VIVA Railings, LLC

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.03 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.04 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Bars and Tubing: ASTM B221 (ASTM B221M), Alloy 6063-T5/T52.
- C. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- D. Drawn Seamless Tubing: ASTM B210 (ASTM B210M), Alloy 6063-T832.
- E. Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.
- F. Die and Hand Forgings: ASTM B247 (ASTM B247M), Alloy 6061-T6.
- G. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.05 FASTENERS

- A. General: Provide the following:
 - 1. Aluminum Railings: Type 316 stainless-steel fasteners.
 - 2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
 - 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

2.06 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.07 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with either welded or nonwelded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Form Changes in Direction as Follows:
 - 1. By bending or by inserting prefabricated elbow fittings.

- J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- O. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.08 ALUMINUM FINISHES

Note to Specifier: Delete "Appearance of Finished Work" Paragraph below if no variable finishes, such as color-anodized aluminum, are used.

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Mill Finish: AA-M12, nonspecular as fabricated.
- C. Clear Anodic Finish: AAMA 611, AA-M12C22A31.

3.00 EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.03 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.04 ANCHORING POSTS

- A. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.

3.05 ATTACHING RAILINGS

- A. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

3.06 ADJUSTING AND CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

3.07 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

DIVISION 26

ELECTRICAL

26 01 26 TESTING OF ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, material, equipment and incidentals of an independent testing agency.
- B. These specifications cover the suggested field tests and inspections that are available to assess the suitability for initial energization and final acceptance of electrical power equipment and systems.
- C. The purpose of these specifications is to assure that electrical equipment and systems are operational, are within applicable standards and manufacturer's tolerances, and are installed in accordance with design specifications.
- D. The Work specified in these specifications may involve hazardous voltages, materials, operations, and equipment. These specifications do not purport to address all of the safety issues associated with their use. It is the responsibility of the user to review all applicable regulatory limitations prior to the use of these specifications.
- E. Testing shall be inclusive of all low voltage equipment including conductors that are provided under this Contract.

1.02 QUALITY ASSURANCE

- A. Testing Organization:
 - 1. The testing organization shall be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.
 - 2. Testing organization shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
 - 3. The Testing organization shall use technicians who are regularly employed for testing services.
 - 4. An organization having a designation of NETA Accredited Company issued by the International Electrical Testing Association meets the above criteria.
 - 5. Independent testing agency shall follow all tests and recommendations in NETA Acceptance Testing Specification for all equipment provided.
 - 6. Testing Organization performing the Work shall submit appropriate documentation to demonstrate that it satisfactorily complies with these requirements.
 - 7. Acceptable Testing Agencies:
 - a. National Field Services.
 - b. Real Power Technologies.
 - c. Shermco Industries.
 - d. Electrical Power Systems.

8. Testing Personnel:

- a. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment.
- b. Technicians shall be certified in accordance with ANSI/NETA ETT, Standard for Certification of Electrical Testing Technicians. Each on-site crew leader shall hold a current certification, Level 3 or higher, in electrical testing.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
 1. Electrical Qualifications & List of Test Submittals: 60 days prior to any testing taking place, Contractor shall submit to the Owner/Engineer the name of the testing agency; a list of all tests to be conducted shall also be submitted at this same time. No testing shall take place until this has been submitted and approved by the Engineer.
 2. Electrical Testing Plan: A minimum of 2 weeks before testing is to take place, Contractor shall submit a detailed testing plan of the different configurations to be tested for the Owner's and Engineer's approval.
 3. Electrical Testing Report:
 - a. A written report shall be submitted by the testing agency performing installation checks, operation and testing of the low voltage equipment. This report shall certify that:
 - 1). The equipment has been properly installed.
 - 2). Is in accurate alignment.
 - 3). Meets the acceptance testing specifications of NETA and the equipment manufacturer.
 - b. Provide a detailed list of all tests that were performed and the test results as part of the Electrical Testing Report.
 - c. Electrical Testing Report(s) shall be submitted to the Engineer for approval no later than 1 week after testing has been conducted.

1.04 STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:
 1. American National Standards Institute (ANSI).
 2. Association of Edison Illuminating Companies (AEIC).
 3. ASTM International (ASTM).
 4. Electrical Apparatus Service Association (EASA).

5. Institute of Electrical and Electronic Engineers (IEEE).
6. Insulated Cable Engineers Association (ICEA).
7. International Electrical Testing Association (NETA).
8. National Electrical Manufacturers Association (NEMA).
9. National Fire Protection Association (NFPA).
10. Occupational Safety and Health Administration (OSHA).
11. State and local codes and ordinances.
12. Underwriters Laboratories, Inc. (UL).

2.00 EXECUTION

2.01 GENERAL

- A. All testing shall be witnessed by the Owner's representative. Types of equipment required to be tested by these specifications shall include but not be limited to the following:
 1. Low Voltage Power and Control Cables.
 2. Medium Voltage Power Cables.
 3. Motor Control Centers.
 4. Generator.
 5. Medium Voltage Automatic Transfer Switch.
 6. Grounding.
- B. At a minimum, unless indicated otherwise, all testing shall be in accordance with the manufacturer's recommendations for energization and startup of the equipment.
- C. Testing shall include a complete functionality testing of electrical equipment under all the different operating parameters identified by the Owner and Engineer.
- D. Electrical testing instrument calibration shall be as indicated in ANSI/NEMA ATS-2021.

2.02 TEST REPORT

- A. The test report shall include the following:
 1. Summary of the Project.
 2. Description of equipment tested.
 3. Description of tests.
 4. Test data.
 5. Analysis and recommendations.
- B. Test data records shall include the following minimum requirements:
 1. Identification of the testing organization.
 2. Equipment identification.

3. Nameplate data.
 4. Humidity, temperature, and other conditions that may affect the results of the tests and/or calibrations.
 5. Date of inspections, test, maintenance, and/or calibrations.
 6. Identification of the testing technician.
 7. Identification of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
 8. Identification of expected results when calibrations are to be performed.
 9. Identification of as-found and as-left results, as applicable.
 10. Identification of all test results outside of specified tolerances.
 11. Sufficient spaces to allow all results and comments to be indicated.
- C. The testing organization shall furnish a copy or copies of the complete test report as specified.

2.03 TEST DECAL

- A. The testing organization shall affix a test decal on the exterior of equipment or equipment enclosure of protective devices after performing electrical tests.
- B. The test decal shall be color-coded to communicate the condition of maintenance for the protective device. Color scheme for condition of maintenance of overcurrent protective device shall be:
1. White: Electrically and mechanically acceptable.
 2. Yellow: Minor deficiency not affecting fault detection and operation, but minor electrical or mechanical condition exists.
 3. Red: Deficiency exists affecting performance, not suitable for service.
- C. The decal shall include:
1. Testing organization.
 2. Project identifier.
 3. Test date.
 4. Technician identifier.

2.04 POWER SYSTEM TESTING

- A. Contractor shall test the operation of the power distribution system, i.e. transformers, medium voltage automatic transfer switch, etc., for the various possible system configurations under load conditions.
- B. Testing shall include, but not be limited to the following:
1. Normal power from Utility Source.
 2. Back-up power from Generator.

- C. Contractor shall submit a detailed testing plan of the different configurations to be tested for the Owner's and Engineer's approval.

END OF SECTION

26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals necessary for complete and operational electrical systems, as specified herein.
- B. This Section, as well as Division 1, concerns all other Sections in Division 26 shall be considered a part of each of those Sections as if written in their entirety.
- C. Contractor shall be responsible to coordinate labor and materials required to install and test all control panels, electrical equipment and instrumentation furnished by process equipment suppliers identified under this Contract.
- D. Permanent Utilities:
 - 1. Contractor shall be responsible to coordinate power at the Site with local utility company.
 - 2. Owner will be responsible to absorb the cost of providing utility power to the Site. However, Contractor is responsible for providing civil and electrical improvements identified on design drawings to assist local utility in onsite upgrades. Such improvements identified on design drawings include but are not limited to primary service entrance trenching and conduit, riser conduits, transformer and metering cabinet concrete pads, equipment racks, etc. Coordinate all additional requirements with local utility.
- E. Temporary utilities:
 - 1. Contractor may need to include generator power for outages, depending on the Contractors' means and methods of connecting to power equipment.
 - 2. Contractor shall provide electrical testing and inspection services for temporary connections to existing equipment.
 - 3. Fusing for temporary equipment shall be coordinated with upstream devices to ensure the fuses will terminate before interrupting electrical service to plant process equipment.
- F. Electrical outages must be coordinated with operations, as well as the electrical, instrumentation and inspections divisions.
 - 1. Shut down sequencing shall be coordinated by the Contractor and if a generator is required to power equipment to maintain service, Contractor shall be responsible to provide the generator, fuel, and conductors required to keep the plant operational.

1.02 QUALITY ASSURANCE

- A. Electrical Contractors' Qualifications:

1. Use adequate numbers of skilled workmen, trained and experienced in their crafts, and who are familiar with the Specifications and methods of performing the Work in this Division. A licensed Journeyman shall be on-site at all times when electrical Work is being performed. Electrical Work shall be performed under the direct supervision of a Master Electrician who holds a valid license in Texas. Contractor shall provide a monthly report to the Owner/Engineer for review stating that the Master Electrician has been to the Site and thoroughly reviewed the Work. The report shall be signed by the Master Electrician and include the data and time the Master Electrician was on the Site.
 2. Contractor's company and worker staff onsite must have 5 years of experience with performing electrical Work within wastewater treatment plants.
- B. Workmanship: Work shall be performed in accordance with quality, commercial practices. The appearance of finished Work shall be of equal importance with its operation. Materials and equipment shall be installed based upon the actual dimensions and conditions at the Site. Locations for materials or equipment requiring an exact fit shall be field measured.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
1. Submittals shall be submitted separated by specification section. Combined submittals will not be reviewed. Submittal will be marked not approved, revise and resubmit.
 2. Incomplete submittals will not be reviewed and will be marked revise and resubmit.
 3. Resubmittals shall be marked with a red strike-through for the items removed from the submittal and clouded with the items added to the submittal. Submittals shall be marked to track changes between resubmittals.
 4. Component catalog number and manufacturing data sheet, indicating pertinent data and identifying each component by the item number and nomenclature as specified.
 5. Component drawings showing dimensions, mounting, and external connection details in AutoCAD format.
 6. Operation and maintenance manuals shall contain the Shop Drawings, submittals, spare part lists, schematics, project-specific final wiring diagrams with any changes made during startup and maintenance procedures.
 7. Unless other additional information is required by the detailed equipment specifications, the following information shall be included for motors:
 - a. Motor identification number and nomenclature as specified.
 - b. Make and motor type.
 - c. Brake horsepower of the motor.
 - d. Locked rotor current at full load.
 - e. Motor efficiency at full load (3-phase motors only).
 - f. Starting torque.
 - g. Method of insulating and impregnating motor coils (3-phase only).

- h. Speed of the motor at full torque.
 - i. Full load current.
 - j. Service factor.
 - k. Motor temperature rise measured by resistance over 40 degrees C ambient.
- B. Delays during submittals due to the Contractor not following the format mentioned above shall not be the fault of the Owner or Engineer.
- C. Contractor shall provide a monthly report to the Owner/Engineer for review stating that the Master Electrician has been to the Site and thoroughly reviewed the Work. The report shall be signed by the Master Electrician and include the data and time the Master Electrician was on the Site.
- D. Contractor shall:
 - 1. Prepare, and keep up-to-date, the Record Drawings and detailed construction drawings.
 - 2. Record the exact locations of each of these differences, sizes and details of the Construction Work as executed, with cross-references to and other requirements on the Record Drawings.
 - 3. Keep the Record Drawings on the Work Site;
 - 4. Upon completion of the Work, or at such other time as may be determined by the Engineer, submit the Record Drawings and copies to the Owner's representative in accordance with the Owner's Requirements.
 - 5. Underground Interference drawing showing all underground duct banks, ground rods, ground conductors, pipes, piers, vaults, manholes, pull boxes, etc. that clearly identifies the location and routing of these systems. All interferences shall be brought to the Engineer's attention.
 - 6. Provide revised drawings in AutoCAD noting any changes made to equipment during startup.

1.04 STANDARDS

- A. Electrical Work shall be executed in accordance with local, state and national codes, ordinances and regulations which have jurisdiction or authority over the Work. If the standards and codes conflict with each other, the most stringent shall apply. The applicable provisions of the following standard shall apply as if written here in their entirety:
 - 1. American National Standards Institute (ANSI).
 - 2. Association Edison Illuminating Companies (AEIC).
 - 3. ASTM International (ASTM).
 - 4. Environmental Protection Agency (EPA).
 - 5. Institute of Electrical and Electronic Engineers (IEEE).
 - 6. Insulated Power Cable Engineers Association (IPCEA).
 - 7. International Electrical Testing Association (NETA).

8. International Electrotechnical Commission (IEC).
9. Local electrical ordinance.
10. Local utility companies.
11. National Electrical Code (NEC).
12. National Electrical Contractors Association (NECA).
13. National Electrical Manufacturers Association (NEMA).
14. National Electrical Safety Code (NESC).
15. National Fire Protection Association (NFPA).
16. Occupational Safety and Health Administration (OSHA).
17. Rural Electrification Association (REA).
18. Texas Commission on Environmental Quality (TCEQ).
19. Underwriters Laboratories (UL).
20. Uniform Building Code (UBC).

1.05 DELIVERY AND STORAGE

- A. Follow the manufacturer's directions for the delivery, storage and handling of equipment and materials. Tightly cover equipment and materials and protect it from dirt, water, chemical or mechanical injury and theft. Major electrical equipment shall be stored indoors and space heaters energized where applicable. Equipment that will be stored indoors for an extended period of time and that do not have space heaters shall have a 100-watt incandescent light placed in it and energized to eliminate the build-up of condensation in the equipment. Coordinate with equipment manufacturer for storage requirements. Damaged equipment shall not be acceptable. Upon installation, protect the materials until the Work is completed and accepted by the Owner.

1.06 JOB CONDITIONS

- A. Permits, licenses and inspections shall be secured and paid for as required by law for the completion of the Work. Certificates of approval shall be secured, paid for, and delivered to the Owner before receiving the final acceptance of the Work.
- B. The location of materials, equipment, devices and appliances indicated are approximate and subject to revisions at the time the Work is installed. Final location shall be as proposed by the Contractor and approved by the Engineer.
- C. Should project conditions require any rearrangement of Work, or if equipment or accessories can be installed better than the general arrangement of Work on the Drawings, the Contractor shall prepare and submit plans of the proposed rearrangement for the Engineer's review and approval.
- D. Motor horsepower ratings identified are anticipated ratings. If the actual equipment is a different size, the Contractor shall provide the appropriate wiring, conduit, over current protection, starters and accessories for a complete and working system at no cost to the Owner.

- E. Contractor is required to abide by the Owner's construction safety and health program where applicable.
- F. Clearances indicated in the National Electrical Code must be maintained around equipment.

1.07 HAZARDOUS LOCATIONS

- A. Contractor shall comply with the latest version of NFPA 70 and NFPA 820 for all materials utilized in the areas listed in the contract drawings.

2.00 PRODUCTS

2.01 MATERIALS

- A. Supplemental or alternative materials supplied and installed by the Contractor shall be approved prior to installation. Materials installed without pre-approval, through the submittals process, shall be removed from the Site and replaced at no additional cost to the Owner. No exceptions.
- B. Discrepancies between the Drawings and Specifications shall be addressed prior to bidding the Project, otherwise the most expensive of the two options shall be assumed.

3.00 EXECUTION

3.01 INSTALLATION

- A. All enclosures for equipment unless specifically identified otherwise shall be:
 - 1. NEMA 1 for indoor air-conditioned areas.
 - 2. NEMA 4X 304 stainless steel enclosures for indoor ventilated and non-ventilated areas.
 - 3. NEMA 4X 304 stainless steel for exterior applications and all other locations.
- B. Maintain waterproof integrity of conduit penetrations through enclosures, the roof, exterior walls and floors.
- C. Install steel reinforced concrete foundations below floor mounted switchboards, panelboards, motor control centers, transformers, control panels and other floor mounted electrical equipment. Concrete foundations shall not be less than 4 inches high. Neatly chamfer top edges. Concrete foundations shall be 4 inches wider and 4 inches longer than the base of the equipment being installed. Concrete shall be in accordance with Division 03, and shall be reinforced with a minimum of 6-inch x 6-inch #6 welded wire mesh.
- D. Route all conduits parallel to building lines, columns, or steel route conduits near to columns and roof beams.
- E. Do not penetrate the top of enclosures in exterior applications.

3.02 CUTTING AND PATCHING

- A. Provide adequate support during cutting operations to prevent any damage to the affected masonry. Where openings are cut through masonry walls, provide lintels or structural supports to protect the remaining masonry. The cutting of structural members shall not be permitted without the specific written approval of the Engineer.

3.03 PAINTING

- A. Painting shall be in accordance with Division 09. Maintain the original factory finish on material and equipment installed, unless specifically indicated on the Drawings or Specifications. If the finish is marred in transit or during installation, re-finish to a neat, workmanlike appearance. Leave equipment and raceway systems clean and free of grease, dirt, rust, and in a suitable condition for painting.

3.04 EXCAVATION, TRENCHING, BACKFILLING AND GRADING

- A. Prior to any excavation or trenching, notify the Owner's representative, utility companies and Owner's facilities department. Allow sufficient time for utilities to be located prior to excavation to avoid disruption of services. Provide a minimum of 72 hours written notice to the Owner prior to trenching or excavation. Do not proceed with trenching or excavation until authorized by the Owner. Utilities or services which are damaged, which are identified prior to excavation or trenching, or where confirmation by utility companies has not been obtained verifying that utilities are marked, shall be repaired to operable condition immediately, at no cost to the Owner.
- B. Barricade open trenches and excavations for the entire duration of the Project. Barricades for excavations shall have warning lights maintained during hours of darkness. Trenches shall be marked with warning tape, or access to trenches shall be prohibited with readily identifiable sawhorses, warning tape or other acceptable means. Barriers shall be illuminated or recognizable during hours of darkness. Barriers and tape shall be properly maintained at all times.
- C. Protect all adjacent Work, structures and properties. Damage to adjacent Work, structures or properties shall be repaired, or the cost of repair reimbursed in full.
- D. All construction areas shall be finally graded as indicated on the Contract Documents, or to the conditions of the Site prior to construction. Grading shall bring the Site back to the existing conditions as close as practical. Turfed areas shall be sodded, or hydro-mulched with matching turf. Landscaping shall be replaced with identical shrubbery, ground cover, or plants as existed. Contractor shall be responsible for maintaining water on new turf and landscaping until established. If new turf and landscaping is impractical due to weather conditions, Contractor shall provide satisfactory arrangements to have turf and landscaping furnished and installed at the earliest opportunity thereafter. Provide a 90-day warranty on new turf and landscaping.
- E. In cases where ductbanks may exist, Contractor shall employ safe drilling/excavating techniques such as vacuum excavation, etc.

3.05 LOCKING OF ELECTRICAL FACILITIES

- A. Install locks immediately upon the installation of the electrical facility. Provide padlocks for exterior electrical facilities subject to unauthorized entry. Furnish the Owner with two keys per lock up to a quantity of 10 keys. Furnish locks to match the Owner's locking system.

3.06 CLEANING AND ADJUSTING

- A. Remove shipping labels, dirt, paint, grease, and stains from equipment. Remove debris as it accumulates. Clean electrical equipment and the entire electrical installation upon completion of the Work.

END OF SECTION

26 05 13 MEDIUM VOLTAGE CABLES

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment, and incidentals necessary to install medium voltage cables. Electrical work shall be in accordance with Section 26 05 00, "Common Work Results for Electrical".

1.02 QUALITY ASSURANCE

A. ACCEPTABLE MANUFACTURERS

- 1. Okonite
- 2. General Cable
- 3. Southwire
- 4. No equal

- B. Cable shall be manufactured in the United States. No exceptions.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 02, "Shop Drawings" and shall include:

- 1. Shop Drawings for:
 - a. Medium Voltage Cables
 - b. Connectors
 - c. Load Break Elbows
 - d. Provide data sheets showing physical sizes of load break elbows.
 - e. Stress Cones
 - f. Dead front Lightning Arresters
 - g. Feed Thru Inserts
 - h. Load Break Cable Junctions
 - i. Insulated Standoff Parking Bushings
 - j. Duct Seal
 - k. Cable pulling lubricant
- 2. Cable pulling tension calculations shall be provided for each duct bank pull that is too long to be done by hand and be provided with the initial submittal. Pulling tension calculations shall clearly state the cable limitations of the pulling tension and sidewall pressures permitted by the cable manufacturer.

3. Cable pulling dynamometer readings. Once cable is pulled, Contractor shall submit to the cable manufacturer the recorded pulling tensions for each pull for their approval. Pulling tension data shall include date and time readings were taken and the name of the person taking the readings. A letter from the cable manufacturer stating that the pulling tensions are acceptable shall be formally submitted to the Engineer for approval within 10 days after being installed.
 4. All cable pulling, other than done by hand, shall be done with equipment specifically designed for cable pulling. Provide information on cable pulling machine used. Pulling equipment not specifically designed for cable pulling shall not be used.
 5. Once cable is delivered to the site, Contractor shall provide as a formal submittal documentation/pictures showing when cable was manufactured. Pictures of each reel showing date shall be provided within 5 days after being delivered to the site. Contractor shall also verify the condition of the cable ends are adequately sealed and there is no damage and no shipping documents stapled to the cable. Contractor shall provide photographs of cabled ends as a formal submittal.
 6. Electrical Testing Report shall be submitted to the Engineer for approval a maximum of 4 weeks after each test has been performed. The Contractor shall not be allowed to wait for the final test to be performed to submit a single testing report. Individual test reports may be submitted to maintain the maximum of four weeks after test has been performed. Testing report shall include VLF, insulation resistance test results, and all testing identified in Section 3.02.
 7. Certifications of personnel making medium voltage terminations.
- B. Certified Test Reports
1. Submit certified test reports of manufacturer's standard production testing and inspection as specified.
- C. Operation and Maintenance Manuals
1. Submit Operation and Maintenance Manuals containing installation and maintenance instructions for termination kits.

1.04 STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:

IEEE 1202	Standard for Flame Test of Cables for use in Cable Tray in Insulated Commercial Occupancies
U.L. 1685	Standard for Vertical-Tray Fire Propagation and Smoke-release Test for Electrical & Optical-Fire cables
ICEA S-93-639 / NEMA WC74	Standard for Shielded Power Cables Rated 5-46kV for the Distribution of Electrical Energy
UL 1072	Standard for Medium-Voltage Power Cables
IEEE 48	Standard Test Procedures and Requirements for High-Voltage Alternating Current Cable Terminators
IEEE 400	IEEE Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above
IEEE 400.2	Guide for Field Testing and Evaluation of the Installation of Shielded Power Cable Using Very Low Frequency (VLF)
IEEE 400.3	Guide for Partial Discharge Testing of Shielded Power Cable Systems in a Field Environment
NEC	National Electrical Code

1.05 DELIVERY AND STORAGE

- A. Deliver cable to the project on original reels with cable ends capped.

2.00 PRODUCTS

2.01 MATERIALS

A. SINGLE CONDUCTOR CABLE:

1. Rated 5kV or 15kV, MV-105, copper conductor with copper tape shield.
2. Conductor: Annealed uncoated copper compressed stranded. The conductor shall be Class B, compressed stranded bare copper per ASTM B3 and ASTM B8.
3. Strand Screen: Extruded semiconducting EPR strand screen. Strand screen shall meet or exceed electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8, CSA C68.3 and UL 1072.
4. Insulation: 133%, 220 mils. Extruded semiconducting EPR insulation screen Meets or exceeds electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8, CSA C68.3 and UL 1072. Low lead type preferred.

5. Jacket: Moisture and abrasion resistant polyvinyl chloride (PVC). Meets or exceeds electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8, CSA C68.3 and UL 1072.
 6. Cable shall be rated for 105°C continuous operating temperature, 140°C emergency rating temperature and 250°C short circuit rated temperature.
 7. Shield: 5 mil coated copper tape helically wrapped with 25% nominal overlap.
 8. Cable shall pass U.L. and IEEE 383 and 1202 (1/0 AWG and larger) Vertical Flame Test.
 9. Cable terminations shall have a voltage rating of not less than the phase to phase voltage of the system.
- B. STRESS CONES: The cable termination must have a voltage class rating that is equal to or greater than the cable being terminated. The rating shall be 5kV or 15kV (as indicated) as an IEEE Class I termination for application. Non-skirted for indoor applications and skirted for outdoor applications. Cold shrink type. Stress cones shall be Raychem, 3M or DSG Canusa.
- C. LOAD BREAK ELBOWS: 15kV. Rated for 105°C continuous operating temperature. The Contractor shall furnish 200 Amp load-break elbows (8.3 kV line-to-ground maximum for 15kV installations, elbow terminators for each bushing in accordance with ANSI C119.2 and conforming to ANSI/IEEE Std. 386 and ANSI C119.2 with copper current carrying parts. The bushings shall be provided with removable copper studs. Elbows shall be manufactured with copper current carrying parts and shall be furnished for each bushing. Elbows shall be manufactured by Elastimold, Cooper or approved equal.
- D. DEAD FRONT LIGHTNING ARRESTERS: 18kV Class (15.3 MCOV), suitable for operation on a 5kV solidly grounded utility system (normal operation) and low resistance grounded system (emergency generator operation), distribution class, externally mounted heavy distribution M.O.V.E. type, complying with IEEE C62.11 suitable for mounting in primary section of a pad-mounted transformer. Arresters shall be manufactured by Cooper Power Systems (Eaton), Elastimold, Hubbell or approved equal. Arresters shall be of the polymer type, no porcelain allowed. Arresters shall be suitable for installation on a 5kV delta secondary transformer with 480V primary.
- E. LOAD BREAK JUNCTIONS: 15kV, 200 amp rated, in accordance with IEEE 386. Manufactured by Hubbell, Cooper Power Systems (Eaton) or Elastimold.
1. Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable load break elbows. Two-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.
 - a. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
- F. FEED THRU INSERTS: 15kV, 200 amp rated, load break type. Manufactured by Cooper Power Systems (Eaton), Hubbell or Elastimold.
- G. INSULATED STANDOFF PARKING BUSHING: 15kV rated. Manufactured by Hubbell, Cooper Power Systems (Eaton), Hubbell or Elastimold. Provide protective cap for each bushing. Cap shall be in accordance with IEEE 386

- H. DUCT SEAL MASTIC: UL Listed, suitable for medium voltage installations. Cooper Power Series Aqua Seal.

3.00 EXECUTION

3.01 INSTALLATION

- A. The cable shall not be bent at any time during handling and installation to a radius smaller than the manufacturer cable's minimum bending radius. Minimum radius shall be twelve (12) times the overall cable outside diameter. Cable bent with a diameter of less than twelve times the overall cable outside diameter shall be remove, discarded, replaced, reinstalled and re-terminated at the Contractor's expense. Once cable is over bent, it shall not be reused in any manner.
- B. Pull all conductors into a raceway at the same time using U.L. listed wire pulling lubricant.
- C. When inserting conductors in raceways, comply with the following:
 - 1. First, install raceways as a complete raceway system without conductors. All raceways shall be inspected by the Engineer prior to covering. Raceways covered before inspection shall be uncovered at the Contractor's expense.
 - 2. Do not install pull wires and conductors until the raceway system is in place.
 - 3. Do not use cleaning agents and lubricants which have a deleterious effect on the conductors.
 - 4. Completely and thoroughly swab raceway system before installing conductors.
- D. Pulling tension calculations are required for all cable pulls that are too long to be done by hand. All cable pulls shall be performed using a suitable dynamometer to accurately measure the pulling tension. Dynamometer shall have a resettable maximum tension recorder. Any pulls done without approved calculations or done without a specified pulling tension meter and properly documented readings will be rejected. The cables shall be removed, discarded, replaced, reinstalled, and re-terminated at the Contractor's expense.
- E. All cable pulls shall be done using cable reels. No cables shall be laid on the ground for installation. Cables laid on the ground will be rejected. The cables shall be removed, discarded, replaced, reinstalled, and re-terminated at the Contractor's expense.
- F. Do not pull cables using Kellum-grip type supports.
- G. Splicing shall not be permitted.
- H. All conduits shall be properly sealed with U.L. listed duct seal suitable for medium voltage applications after the installation of the cables.
- I. Identify each circuit with non-ferrous metal or fiber tags in pull boxes, sectionalizing cabinets, and junction boxes and at terminations in junction boxes, sectionalizing cabinets and transformers.
- J. Waste certain footage (3' - 6') of cable at each end to get a good piece of cable after the pull. Verify with cable manufacturer for exact distance to waste.
- K. Remove and replace conductors with insulation showing deterioration within one (1) year after final completion and acceptance of the work and at no cost to the Owner.

- L. Load break elbows shall be rated for 105 deg C rated cable. Conductors and elbows shall be installed per the manufacturer's recommendations and instructions.
- M. Soldered connections shall not be allowed.
- N. Provide stress-relief cones at the terminals of shielded cables except where load break elbows are required. See One-Line Diagram in electrical plans for cable sizes.
- O. Cable with a manufacture date of greater than twelve (12) months previous of being installed will not be acceptable. If cable is older than 12 months and is installed, then Contractor shall replace and install new cable at no cost the Owner.
- P. Install insulated standoff bushings in all new sectionalizing cabinets. Refer to plans for more details.

3.02 TESTING

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 - 2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 3. Perform Very Low Frequency (VLF) test of each new conductor according to NETA ATS, Ch. 7.3.3.
 - 4. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
- D. Medium-voltage cables will be considered defective if they do not pass tests and inspections.
- E. Perform tests and inspections and prepare test reports. Test reports shall be submitted as required by Specification Section 26 01 26, "Testing of Electrical Systems". All test reports shall be submitted in one binder under Specification Section 26 01 26, "Testing of Electrical Systems".

END OF SECTION

26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1.00 GENERAL

1.01 WORK INCLUDED

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Furnish labor, materials, equipment and incidentals necessary to install 2000 volt and below single conductors, cables, wiring connections and terminations. Electrical work shall be in accordance with Section 26 05 00 "Common Work Results for Electrical".

1.02 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 2000 V and less.
 - 2. Connectors, splices, and terminations rated 2000 V and less.

1.03 SUBMITTALS

- A. Product Data: For each type of product. Indicate all sizing and options used on each cutsheet. Cross out sizes and options
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Testing
 - 1. Testing shall be provided for conductors and cables specified within this section.

1.06 DELIVERY AND STORAGE

- A. Deliver cable and wire to the project site in the original packages. Conductors with damaged insulation or exposed nylon jacketing shall not be permitted.
- B. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable.
- C. Check for reels not completely restrained, reels with interlocking flanges or broken flanges, damaged reel covering or any other indication of damage. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel.
- D. Do not drop reels from any height.

- E. Unload reels using a sling and spreader bar. Roll reels in the direction of the arrows shown on the reel and on surfaces free of obstructions that could damage the wire and cable.
- F. Store cable on a solid, well drained location. Cover cable reels with plastic sheeting or tarpaulin. Do not lay reels flat. Do not store cable exposed to the sun.
- G. Provide moisture protection by using manufacturer's standard procedure or heat shrinkable self-healing end caps applied to both ends of cable. Do not remove end caps until cables are ready to be terminated.

2.00 PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company
 - 2. Belden Inc
 - 3. Encore Wire Corporation.
 - 4. General Cable Technologies Corporation.
 - 5. Southwire Company.
 - 6. Okonite
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Tinned Copper, complying with NEMA WC 70/ICEA S-95-658.
 - 1. Conductor Insulation: Conductor with cross-linked polyethylene insulation rated at 600 volts. Wire shall be water tank tested and approved as machine tool wire, in accordance with National Machine Tool Builders Association. Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2, Tinned Type XHHW-2 and Tinned Type SO.

2.02 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. 3M Electrical Products.
 - 2. Ideal Industries, Inc.
 - 3. ILSCO.
 - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 5. AFC Cable Systems, Inc.
 - 6. Hubbel Power systems, Inc.

- 7. Thomas & Betts Corporation, A Member of the ABB Group.
- 8. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. CONNECTORS, COMPRESSION, COPPER, 600 VOLT: The appropriate hole sizes and spacing which are in accordance with NEMA standards; two (2) holes in the tongue for use on conductor sizes 250 kcmil or larger; not required for connections to the circuit breakers in the lighting and/or receptacle panels. All compression connectors shall be long-barrel type, no exceptions.
- D. SPLIT BOLTS: Shall be usable for connecting conductors which are both copper, both aluminum or one copper and one aluminum. Split bolts shall have a spacer between the two conductors, which it connects.
- E. MECHANICAL SET SCREW CONNECTOR: Consisting of an aluminum body which has openings on opposite ends for insertion of the conductors. Conductors inserted into these holes shall each be clamped by two set screws. Connectors shall be suitable for use with copper conductors.
- F. POWER DISTRIBUTION BLOCKS: Rated for 600 VAC at 75C for termination of copper conductors. Individual poles shall be constructed of tin plated aluminum and mounted on an insulating base.
- G. WIRENUTS: Silicone-based pre-filled spring wire connecting devices with plastic covering; UL listed for damp and wet locations. Wirenut shall meet requirements of UL 486D for Sealed Wire Connector Systems. Wirenut shall be spring insulated, properly sized and resistant to vibration may be used for No.12 through No.10 solid gauge conductor for lighting and branch circuits only.
- H. 600 VOLT VINYL TAPE (PHASE IDENTIFICATION): Scotch Vinyl Electrical Tape 35.
- I. 600 VOLT VINYL TAPE: Scotch Vinyl Electrical Tape Super 88.
- J. RUBBER TAPE: Scotch Linerless Rubber Splicing Tape 2242 or Scotch Linerless Rubber Splicing Tape 130C.
- K. ARC PROOFING TAPE: Scotch Fire and Electric Arc Proof Professional Grade Tape 77. Fireproofing shall be done with a half-lapped layer of arc proofing tape, anchored at each end with a double wrap of Scotch Glass Cloth Electrical Tape 89.
- L. INSULATING RESIN: Scotchcast Electrical Insulating Resin 2104.

3.00 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- B. Administration Building other than Electrical Room: Type THHN/THWN-2, single conductors in raceway. Equipment being fed from electrical room to other parts of the administration building use THHN-2/THWN-2.
- C. Administration Building Electrical Room
- D. All Other Locations: Type XHHW-2, single conductors in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. General Installation

1. Installed unapproved conductors and cables shall be removed and replaced at the Contractor's expense.
2. Properly support cables in accordance with the NEC and manufacturer's recommendations in all raceways. Provide strain relief for vertical runs as required.
 - a. Where single conductors and cables are in manholes, hand holes, vaults, cable trays, and other indicated locations are not wrapped together by some other means such as arc and fireproofing tapes, bundle throughout their exposed length all conductors entering from each conduit with nylon, self-locking, releasable, cable ties placed at intervals not exceeding 4 inches on center.
 - b. Arrange wiring in cabinets and panels neatly cut to proper length, remove surplus wire, and bundle and secure in an acceptable manner. Identify all circuits entering motor control centers or other control cabinets in accordance with the conductor identification system specified herein and in specification section 26 05 53, "Identification for Electrical Systems."
 - c. Cap and label each side of spare conductors not terminated with the UL listed end caps.
 - d. Where conductors pass through holes or over edges in sheet metal, remove all burrs, chamfer all edges, and install bushings and protective strips of insulating material to protect the conductors.
 - e. For conductors that will be connected by others, provide at least 6 feet spare conductors in free standing panels and at least 2 feet spare in other assemblies. Provide additional spare conductor in any particular assembly where it is obvious that more conductor will be needed to reach the termination point.
 - a). Each circuit shall include a ground wire. Sharing grounds or neutrals is not allowed.
 - f. Neatly train wiring inside boxes, equipment and panelboards.

B. Conductors and Cables Installed In Conduit

1. Grouping conductors together into one conduit shall not be allowed where the plans indicate the conductors to be placed in separate conduits. Each home run shown on the plans shall be in its own conduit.
2. Prior to pulling conductors and cables
 - a. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
 - b. Do not install pull wires and conductors until the raceway system is in place in accordance with the NEC and these specifications. Exception: Only flexible connections to motors shall be permitted to be installed after the installation of the remainder of the raceway system. The installation of these conductors shall be limited to exposure to damage for a maximum of one (1) week prior to installing flexible connection and making final terminations. Any conductors exposed to damage (i.e. not installed in raceway) longer than one (1) week shall be subject to rejection by the Owner and/or Engineer. If rejected, the cables shall be removed, discarded, replaced, reinstalled and re-terminated at the Contractor's expense.
 - c. Completely swab raceway system before installing conductors. Do not use cleaning agents and lubricants which have a deleterious effect on the conductors or their insulation.
3. Process for pulling conductors and cables
 - a. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor, insulation or cable outer jacket. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - b. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii.
 - c. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage usable portions of cables or raceway.
 - d. Except for hand-pulled conductors into raceways, all wire and cable installation shall be installed with tension-monitoring equipment. Where conductors are found to have been installed without tension-monitoring, the conductors and cables shall be immediately removed from the raceways, permanently identified as rejected material, and removed from the jobsite. New conductors and cables shall be reinstalled, tagged and raceways resealed, all at the Contractor's expense.
 - e. Pull conductors into a raceway at the same time and use U.L. listed, wire pulling lubricant for pulling No. 4 AWG and larger wire.

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

- B. Make splices, terminations, and taps compatible with conductor material and that possess equivalent or better mechanical strength, continuous temperature and insulation ratings than unspliced conductors.
- C. Power Conductors: Splice in junction boxes or at outlets only for lighting and receptacle branch circuits. Splices for all other circuits shall be disallowed. All splices are subject to the Engineer's approval. Obtain approval from Engineer before installing any splices.
- D. Where pre-approved by Engineer, 480V splices shall terminate conductors using power distribution blocks mounted on a junction box backplane.
- E. No splicing of conductors shall be performed in any below ground structure.
- F. Condulet type fittings shall not contain splices.
- G. Under no condition shall conductors of a different color be spliced together.
- H. For No. 10 and smaller, connect conductors with a silicone filled twist-on spring wirenut. If a splice or tap is below 3' above the final grade, fill the spring connectors with an electrical insulating resin so that the resin encapsulates conductor and spring materials. Conductor splices and taps inside the MCC, VFDs, panels, etc. shall be on the terminal strips or power distribution blocks.
- I. For No. 8 and larger, connect conductors with a split bolt type of connector or a mechanical, set screw type connector. Wrap splices and taps with a single half-lapped layer of rubber tape followed by successive layers of vinyl tape until a vinyl tape layer thickness of twice the original conductor insulation thickness is achieved. If splice or tap is below 3' above the finished grade, the tape or splice shall have a final outer coating or insulating resin. Splices must be pre-approved by the Engineer.
- J. Furnish and install power distribution blocks as required for terminating conductors at their load connection point with conductors of smaller size. Install power distribution blocks with the number of poles and sizes needed for connecting the phase, neutral, and ground conductors.
- K. Tighten all screws and terminal bolts using torque type wrenches and/or drivers to tighten to the inch-pound requirements of the NEC and UL.
- L. Use crimp connectors on all stranded conductors.
- M. Soldered mechanical joints insulated with tape will not be acceptable.
- N. SINGLE CONDUCTORS: Sufficient wire shall be left at outlets to make connections to equipment without straining. Light switches and receptacles shall be connected with pig-tails and crimp-on connectors.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 FIRESTOPPING

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

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.
 - a. Perform each visual and mechanical inspection and electrical tests stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1). A low-resistance ohmmeter.
 - 2). Calibrated torque wrench.
 - 3). Thermographic survey.
 - c. Inspect compression applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor with respect to ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
 - 3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:

1. Procedures used.
 2. Results that comply with requirements.
 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

26 05 23 CONTROL-VOLTAGE ELECTRICAL POWER CABLES

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals necessary to install 600-volt wires and cables. Electrical Work shall be in accordance with Section 26 05 00 "Common Work Results for Electrical."
- B. Work shall include building wire, cable, wiring connections and terminations, and modular wiring systems.

1.02 SUMMARY

- A. Section Includes:
 - 1. Category 6 balanced twisted pair cable.
 - 2. Category 6 Balanced twisted pair cable hardware.
 - 3. Low-voltage control cabling.
 - 4. Control-circuit conductors.
 - 5. Fire-alarm wire and cable.
 - 6. Optical-fiber cabling.
 - 7. Optical-fiber cable hardware.
 - 8. Identification products.

1.03 DEFINITIONS

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

1.04 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
 - 1. Shop Drawings: For each type of product.
 - 2. Qualification Data: For testing agency, RCDD, layout technician, installation supervisor, and field inspector.
 - 3. Source quality-control reports.
 - 4. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
- B. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

2.00 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
 - 1. Flame Travel Distance: 60 inches or less.
 - 2. Peak Optical Smoke Density: 0.5 or less.
 - 3. Average Optical Smoke Density: 0.15 or less.
- C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.
- E. RoHS compliant.

2.02 CATEGORY 6 BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. Belden Inc.
 - 3. Berk-Tek Leviton; a Nexans/Leviton alliance.
 - 4. CommScope, Inc.
 - 5. General Cable; Prysmian Group North America.
 - 6. Hitachi Cable America Inc.
 - 7. Mohawk; a division of Belden Networking, Inc.
 - 8. SYSTIMAX Solutions; a CommScope Inc. brand.
 - 9. West Penn Wire.
- C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 5e cables.

- D. Conductors: 100-ohm, 23 AWG solid copper.
- E. Shielding/Screening: Unshielded twisted pairs (UTP).
- F. Cable Rating: Plenum.
- G. Jacket: Blue thermoplastic.
- H. General Requirements for Balanced Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of Category 6.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
- I. Cables shall be terminated with connecting hardware of same category or higher.

2.03 CATEGORY 6 BALANCED TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M.
 - 2. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 3. Belden.
 - 4. Berk-Tek Leviton; a Nexans/Leviton alliance.
 - 5. CommScope, Inc.
 - 6. General Cable; Prysmian Group North America.
 - 7. Genesis Cable Products; Honeywell International, Inc.
 - 8. Hitachi Cable America Inc.
 - 9. Mohawk; a division of Belden Networking, Inc.
 - 10. Prysmian Cables and Systems; Prysmian Group North America.
 - 11. Superior Essex Inc.
 - 12. SYSTIMAX Solutions; a CommScope Inc. brand.
- C. General Requirements for Balanced Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of Category 6.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
 - 3. Cables shall be terminated with connecting hardware of same category or higher.
- D. Source Limitations: Obtain balanced twisted pair cable hardware from single source from single manufacturer.

- E. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- G. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
 - 1. Features:
 - a. Universal T568A and T568B wiring labels.
 - b. Labeling areas adjacent to conductors.
 - c. Replaceable connectors.
 - d. 24 or 48 ports.
 - 2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
 - 3. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
- H. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with an eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
 - 2. Patch cords shall have color-coded boots for circuit identification.
- I. Plugs and Plug Assemblies:
 - 1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
 - 2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.
 - 3. Marked to indicate transmission performance.
- J. Jacks and Jack Assemblies:
 - 1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
 - 2. Designed to snap-in to a patch panel or faceplate.
 - 3. Standards:
 - a. Category 6, unshielded balanced twisted pair cable shall comply with IEC 60603-7-4.
 - b. Category 6, shielded balanced twisted pair cable shall comply with IEC 60603-7.5.
 - 4. Marked to indicate transmission performance.

K. Faceplate:

1. Two port, vertical single-gang faceplates designed to mount to single-gang wall boxes.
2. Plastic Faceplate: High-impact plastic. Coordinate color with Section 26 27 26 "Wiring Devices."
3. Metal Faceplate: Stainless steel, complying with requirements in Section 26 27 26 "Wiring Devices."
4. For use with snap-in jacks accommodating any combination of balanced twisted pair, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.

L. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.04 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. Individually and overall shielded multi-pair, twisted, No. 18 AWG, stranded (7x28) tinned-copper conductors with 0.021-inch extruded PVC; 0.004-inch nylon insulation twisted into pairs, stranded into a core and enclosed by a non-hygroscopic core tape, 100 percent coverage, helically wound, aluminum foil shield, and drain wire. Pairs shall be black/red or black/white numbered. Cables shall be 600 volts in accordance with NEC-725 and IEEE 383 and shall be suitable for wet location.
2. Shielded.
3. Extruded PVC jacket minimum 0.050.
4. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. Individually and overall multi-pair, twisted, No. 18 AWG, stranded (7x28) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.05 CONTROL-CIRCUIT CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. General Cable; General Cable Corporation.
2. Southwire Company.

3. Alpha.
 4. Okonite.
 5. Belden.
- B. General:
1. Wires and cables shall be soft-drawn, annealed tinned copper with a conductivity of not less than that of 98 percent pure copper, UL 83 and UL 1063 listed, rated 600 volts and certified for continuous operation at maximum conductor temperature of 90 degrees Celsius in dry locations and in wet locations.
 2. Control (discrete) circuits and as specifically indicated on the Drawings the minimum conductor permitted is #14.
- C. Single Conductor Cables: Conductor with thermoplastic insulation rated at 600 volts and insulated with type XHHW-2 insulation. Wire shall be water tank tested and approved as machine tool wire, in accordance with National Machine Tool Builders Association.
- D. Class 1 Control Circuits: Stranded copper, Type XHHW-2, complying with UL 44 in raceway.
- E. Class 2 Control Circuits: Stranded copper, Type XHHW-2, complying with UL 44 in raceway.
- F. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type XHHW-2, complying with UL 44 in raceway.
- G. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.
1. Smoke control signaling and control circuits.

2.06 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test twisted pair cables according to TIA-568-C.2.
- C. Factory test optical-fiber cables according to TIA-568-C.3.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.00 EXECUTION

3.01 EXAMINATION

- A. Test cables on receipt at the Site.
1. Test optical-fiber cable to determine the continuity of the strand end to end. Use optical-fiber flashlight or optical loss test set.
 2. Test optical-fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 3. Test each pair of twisted pair cable for open and short circuits.

3.02 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
 - 2. Outlet boxes for cables shall be no smaller than 4 inches square by 2-1/8 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
 - 3. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius as required elsewhere in specifications and drawings or as required to meet cable bend radius requirements.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C Series of standards.
 - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems."
 - 3. Terminate all conductors and optical fibers; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
 - 5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
 - 6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
 - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 9. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Do not use heat lamps for heating.

10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Monitor cable pull tensions.
 11. Support: Do not allow cables to lay on removable ceiling tiles.
 12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
- C. Balanced Twisted Pair Cable Installation:
1. Comply with TIA-568-C.2.
 2. Install termination hardware as specified in Section 27 15 00 "Communications Horizontal Cabling" unless otherwise indicated.
 3. Do not untwist balanced twisted pair cables more than 1/2 inch at the point of termination to maintain cable geometry.
- D. Installation of Control-Circuit Conductors:
1. Install wiring in raceways.
 2. Use insulated spade lugs for wire and cable connection to screw terminals.
 3. Comply with requirements specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- E. Optical-Fiber Cable Installation:
1. Comply with TIA-568-C.3.
 2. Terminate cable on connecting hardware that is rack or cabinet mounted.
- F. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
 3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.
- G. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Below each feed point, neatly coil a minimum of 72 inches of cable in a coil not less than 12 inches in diameter.
- H. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment or Circuit Rating Between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment or Circuit Rating Between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment or Circuit Rating Between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.04 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

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

3.05 GROUNDING

- A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.06 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

- B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.
- C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire shall have a unique tag.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
 - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.08 PREPARATION

- A. Completely swab raceway system before installing conductors. Do not use cleaning agents and lubricants which have a deleterious effect on the conductors or their insulation.

3.09 INSTALLATION

- A. General:
 - 1. Conductors shall be continuous from terminal block to terminal block without splice. Condulet type fittings shall not contain splices. No splicing of conductors shall be performed in any below ground structure.

2. If rejected, the cables shall be removed, discarded, replaced, reinstalled and re-terminated at the Contractor's expense.
 3. Grouping conductors together into one conduit shall not be allowed where the Drawings indicate the conductors to be placed in separate conduits. Each home run shown on the Drawings shall be in its own conduit.
 4. Properly support cables in accordance with the NEC and manufacturer's recommendations in all raceways. Provide strain relief as required.
 5. The cable shall not be bent to a radius no smaller than the manufacturer cable's minimum bending radius.
 6. All terminated conductors shall be labeled as specified prior to testing and final terminations being done. Any conductor that is de-terminated for any reason shall be re-tested. All associated controls, if tested before, shall be re-tested following final re-termination.
- B. Paired Shielded Cable: Ground paired shielded cable at the instrument panel or starter end only and insulate from ground elsewhere. The shield shall be continuous for the entire run. The paired shielded cable shall not be laced with or placed in the same conduit with power cables and control cables. Each termination of paired shielded cable shall be coated with silicone jelly after termination. The shield of pair shielded cable shall only be broken when the conductors are terminated on terminal strips. Each conductor and shield shall be landed on its own terminal. Double terminations of any conductor or shield shall not be allowed.
- C. Ground Conductors: Conduits and other raceway shall contain an insulated equipment grounding conductor whether the raceway is metallic or not. Conduits, cabinets, and other equipment shall be properly grounded in accordance with National Electrical Code requirements. Where ground wire is exposed to mechanical damage, install wire in rigid aluminum conduit. Bond each end of each of the conduit to the ground system. Make connections to equipment with solderless connections.

END OF SECTION

26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment, and incidentals necessary to install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (NEC) as shown on the drawings or as specified herein. Electrical work shall be in accordance with Section 26 05 00, "Common Work Results for Electrical".

1.02 SUMMARY

- A. Submittal shall be in accordance with Section 01 33 00 "Document Management" and shall include:
 - 1. Product Data: For each type of product indicated, including but not limited to:
 - a. Test wells.
 - b. Ground rods.
 - c. Ground conductors
 - d. Connectors
 - 2. Grounding arrangements and connections for separately derived systems.
 - 3. Field quality-control reports in accordance with Section 26 01 26 "Testing of Electrical Systems".

1.03 QUALITY ASSURANCE

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

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. ERICO International Corporation.
 - 3. Harger Lightning & Grounding.
 - 4. ILSCO.
 - 5. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 6. Thomas & Betts Corporation, A Member of the ABB Group.

2.02 CONDUCTORS

- A. Insulated Conductors: Tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Tin-plated Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.

2.03 CONNECTORS

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

2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet

2.05 MISCELLANEOUS

- A. CONDUIT GROUND FITTINGS: Fittings for bonding ground cable to the conduit shall be Thomas & Betts No. 3951 series.
- B. GROUND ROD BOXES: Precast concrete box with cast iron lid. Lid shall read "ground rod". H-10 rated boxes shall be Brooks Precast Model "3-RT" or approved equal. Ground rod boxes located in driveway areas shall have an AASHTO HS-20 rating by ALT Fabrication Item #3114 or approved equal.
- C. EXOTHERMIC WELDING PROCESS: CADWELD MATERIALS – as manufactured by ERICO products or approved equal.

2.06 PROCESSES

- A. All grounding system connections to building steel and ground rods shall be exothermically welded including all cable connections, and cable steel terminations. The use of mechanical type connections is not acceptable.
- B. Any concealed connection (buried, encased in concrete, or otherwise sealed) shall be done only with exothermic welds.

- C. All materials involved must be from the same sources to insure compatibility. Connections made from this process shall meet the requirements of IEEE Standards 80 and 837 and as listed in MIL 419 and other standards, National Electrical Code, etc.

2.07 GROUNDING SYSTEM

- A. Provide a complete grounding system that includes all connections and the testing of ground rods, ground cables, ground buses, conduits, fittings, anchor supports, thermite process materials and equipment and other materials required for a complete installation. Contractor required to provide all grounding electrodes, grounding electrode conductors, and bonding jumpers as required by the National Electric Code. Grounding system shall be installed and sized in accordance with the National Electrical Code unless a larger size is shown on the drawings.

3.00 EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tin-plated copper conductor, conductor size as shown on drawings.
 - 1. Bury at least 30 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Place conductor on top of duct bank prior to back filling above duct bank when indicated as part of duct-bank installation.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted/clamp type connectors.
 - 2. Underground Connections: Exothermically welded connectors.
 - 3. Connections to Ground Rods at Test Wells: Exothermically welded connectors.
 - 4. Connections to Structural Steel: Exothermically welded connectors.
 - 5. Connections to Equipment: NEMA ground pads and insulated jumpers.
 - 6. Connections to Ground Pad: Exothermic.
 - 7. The use of "pig tails" for connections to ground loops or equipment shall not be allowed.

3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.04 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 and NFPA 70 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, 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 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 insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non shrink grout.
- C. Grounding Connections to Manhole Components: Bond 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 bonding conductor. Train conductors' level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.05 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, 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.
- G. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.06 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.
- C. Ground Rods: Drive rods until tops are 6 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

- D. Test Wells: Ground rod driven through bottom of Ground Rod Box. Ground Rod Box shall be at least 12 inches deep, with cover.
 - 1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated tin-plated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.
 - 1. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- I. Ground electrical work in accordance with the National Electrical Code Article 250 and local codes.
- J. Install ground cables continuously between connections. Splices shall not be permitted, except where indicated on the plans. Where ground cables pass through floor slabs, buildings, etc., and when not in metallic enclosures, provide a sleeve of approved, non-metallic materials.

- K. Install a green-colored, equipment grounding conductor in raceways. Size conductors in accordance with NEC Article 250.
- L. Where ground wire is directly buried in earth or concrete, use standard bare tinned- copper cable, in all other cases install a green-colored insulation, equipment grounding conductor in accordance with Section 26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES. Size conductors in accordance with NEC Article 250. Provide grounding conductors as required per the NEC.
- M. Metal conduits stubbed up into switchgear, motor control center or other electrical equipment shall be terminated with insulated grounding bushings and connected to the equipment ground bus. Size the grounding wire in accordance with applicable sections of the National Electrical Code.
- N. Liquid tight flexible metal conduit in sizes 1-1/2" or larger shall have bonding jumpers. Bonding jumpers shall be external, run in parallel (not spiraled) and fastened with plastic tie wraps. Contractor shall provide bonding jumpers sized in accordance with the National Electrical Code.
- O. All equipment enclosures, motor and transformer frames, conduit systems, cable armor, exposed structural steel and all other equipment and materials required by the NEC to be grounded, shall be grounded, and bonded in accordance with the NEC. Provide grounding and bonding jumpers as required per the NEC.
- P. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with NEC Article 250.
- Q. Run a grounding cable the full length of each cable tray section and bond to each cable tray section. Provide #4/0 bare copper in cable tray.
- R. Where exothermic bonding is used, molds shall be of the appropriate size for the wire and rod used. All bonds shall remain exposed for inspection of the Owner's Representative.
- S. At each convenience outlet, install a grounding clip attached to the outlet box and leave a sufficient length of #12 wire with green-colored insulation to connect to the grounding terminal at the receptacle.
- T. A ground pad shall be installed in concrete foundations for connections to equipment and the grounding system. Flat plate all copper alloy Erico CADWELD B164-2Q or approved equal. Connections between the ground pad and ground cables shall be an exothermic weld.
 - 1. Transformer Pads: Provide a ground pad in the concrete pad. Provide a #4/0 bare copper to the grounding system. Provide two-hole spade terminals connected to a #4/0 bare copper conductor at each end and connect to the transformer enclosure and to the ground pad.
 - 2. Motor Grounding: Provide a ground pad in the concrete slab. Provide a #4/0 bare copper to the grounding system. Provide two-hole spade terminals connected to a #4/0 bare copper conductor at each end and connect to the motor enclosure and to the ground pad and to the pump frame.
 - 3. The use of "pig tails" for connections to ground loops or equipment shall not be allowed.

- U. Provide a minimum of two ground connections to all medium voltage equipment including VFD's and transformer frames.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections. Testing shall be in accordance with Section 26 01 26 TESTING OF ELECTRICAL SYSTEMS and the latest version of NETA Acceptance Testing Specification
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.
 - 3. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 4. Use Biddle Direct Reading Earth Resistance Tester or equivalent to measure resistance to ground of the system. Perform testing in accordance with the test instrument manufacturer's recommendation using the fall of potential method.
 - 5. All test equipment provided under this section shall be approved by the ENGINEER.
 - 6. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground. The contractor shall test the grounding system at each ground rod shown on plans.
 - 7. Testing shall be performed before energizing the distribution system.
 - 8. A separate test shall be conducted for each building or system.
 - 9. Notify the ENGINEER immediately if the resistance to ground for any building or system is greater than five ohms. Provide additional ground rods and conductors as required to bring the resistance to five ohms.
 - 10. 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. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 11. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed 5 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner/Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
 - 3. Steel slotted support systems.
 - 4. Conduit and cable support devices.
 - 5. Support for conductors in vertical conduit.
 - 6. Structural steel for fabricated supports and restraints.
 - 7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
 - 8. Fabricated metal equipment support assemblies.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
 - 1. Product Data: For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - 1). Hangers.
 - 2). Steel slotted support systems, hardware, and accessories.
 - 3). Nonmetallic support systems, hardware, and accessories.
 - 4). Trapeze hangers.
 - 5). Clamps.
 - 6). Turnbuckles.
 - 7). Sockets.
 - 8). Eye nuts.
 - 9). Fasteners.
 - 10). Anchors.

11). Saddles.

12). Brackets.

b. Include rated capacities and furnished specialties and accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which hangers and supports will be attached.
3. Size and location of initial access modules for acoustical tile.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

2.00 PRODUCTS

2.01 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 of the following:
 - a. ABB, Electrification Products Division.
 - b. Allied Tube & Conduit; Atkore International.
 - c. B-line; Eaton, Electrical Sector.
 - d. CADDY; nVent.
 - e. Flex-Strut Inc.
 - f. Gripple Inc.
 - g. G-Strut.
 - h. Haydon Corporation.
 - i. Metal Ties Innovation.
 - j. MIRO Industries.
 - k. Unistrut; Atkore International.
 - l. Wesanco, Inc.

2. Material for Channel, Fittings, and Accessories: Stainless steel, Type 304.
 3. Channel Width: 1-5/8 inches.
 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 8. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: 304 Stainless-steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored 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 made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1). B-line, an Eaton business.
 - 2). Empire Tool and Manufacturing Co., Inc.
 - 3). Hilti, Inc.
 - 4). ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 5). MKT Fastening, LLC.
 2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A325.
 5. Toggle Bolts: Stainless-steel springhead type.

6. Hanger Rods: 304 Threaded stainless steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

3.00 EXECUTION

3.01 APPLICATION

- A. Installation Schedule:
 - 1. Administration building: hot dipped galvanized.
 - 2. WWTP: 304 stainless steel.
- B. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- C. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- E. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 3/8 inch in diameter.
- F. 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 two-bolt conduit clamps or single bolt conduit clamps using spring friction action for retention in support channel.
- G. 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.]

3.02 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, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to 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 pounds.

- 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 New Concrete: Bolt to concrete inserts.
 - 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. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 - 5. To Light Steel: Sheet metal screws.
 - 6. 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 comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" 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/D1.1M.

3.04 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 00 "Cast-In-Place Concrete."
- C. Anchor equipment to concrete base as follows:
 - 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.

3.05 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 Section 09 96 00.01 "High-Performance Coatings" and Section 09 96 00.01 "Concrete Protective Coatings" 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

26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals necessary to install a complete conduit system for each type of electrical system. Electrical Work shall be in accordance with Division 26.
- B. Furnish labor, materials, equipment and incidentals necessary to install concrete electrical manholes and pull boxes, as specified and indicated on the Drawings. Manhole sizes shown on the Drawings are the minimum size allowed. Contractor shall be responsible for sizing all manholes and pull boxes in accordance with the latest edition of the National Electrical Code (NEC), Article 370 and relevant sections of the NEC. Contractor shall be responsible for setting elevations at manhole and cable entry locations to meet the intent of the Contract Documents.
- C. Contractor shall be responsible for sizing all pull boxes and junction boxes per the NEC Article 314 and all other relevant sections of the NEC. Electrical Work shall be in accordance with Section 26 05 00 "Common Work Results for Electrical".

1.02 SUMMARY

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

1.03 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. FMC: Flexible metal conduit.
- C. EMT: Electrical Metallic Tubing.
- D. LFMC: Liquidtight flexible metallic conduit.
- E. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:

1. Product Data: For all products specified.
2. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
3. Contractor shall provide detailed conduit layout showing number, size, and location of conduits entering the manholes. Cables routed in conduits shall be clearly identified. Details shall also show elevation of conduits entering manholes. Manhole details shall be submitted to the Engineer for approval prior to the duct bank/manhole system being installed.
4. Manholes, Pull and Junction Boxes Sizing Calculations: Detailed calculations shall be submitted to the Engineer with the manholes, pull and junction boxes' initial submittal. Submittals submitted without sizing calculations shall not be accepted.

2.00 PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. AFC Cable Systems; a part of Atkore International.
 2. Allied Tube & Conduit; a part of Atkore International.
 3. Anamet Electrical, Inc.
 4. Electri-Flex Company.
 5. FSR Inc.
 6. O-Z/Gedney; a brand of Emerson Industrial Automation.
 7. Picoma Industries, Inc.
 8. Republic Conduit.
 9. Robroy Industries.
 10. Calbond.
 11. Southwire Company.
 12. Thomas & Betts Corporation, A Member of the ABB Group.
 13. Western Tube and Conduit Corporation.
 14. Wheatland Tube Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. PVC-Coated Aluminum Conduit: PVC-coated.
 1. Comply with UL 6A.

- 2. Exterior Coating Thickness: 0.040 inch, minimum.
- E. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- F. LFMC: Flexible aluminum conduit with PVC jacket.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for Rigid Aluminum:
 - a. Material: Aluminum.
 - 1). Type: Form 7.
 - b. Class I and II Hazardous Locations:
 - 1). Material: Copper-free aluminum.
 - 2). Type: Series OE, LBH and LBY.
 - 3). Covers: Copper-free aluminum.
 - 3. Fittings for PVC Coated Rigid Aluminum:
 - a. Material: PVC Coated Cast Aluminum.
 - b. Type: Form 7.
 - c. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inches, with overlapping sleeves protecting threaded joints.
 - 4. Fittings for PVC Coated Rigid Steel:
 - a. Material: PVC Coated Rigid Steel
 - b. Type: Form 7.
- H. Expansion Fittings: PVC, aluminum, or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper. Crouse Hinds XJG 8inches or equal with bonding jumper for aluminum or steel. Where expansion/deflection fitting is specified on the Drawings, provide Crouse Hinds XJGD or equal.
- I. Insulated Grounding Bushings: Threaded bushings, O-Z Type ABLG with lay-in means of grounding conduit.
- J. Fittings for LFMC:
 - 1. Fittings for aluminum LFMC shall be aluminum with reinforced sealing gaskets with Thomas and Betts stainless steel retaining ring, external grounding lugs, and insulated throat. Fittings shall be Emerson STB-L or equal.
 - 2. Fittings for steel LFMC shall be steel with reinforced sealing ring, external grounding lug, and insulated throat. Fittings shall be Emerson STB-L or equal.
- K. Joint Compound for ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.
 - 1. Aluminum Conduit: Penetrox A-13 or approved equal.

- a. UL Listed.
 - b. Compatible with insulating materials such as rubber, or polyethylene.
 - c. Rated for all voltages.
- L. Sealing Compound:
 - 1. Hazardous Locations: Chico "A" or Chico SpeedSeal, Hydra-Seal S-60 or approved equal.
- M. Lubricants:
 - 1. Hazardous locations Class I, Div. II Locations:
 - a. Metal-to-Metal Joint: STL thread lubricant.
 - 1). Applicable to dissimilar metals.
 - 2). Maintain grounding continuity.
 - b. Lighting Fixture Threaded Joint: HTL high temperature lubricant.
 - 1). Applicable to dissimilar metals.
 - 2). Maintain grounding continuity.

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems; a part of Atkore International.
 - 2. Anamet Electrical, Inc.
 - 3. Arnco Corporation.
 - 4. CANTEX INC.
 - 5. CertainTeed Corporation.
 - 6. Condux International, Inc.
 - 7. Electri-Flex Company.
 - 8. Kraloy.
 - 9. Lamson & Sessions.
 - 10. Niedax Inc.
 - 11. RACO; Hubbell.
 - 12. Thomas & Betts Corporation, A Member of the ABB Group.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. Square D.
- B. Description:
 - 1. 304 stainless steel, complying with UL 870 and NEMA 250. NEMA type and material for wireways and gutters shall conform to the conduit installation schedule below, unless otherwise indicated, and sized according to NFPA 70.
 - 2. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.
- F. Wireways shall come with a threaded grounding post welded to the enclosure used for grounding.

2.04 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Moulded Products, Inc.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. Lamson & Sessions.
 - 4. Niedax Inc.
- B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.05 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Adalet.
 2. Crouse-Hinds, an Eaton business.
 3. EGS/Appleton Electric.
 4. Erickson Electrical Equipment Company.
 5. FSR Inc.
 6. Hoffman; a brand of Pentair Equipment Protection.
 7. Hubbell Incorporated.
 8. Kraloy.
 9. Milbank Manufacturing Co.
 10. MonoSystems, Inc.
 11. Oldcastle Enclosure Solutions.
 12. O-Z/Gedney; a brand of Emerson Industrial Automation.
 13. RACO; Hubbell.
 14. Robroy Industries.
 15. Spring City Electrical Manufacturing Company.
 16. Stahlin Non-Metallic Enclosures.
 17. Thomas & Betts Corporation, A Member of the ABB Group.
 18. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
1. Outlet Boxes for Rigid Aluminum:
 - a. Material: Aluminum.
 - 1). Type: Form 7.
 - b. Class I and II Hazardous Locations:
 - 1). Material: Copper-free aluminum.
 - 2). Type: Series GUA.
 - 3). Covers: Copper-free aluminum.
 2. Outlet Boxes for PVC Coated Rigid Aluminum:
 - a. Material: PVC Coated Cast Aluminum.
 - b. Type: Form 7.

- c. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inches, with overlapping sleeves protecting threaded joints.
- D. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- G. Gangable boxes are prohibited.
- H. Cabinets and Termination Cabinets:
 - 1. NEMA type and material for cabinets shall conform to the conduit installation schedule below, unless otherwise indicated, and size according to the NFPA 70. Cabinets shall come with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 7. Cabinet shall include a grounding kit.

2.06 MANHOLES AND PULL BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Manholes and Pull Boxes:
 - 1. Manholes and pull boxes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. Manhole minimum interior dimensions shall be 4' Width x 4' Length x 6' Depth.
 - 4. Minimum dimension from the bottom of conduit penetrations to the bottom of the manhole interior shall be no less than 2'-0" for all manholes.
- B. Concrete Manholes and Concrete Pull boxes:
 - 1. Acceptable Manufacturers; Precast: Precast concrete products shall comply with the Specifications and shall be produced by the following manufacturers:
 - a. Brooks Products.
 - b. American Industrial Precast Products.
 - c. Dalworth Quickset Co.
 - d. Old Castle.

- e. No Equal.
- 2. Acceptable Manufacturers; Castings: Metal castings shall comply with the Specifications and shall be produced by the following manufacturers:
 - a. McKinley Iron Works, Fort Worth, TX.
 - b. Neenah Foundry, Neenah, WI.
 - c. No other manufacturers permitted.
- 3. Design Criteria: Concrete for precast concrete shall obtain a compressive strength of 4000 psi minimum at 28 days, and shall be an air entrained mix of the manufacturer's standard mix design.
- 4. Standards:
 - a. The applicable provisions of the following standards shall apply as if written here in their entirety:
 - 1). AASHTO H 20 — Standard Specifications for Highway Bridges.
 - 2). ANSI/ASTM A-15 — Zinc Coating (Hot Dipped) on Iron and Steel Hardware.
 - 3). ANSI/ASTM A-569 — Steel, Sheet and Strip, Carbon (0.15% Maximum), Hot Rolled, Commercial Quality.
 - 4). ASTM A-48 — Gray Iron Castings.
 - 5). ASTM A-123 — Zinc (Hot Galvanized) Coatings on Products fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.
- 5. Materials:
 - a. Manhole Frames and Covers: Class 30B gray cast iron conforming to ASTM A48; machine finished with flat bearing surfaces.
 - b. Sump Covers: Class 30B gray cast iron conforming to ASTM A48.
 - c. Pulling Irons: 316 stainless steel bar with 7/8-inch diameter forming a triangle of 9 inches per side when set; galvanized according to ANSI/ASTM A153 for irregularly shaped articles.
 - d. Cable Rack Inserts: 316 stainless steel channel inserts with a minimum load rating of 800 pounds; length to match cable rack channel.
 - e. Cable Rack Channel: 4-inch by 1-1/2-inch by 3/16-inch 316 stainless steel channel wall bracket, 48 inches long, with cable rack arm mounting slots on 8-inch centers.
 - f. Cable Racks: 2-1/2-inch by 14-inch 316 stainless steel channel with high glazed, wet process porcelain insulators conforming to ANSI/ASTM A569.
 - g. Ground Rod: 3/4-inch by 10-foot copper clad steel, installed in the floor of the manhole, and all metallic cable racks, irons, etc. grounded (to the ground rod). Ground rod may be field installed, but floor penetration shall be sealed against the entrance of water under positive head.
 - h. Joint Sealant: Flexible plastic gasket of flexible butyl resin sealant.

- i. Dampproofing: Sonneborn, Div. of ChemRex, Inc. or Engineer approved equal/equivalent.
 - 1). Bituminous Dampproofing:
 - a). Cold-Applied, Emulsified-Asphalt Dampproofing:
 - (1). Brush and Spray Coats: ASTM D1227, Type III, Class 1.
 - 2). Miscellaneous Materials:
 - a). Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended by manufacturer.
- 6. Mixes:
 - a. Concrete and reinforcing shall be in accordance with Section 03 30 00 "Cast-In-Place Concrete."

2.07 ACCESSORIES

A. Conduit Foam Sealant

- 1. UL recognized two-part foam sealant, compatible with electrical cable jacket materials. Capable of holding 10' of continuous water pressure.
- 2. Manufactured by Polywater model AFT spray foam sealant or equal.

B. Link Seal

- 1. Link seal shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the space between the conduit and the wall opening. Link seal shall be suitable for use in a core-drilled and pre-cast wall openings and shall be manufactured by Pipeline Seal & Insulator, Inc. or approved equal.

2.08 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

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

3.00 EXECUTION

3.01 INSTALLATION SCHEDULE

- A. Conduit types shall be installed in accordance with the following schedule:
 - 1. Buried or Concrete Encased Conduit: Schedule 40 PVC, Type EPC-40-PVC, concrete encased unless noted otherwise. Conduit below grade shall not be smaller than 2 inches.

- a. Elbows 2 Inches and Larger: PVC coated ARC.
 - b. Elbows Below 2 Where Allowed: RNC, Type EPC-40-PVC .
- 2. Above Grade Non Concealed Conduit: ARC unless noted otherwise.
- 3. PVC Coated Rigid Aluminum Conduit: Shall be used for conduit stub-ups through concrete and concrete wall penetrations.
- 4. Rigid Aluminum Conduit: May be used in all locations. PVC coated rigid aluminum conduit shall be used in corrosive environments or where in contact with concrete.
- 5. Concealed Conduit (Through Concrete or Masonry), Aboveground: PVC coated ARC.
- 6. Liquid Tight Flexible Metallic Conduit: Shall only be used to equipment in non-hazardous locations not subject to physical damage or excessive temperatures, requiring vibration isolation unless otherwise indicated, 6 feet maximum length. The bending radius shall be in accordance with Chapter 9, Table 2 of the NEC and shall not deform or alter the flex jacket.
- 7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
- B. Outdoors
 - 1. Boxes and Enclosures, Aboveground: NEMA 4X 304 stainless steel.
 - 2. Boxes and Enclosures, Aboveground for Class I, Div. 2 hazardous locations: NEMA 250 cast aluminum Type 7.
- C. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Boxes and Enclosures: NEMA 250, 4X 304 stainless steel.
 - 2. Exposed, Not Subject to Physical Damage: ARC.
 - 3. Exposed, Not Subject to Severe Physical Damage: ARC.
 - 4. Exposed and Subject to Severe Physical Damage: ARC.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 6. Damp or Wet Locations: ARC.
 - 7. Administration Building:
 - a. Exposed or Concealed Conduit: EMT.
 - b. Outlet and Device Boxes: Sheet metal.
- D. Minimum Raceway Size:
 - 1. Exposed 1/2 inch for light fixture whips, 3/4 inch trade size.
 - 2. Underground: 2 inches in duct banks, 1-inch independent conduits for power to light poles.
- E. All conduits that transition into air-conditioned spaces from outdoor locations, including below outdoor below grade, must be sealed when entering the air-conditioned space. Seal conduits at first opening within space.

- F. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid Aluminum Conduit: Use threaded rigid aluminum conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 3. PVC Externally Coated, Rigid Aluminum Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 4. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 5. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 - 6. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- G. Where raceways are installed for such circuits and pass through concrete, install PVC coated rigid aluminum extending 6 inches past the top of the concrete slab where conduit does not terminate in a floor mounted enclosure.
- H. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- I. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg. F.

3.02 CONDUIT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on the Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Use the conduit route where shown on the Drawings. Route conduits that do not have a specified route in the most direct path between the two points, i.e. home runs shown with an arrow symbol. Route conduits parallel to building lines. Concealed conduits on the Drawings shall be below grade, within walls, or above ceilings.
- C. Route conduit through roof openings for piping and ductwork where possible. Otherwise, route conduit through the roof with pitch pocket. Conduit shall not penetrate ductwork. Exposed conduit shall not be installed on the roof without the Engineer's prior approval.
- D. Install conduit at elevations which maintain headroom, and at locations which avoid interference with other Work requiring grading of pipe, the structure, finished walls, etc. Avoid crossing other Work. Conduits shall not be placed in close proximity to equipment, systems, and service lines. Maintain a minimum of 3 inches of separation, except in crossing which shall be a minimum of 1 inch. Conduits shall not be installed/concealed in water bearing walls.

- E. Conduits in buildings shall be exposed on unfinished ceilings and basements, as shown on the Drawings. Rigidly support conduits to the building structures using hardware bolted or screwed to the structure. The mounting hardware shall not mount the conduit directly on concrete walls and ceilings, but shall space the conduit away from the surfaces using mineralac-type hardware, strut channel clamps, or one hole straps with clamp backs.
- F. Group conduit in parallel runs where practical. Use a conduit rack constructed of channels with conduit straps or clamps. Provide space for an additional 25 percent conduit.
- G. Parallel runs of conduit shall have bends and offsets made at the same point such that the angle of bend is the same in each conduit and the conduits remain parallel throughout the run. Conduits not installed in this manner shall be removed and reinstalled at the Contractor's expense. Conductors that are installed shall be removed and replaced at the Contractor's expense.
- H. Conduits installed in parallel shall be arranged such that crossings are eliminated.
- I. Nuts, bolts, concrete anchor bolts and other metallic fasteners shall be 304L stainless steel.
- J. Install conduit with threaded couplings and other threaded fittings. Threadless, or clamp type fittings shall not be used on metallic conduit. Rigid aluminum conduit shall have each set of threads coated with an oxidation inhibitor, IIsco, De-Ox, ITT Noalox, Blackburn Contax or approved equal.
- K. Use suitable conduit caps to protect installed conduit against entry of dirt and moisture. The use of duct tape or any other tape shall be prohibited.
- L. Use watertight hubs to fasten conduit to metal boxes, etc. in wet or damp locations per the National Electrical Code.
- M. Provide at least 1/4-inch air space between the back of boxes, equipment and the wall.
- N. Conduits terminating inside an air-conditioned space from outside shall be sealed to prevent moisture/condensation from entering the enclosure.
- O. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- P. Where applicable, aluminum conduit, straps, and struts shall not be in direct contact with concrete. Provide a neoprene washer between the two materials.
- Q. PVC conduit shall not be installed above grade level, above concrete slab level, or for any exposed installations unless specified.
- R. Conduit system shall be swabbed clean prior to installation of conductors.
- S. Ground conduits in accordance with the National Electrical Code and Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- T. Install manufactured PVC coated aluminum conduit elbows for stub-ups at poles and equipment and at building entrances through floor. Encase elbows for stub-up ducts throughout length of elbow.
- U. Complete raceway installation before starting conductor installation.
- V. Cut conduit perpendicular to the length. For conduits 2 inches trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

- W. Comply with requirements in Section 26 05 29 “Hangers and Supports for Electrical Systems” for hangers and supports.
- X. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- Y. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 36 inches of changes in direction or where conduit penetrates through a floor, wall, or transitions from underground. Conduits transitioning from underground to be supported by a structure shall include an expansion fitting before the conduit is strapped at its first conduit support.
- Z. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer’s written instructions.
- AA. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- BB. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-pound tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- CC. Install conduit drain assemblies in outside or underground conduits to provide for draining.

3.03 CONDUITS THROUGH CONCRETE:

- A. Conduit shall not be placed horizontally in a concrete floor slab or a beam without the Engineer’s written approval.
- B. Conduit stubbed-up through concrete and under free standing enclosures located indoors/outdoors, in an electrical room, etc., such as a motor control center, shall include a solvent welded PVC end bell fitting to the conduit termination. End bell fitting shall be installed flush with the finished floor. No PVC shall be exposed to daylight or be installed such that any portion is out of concrete housekeeping pad or duct bank.
- C. Conduit passing through concrete shall be PVC coated aluminum. Conduit shall extend 6 inches above concrete transition.
- D. Where conduit transitions from below concrete into a duct bank, the conduit shall be PVC coated aluminum to the elbow.
- E. Conduit extending into concrete shall not be closer than 3 inches from adjacent conduit and shall not be closer than 1 inch from any reinforcement bars.
- F. Where conduits stub up through a floor slab from below finished floor level for multi-level structures, install a threaded fitting with PVC plug so that the top of the fitting is flush with the concrete or finished floor surface.

3.04 RACEWAYS EMBEDDED IN SLABS

- A. Run conduit larger than 1 inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.

- B. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- C. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
- D. Do not embed threadless fittings in concrete unless specifically approved by the Engineer for each specific location.

3.05 STUB-UPS TO ABOVE RECESSED CEILINGS

- A. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

3.06 SURFACE RACEWAY INSTALLATION

- A. Install surface raceway with a minimum 2 inches radius control at bend points.
- B. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

3.07 HAZARDOUS LOCATION CONDUIT INSTALLATION

- A. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70. Sealing fittings shall be filled with compound rated for hazardous locations Class I, Div.2 for conduits leaving classified areas as indicated on the Drawings.
- B. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- C. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

3.08 EXPANSION FITTING INSTALLATION

- A. Expansion Fittings:
 - 1. Expansion fittings used with aluminum conduit shall be installed in the following locations:
 - a. At construction joints.
 - b. In conduit runs longer than 100 feet.
 - c. Transitions from underground to above elevation (exposed).

- d. Install expansion fittings at all locations where conduits, concealed or surface mount, cross building, structure, construction, and seismic expansion joints.
 - e. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
 - f. Acceptable expansion/deflation fittings made of neoprene in outdoor applications shall have aluminum lagging over the neoprene held in place with stainless steel tie-wraps.
- 2. Conduits transitioning from underground to above grade shall include an expansion fitting before the conduit is strapped at its first conduit support. For conduits transitioning through an exterior concrete pad or walkway, provide a conduit window around conduit. Fill area around conduit window and conduit with grout.
 - 3. Conduits with expansion fittings for above grade conduit runs such as at construction joints or conduit runs longer than 100 feet, provide bonding jumper across expansion fitting. Bonding jumpers for expansion fittings on conduits transitioning to above elevation will not be required.

3.09 LIQUID TIGHT FLEXIBLE CONDUIT INSTALLATION

- A. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC in damp or wet locations not subject to severe physical damage.

3.10 JUNCTION BOX AND PULL BOX INSTALLATION

- A. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- B. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- C. Locate boxes so that cover or plate will not span different building finishes.
- D. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- E. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- F. Set metal floor boxes level and flush with finished floor surface.
- G. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- H. Drilling holes in boxes to support the box shall not be allowed.

3.11 INSTALLATION OF UNDERGROUND CONDUIT

A. Concrete Encased Conduit:

1. All duct banks routed below grade shall be steel reinforced concrete encased, unless below building or equipment pad.
2. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 05 13 "Soils for Earthwork" for pipe less than 6 inches in nominal diameter.
3. Install backfill as specified in Section 31 05 13 "Soils for Earthwork."
4. After installing conduit and concrete, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 05 13 "Soils for Earthwork."
5. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
6. For installation of conduits to be used by electric utility, coordinate with the utility for exact requirements.
7. Conduit which is below the finished grade shall be PVC Schedule 40, except where indicated on the Drawings or noted otherwise.
8. Bury underground conduit a minimum of 18 inches deep to the top of the concrete encasement for 600-volt duct banks as shown on the Drawings, whichever is greater. Backfill buried conduit banks with material which is free from large rock, paving material, or large angular substance.
9. Install underground conduit with the conduit duct bank dimensions shown on the Drawings. Adhere to conduit spacing by using spacers at intervals to ensure that proper spacings are maintained.
10. The concrete shall be red in color. Apply dye in concrete truck, sprinkling dye on top of the duct bank after concrete placement is prohibited. Place 3-inch CMU blocks under rebar cage to suspend rebar off of the bottom of the trench so that it does not contact the soil and is completely encased in the concrete envelope when concrete is placed.
11. Underground 1.5 inches and larger conduit bends shall have a long sweep bend radius.
12. Contractor shall install duct bank spacers a minimum of every 5 feet.

3.12 INSTALLATION OF PAD MOUNTED ABOVE GRADE PULL BOXES

- A. Provide end bell fittings for all conduit stub ups into above grade pull boxes.
- B. No splicing of conductors within these pull boxes are permitted.
- C. Install pull box level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

D. Elevation: Set concrete pad 4 inches above finished grade.

3.13 SIZING AND INSTALLATION OF WIREWAYS, PULL BOXES AND JUNCTION BOXES

- A. Contractor shall be responsible for providing and sizing all wireways, pull boxes and junction boxes per the National Electrical Code (NEC) Article 314 and all other relevant sections of the NEC.
- B. Install Products in accordance with manufacturer's instructions.
- C. Use screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
- D. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- E. Wireway Supports: Per manufacturer's recommendations. Contractor shall support the wireway rigidly to the building structures using hardware bolted or screwed to the structure. Supporting wireways from corrugated metal structures shall not be allowed.
- F. Close ends of wireway and unused conduit openings.
- G. Use separate pull boxes and junction boxes for electric power, control, and communication systems.
- H. Install pull boxes in interior conduit at not more than 100 feet apart when conduit runs are not broken by junction or outlet boxes.
- I. Pull and junction boxes shall be accessible and not buried.
- J. Do not install boxes back-to-back in walls and provide a minimum of 6 inches separation, except in acoustic-rated walls, provide 24 inches separation.
- K. Support boxes independently of conduit except for cast boxes that is connected to two rigid metal conduits, both supported within 12 inches of box.
- L. Box shall be mounted using mounting lugs. Drilling through the box to mount is prohibited. Any box drilled to mount will be rejected and shall be removed and replaced at the Contractor's expense.

3.14 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."
- B. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 07 84 13 "Penetration Firestopping."
- C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.

- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Section 07 92 00 "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials.
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.15 FIRESTOPPING

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

3.16 PROTECTION

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

3.17 CONDUIT TERMINATIONS

- A. Conduit terminations at enclosures shall maintain the NEMA rating of the enclosure. Conduit terminations damaging enclosures shall not be permitted. Damaged enclosures will not be accepted and shall be replaced at the Contractor's expense.
- B. Locknut termination of conduits shall be permitted for indoor air-conditioned locations only. Damp, wet, or non-conditioned locations use grounding myers hubs for termination of conduits into enclosures.
- C. Use grounding myers hubs for all myers hubs fitting 1 1/2" and larger.
- D. Locations utilizing liquid tight fittings shall include a stainless steel banded sealing gasket. Damaged bands or gaskets due to overtightening shall be replaced by the Contractor.
- E. For exterior, wet locations, and where conduit enters from exterior or wet locations, conduit terminations shall not penetrate the top of enclosures. Enclosures with top penetrations shall be removed and replaced with conduits re-routed for side or bottom penetration at the Contractor's expense. If conductors have been installed and are too short to accommodate the re-routed conduit, then they shall be removed and replaced at the Contractor's expense.

- F. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- G. Use suitable conduit caps to protect installed conduit against entry of dirt and moisture. The use of duct tape or any other tape shall be prohibited.
- H. Conduits terminating inside an air conditioned space from outside shall be sealed to prevent moisture/condensation from entering the enclosure.

3.18 JUNCTION BOX INSTALLATION

- A. Junction boxes shall be installed so they are accessible from the front.
- B. Junction boxes shall have terminal strips/distribution blocks for splicing conductors where approved by the Engineer or as shown/specified on the Drawings. Terminal strips shall be manufactured by Allen-Bradley, Phoenix Contact or approved equal. Distribution blocks shall be per Section 26 05 19.01 "Wire Connections and Devices." No top entry in junction boxes with a terminal strip.
- C. Use watertight hubs to fasten conduit to metal boxes, etc. in wet or damp locations per the National Electrical Code.
- D. Metallic Junction boxes shall be grounded with NEC approved grounding fasteners and by means allowed by the enclosure manufacturer. Enclosures drilled for grounding fasteners that do not meet code shall be replaced at the cost of the Contractor.

END OF SECTION

26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels, including arc-flash warning labels.
 - 8. Miscellaneous identification products.

1.03 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For arc-flash hazard study.

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

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

- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:

- 1. Black letters on an orange field
 - 2. Legend: Indicate voltage and system or service type.

- B. Warning labels and signs shall include, but are not limited to, the following legends:

- 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.03 LABELS

- A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Champion America/ Seton Identification Products.
 - c. emedco.
 - d. Grafoplast Wire Markers.
 - e. LEM Products Inc.
 - f. Marking Services, Inc.
 - g. Panduit Corp.
 - h. Seton Identification Products.

- B. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Marking Services, Inc.
 - c. Panduit Corp.
 - d. Champion America/ Seton Identification Products.

C. Self-Adhesive Labels:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. A'n D Cable Products.
- b. Brady Corporation.
- c. Brother International Corporation.
- d. emedco.
- e. Grafoplast Wire Markers.
- f. Ideal Industries, Inc.
- g. LEM Products Inc.
- h. Marking Services, Inc.
- i. Panduit Corp.
- j. Seton Identification Products.

Preprinted, 3-mil-thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

- k. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the cable diameter, such that the clear shield overlaps the entire printed legend.
2. Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
 - a. Nominal Size: 3.5-by-5-inch.
3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.04 BANDS AND TUBES:

- A. Snap-Around, Color-Coding Bands for Raceways and Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Marking Services, Inc.
 - c. Panduit Corp.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around cables they identify. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Panduit Corp.

2.05 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. Champion America.
 - c. Ideal Industries, Inc.
 - d. Marking Services, Inc.
 - e. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M
 - b. Brady Corporation.
 - c. Carlton Industries, LP.
 - d. emedco.
 - e. Marking Services, Inc.

C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LEM Products Inc.
 - b. Marking Services, Inc.
 - c. Seton Identification Products.

D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.

- b. Seton Identification Products.

E. Underground-Line Warning Tape

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Ideal Industries, Inc.
 - c. LEM Products Inc.
 - d. Marking Services, Inc.
 - e. Reef Industries, Inc.
 - f. Seton Identification Products.
2. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines and communications.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CAT6 CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
4. Tag: Type I:
 - a. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches.
 - c. Thickness: 4 mils.
 - d. Weight: 18.5 lb/1000 sq. ft.
 - e. Tensile according to ASTM D 882: 30 lbf and 2500 psi.

2.06 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.

- c. Marking Services, Inc.
 - d. Champion America/Seton Identification Products.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. Grafoplast Wire Markers.
 - d. LEM Products Inc.
 - e. Marking Services, Inc.
 - f. Panduit Corp.
 - g. Seton Identification Products.

2.07 SIGNS

- A. Baked-Enamel Signs:
 - 1. Preprinted aluminum signs punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal Size: 7 by 10 inches.
 - 4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Carlton Industries, LP.
 - b. Champion America.
 - c. emedco.
 - d. Marking Services, Inc.
- B. Metal-Backed Butyrate Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal Size: 10 by 14 inches.
 - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.

- b. Champion America.
 - c. Marking Services, Inc.
- C. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Engraved legend.
 - 2. Thickness:
 - a. For signs up to 20 sq. inches, minimum 1/16-inch-.
 - b. For signs larger than 20 sq. inches, 1/8 inch thick.
 - c. Engraved legend with black letters on white face.
 - d. Self-adhesive.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
 - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. Marking Services, Inc.

2.08 MISCELLANEOUS IDENTIFICATION PRODUCTS

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

3.00 EXECUTION

3.01 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.

- D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.
- I. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- J. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- K. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.03 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30A and 120V to Ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- C. Power and Control Cable Identification: All markings to labels, schedules, tags or name plates shall be machines printed only. Hand printing is prohibited. Circuits shall be tagged at terminations (both ends), in pull boxes, cabinets, and enclosures as follows:
 - 1. Tags relying on adhesives or tape-on markers are not acceptable.
 - 2. Provide conductor tags for conductors No. 10 AWG and below with legible permanent sleeve of yellow or white PVC with machine printed black markings.

3. Tags shall be imprinted with panelboard and panelboard position number (e.g. LA3-23) for conductors fed from panelboards. Other conductors shall have tags imprinted with the MCC which feeds the conductors (e.g. MCC 1).
 4. Switchlegs shall have the designation described above on their tags, plus an "S" suffix. Travelers shall have the designation described above on their tags, plus a "T" suffix.
 5. Where more than one neutral is present with a group of conductors, a tag shall be applied to each neutral indicating which phase conductors are served by each neutral (e.g. HA-2, 4, 6).
- D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - b. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- E. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive, self-laminating polyester labels with the conductor designation.
- H. Conductors To Be Extended in the Future: Attach write-on tags to conductors and list source.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- J. Conduit Identification Plate: A conduit identification plate shall be installed on all power, control and instrumentation conduits at the end of each run and at the conduit ends inside intermediate junction and pull boxes, manholes, handholes, etc.
1. Conduit plates shall be installed before conductors are pulled into the conduits.

2. Exact identification plate location shall be coordinated with the Owner/Engineer at the time of installation. The conduit identification tags shall identify the cable numbers as shown on the FNI plans and the "to" and "from" information.
 3. Coordinate with Owner for exact requirements for plate material and type. Provide an example to Owner/Engineer as a formal submittal for approval prior to the installation. Attach conduit identification plate with stainless steel tie wraps or stainless-steel wire.
- K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- M. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
1. Comply with NFPA 70E and ANSI Z535.4.
 2. Comply with Section 26 05 74 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- N. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- O. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for load shedding.
- P. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine plastic label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment To Be Labeled:
- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchboards.
 - e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - f. Emergency system boxes and enclosures.
 - g. Motor-control centers.
 - h. Enclosed switches.
 - i. Enclosed circuit breakers.
 - j. Enclosed controllers.
 - k. Variable-speed controllers.
 - l. Pushbutton local control stations.
 - m. Power-transfer equipment.
 - n. Contactors.
 - o. Remote-controlled switches, dimmer modules, and control devices.
 - p. Generator.
 - q. Power-generating units.
 - r. Monitoring and control equipment.
 - s. Conduits.

END OF SECTION

26 05 73.01 ELECTRICAL POWER SYSTEM STUDIES

1.00 GENERAL

1.01 DESCRIPTION

General: This section specifies that the CONTRACTOR prepare a short circuit and protective device coordination study, load flow and motor starting study, and an arc flash hazard analysis for the electrical power system as shown on the plans for the complete electrical system at the Pearson Pump Station.

Short Circuit and Protective Device Coordination Study, Arc Flash Analysis, and Load Flow Study, and Motor Starting Study

The studies shall provide an evaluation of the electrical power system and the model numbers and settings of the protective relays or devices and metering or motor monitoring devices for setting by the CONTRACTOR. The Studies shall include settings for all protective relays and circuit breakers, including breakers mounted in generator, power meters and electric system monitoring for both devices provided under this contract and for the existing devices. The Contractor shall obtain any needed data or information for the electrical equipment from Contract Documents, various suppliers, and from conducting his own field investigations.

A. Scope:

1. The CONTRACTOR is responsible for providing all pertinent information necessary for the successful completion of the Short Circuit and Protective Device Coordination Study, Load Flow and Motor Starting Study, and Arc Flash Analysis. All cable and raceway data, data from all new Switchgear, transformers, generator, panelboards, and separately mounted fuses, starters or circuit breakers shall be obtained by the CONTRACTOR. Obtain all existing or new protective device information to include all present settings. The CONTRACTOR shall obtain any needed data or information from Contract Documents, various suppliers, the Electric Utility and from conducting his own field investigations. The data obtained shall be organized and submitted to the ENGINEER to show that all the necessary data gathering work has been done.
2. Calculations shall utilize actual X/R and three phase short circuit values obtained by the CONTRACTOR from the Electric Utility. The use of infinite bus fault current calculation is not acceptable.
3. The Contractor shall redo the Power System Studies if any changes are made during the field testing checkout and/or start-up and shall re-submit the updated study for engineer approval.
4. Provide a complete short circuit study. Include three phase and phase-to-ground calculations. Provide an equipment interrupting or withstand evaluation based on the actual equipment and model numbers provided on this project. Generic devices are not acceptable. Normal system operating method, alternate operation, and operations that could result in maximum fault conditions shall be thoroughly addressed in the study.
 - a. The study shall assume all motors operating at rated voltage with the exception that motors identified as "standby" shall not be included.
 - b. Electrical equipment bus impedance shall be assumed zero.

- c. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at the electrical equipment busses.
 - d. The Study shall be performed using actual available short circuit currents available and system impedances as obtained from the Electric Utility and Generator manufacturer. An assumption of infinite bus for the purposes of the Study is not acceptable.
 - e. Study shall use actual motor X/R and subtransient reactance data obtained from equipment suppliers.
5. A protective device coordination study shall be performed to determine appropriate relay settings. The study shall include all electrical equipment provided under this contract and any up-stream equipment that has an impact on the coordination study. The study shall show transformer damage curves, generator damage curves, cable short circuit withstand curves and motor curves. Include all medium and low voltage switchgear, distribution switchboards, motor control centers, soft starters, and panelboards main circuit breakers. Complete the short circuit study down to the main breaker or main lugs on all panelboards. Panelboard branch circuit devices need not be considered. The phase over current and ground-fault protection shall be included as well as settings for all other adjustable protective devices. All motor monitoring relays and protective or monitoring devices that are a part of a supplier's equipment (such as soft starters, switchgear) shall be included. Include the last protective device in the Electric Utility's system feeding each facility being considered.
 6. Provide Time-Current Curves on 11X17 log-log paper. Do not put more than one branch of protective devices on any one coordination curve. Include a one-line diagram and the names of each protective device in the branch. Use the names designated in the Contract Documents. Include motor and transformer damage curves, and cable short circuit withstand curves. Coordination study time-current curves (11x17 log-log type) including the instrument transformer ratios, model numbers of the protective relays, and the relay settings associated with each breaker. Organize the curves as specified here in. Ground fault time current curves shall be on a separate sheet.
 7. An equipment evaluation study shall be performed to determine the adequacy of the fault bracing of all bus from the panelboard level up to the main Switchgear or protective device. Include circuit breakers, controllers, surge arresters, busway, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents.
 8. Provide arc flash hazard analysis in accordance with the applicable NFPA, ANSI, and IEEE standards.
 9. The studies shall be performed, sealed and signed by a Registered Professional Engineer licensed in the State of Texas.
 10. Any problem areas or inadequacies in the equipment shall be promptly brought to the ENGINEER's attention.
 11. Use industry standard short circuit software, SKM CAPTOR and DAPPER or an equal approved by the ENGINEER.

12. The report shall include a comparison of short circuit duties of each bus to the interrupting capacity of the equipment that is protecting that bus.
13. The report shall include all data that was used as input to the report. This data shall include cable impedance, conduit type, source impedance, equipment ratings, motor X/R and subtransient reactance data, etc.
14. Provide and program all settings for all power meters, motor protection relays, feeder protection relays, etc.
15. The CONTRACTOR shall coordinate with the Utility for electrical data required for the studies.

1.02 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.

<u>Reference</u>	<u>Title</u>
IEEE 141	Recommended Practice for Electric Power Distribution for Industrial Plants
IEEE 242	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
NFPA 70E	Handbook for Electrical Safety in the Workplace
IEEE 1584	IEEE Guide for Performing Arc-Flash Hazard Calculations
NEC	National Electrical Code

1.03 SCHEDULE

- A. The report shall be provided to the ENGINEER NO LATER THAN 60 days before the equipment is shipped to the Work site. SHIPMENT AND DELIVERY OF EQUIPMENT WILL NOT BE ACCEPTED AT THE JOBSITE UNTIL THE STUDY HAS BEEN COMPLETED, SUBMITTED AND APPROVED BY THE ENGINEER.

1.04 SUBMITTAL PROCEDURES

Submittals shall be in accordance with this section, the General Requirements, and shall include the following minimum information:

- A. Shop Drawings:
1. Short Circuit and Protective Device Coordination Study. Time current curves shall be on 11x17 log-log type paper. The 11x17 paper with the TCC shall also include a one-line diagram for the branch that the TCC on that sheet corresponds with. The CONTRACTOR can provide time current curves on 8 ½ x 11 log-log type paper as a supplement but not as a replacement.
 2. Provide a list of all recommended settings for all power meters, motor protection relays, feeder protection relays, etc.

3. Load Flow Study
4. Motor Starting Study
5. Contractor shall coordinate with the starter manufacturers for all data required to perform the motor starting analysis. The preliminary starting analysis shall determine the maximum inrush allowed when starting the motor to not drop out the loads under the worst operating conditions.
6. Arc Flash Hazard Analysis
 - a. Provide a color copy of project specific Arc Flash labels for each panelboard, switchboard, switchgear, disconnect, Motor Control Center, VFDs, starters, transfer switches, including all existing electrical equipment – switchgear, starters, motor control center, panelboards, starters, etc.
 - b. Provide a copy of the one-line diagram color-coded to show the incident ranges at each bus. The one-line shall be on 11x17 paper.
 - 1). The one-line shall also include the information specified in section 2.03 below.
- B. After the report and one-line has been approved, provide a color copy in PDF format of the finalized 11x17 one-line diagram to the Contractor for the Contractor's use to frame in the electrical room as specified in section 26 05 00, "Common Work Results for Electrical". The one-line shall reflect all changes made including but not limited to changes made during construction.
- C. The Contractor shall redo the Power System Studies if any changes are made during the field testing checkout and/or start-up. The Contractor shall re-submit the Power System Studies for Engineer Approval. The Studies shall include an updated copy of the color copy Arc Flash Labels.
- D. A CD with all SKM input files and a PDF of all output files is required for both the preliminary and final power system studies Submittal Procedures.
 1. Two Software copies of actual power systems computer program project data files burned in on a CD. The CONTRACTOR shall provide an electronic copy on a CD-ROM of all files used to develop the electrical system model in the power system analysis program and all files for the written study analysis and summary data tables. For instance if SKM software is used for the power system studies, then the SKM files shall be burned in on a CD-ROM and provided to the OWNER/ENGINEER. This shall include any library files used for circuit breakers, fuses, etc. for the power system analysis.

2.00 EXECUTION

2.01 GENERAL

- A. Provide a short-circuit and protective device coordination study load flow and motor starting study, and arc flash hazard analysis on the electrical power distribution system, as specified. The studies shall be performed in accordance with IEEE Standards 141 and 242, IEEE 1584, ANSI, and the NEC and shall utilize the ANSI method of short circuit analysis in accordance with ANSI C37.010. The studies shall be performed using actual equipment data for all equipment. The coordination studies shall use the data from the manufacturer of protective devices.

2.02 QUALIFICATIONS

- A. The studies shall be performed by a consultant who is regularly engaged in power system studies. A Licensed Professional Engineer with proficiency in electrical power engineering shall conduct the studies and shall seal and sign the studies. The Professional Engineer shall be licensed to practice engineering in the State of Texas. A study submitted without a Professional Engineer's seal will not be reviewed and returned Not Approved, Revise & Resubmit. **EQUIPMENT MANUFACTURERS SHALL NOT BE ALLOWED TO PERFORM THE STUDIES, NO EXCEPTIONS.**
- B. Acceptable Power System Study Providers:
 - 1. Strategic Engineering – Jeff Wilbanks, P.E. (214) 679-0092
 - 2. Coordinated Power Systems, Inc. – Robert Stockinger, P.E. (414) 425-5993
 - 3. All others shall submit qualifications to the Owner and the Engineer for review and approval prior to bid submittal no later than one week after bid advertisement date. Any submittals after this time period shall not be evaluated. Qualifications shall include Power Systems Studies providers who have had at least 5 years of successful experience in the performing studies of similar projects with a generator and pump station configurations. Qualifications shall include a list of similar projects within the last 5 years with the name of the project and contact information of the Owner.

2.03 OPERATING SCENARIOS

- A. The following Operating Scenarios shall be included in the study:
 - 1. NORMAL OPERATING CONDITIONS: All connected loads running.
 - 2. GENERATOR OPERATING CONDITIONS: All connected loads running.

2.04 SHORT CIRCUIT STUDY

- A. The CONTRACTOR shall be responsible for obtaining and verifying all data needed to perform the study.
- B. As a minimum, each short circuit study shall include the following:
 - 1. One-Line Diagram:
 - a. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.
 - b. Type designation, current rating, range or adjustment, manufacturer's style and catalog number for all protective devices.
 - c. Power and voltage ratings, impedance, primary and secondary connections of all transformers. Use the ratings (ie. Impedance, X/R, etc.) of the actual transformers being provided where available.
 - d. Type, manufacturer, and ratio of all instrument transformers energizing each relay.
 - e. Nameplate ratings of all motors and generators with their subtransient reactances. Transient reactances of synchronous motors and generators and synchronous reactances of all generators. Obtain data on the actual equipment being provided. Generic or average data numbers are not acceptable.

- f. Sources of short circuit currents such as utility ties, generators, synchronous motors, and induction motors. Provide short circuit studies using each source of power separately. The study shall determine if there is sufficient short circuit current to adequately cause interruption of a protective device using the weaker power source (typically local generation), and shall determine if the equipment can safely interrupt the fault if the greater power source is connected. Additional short circuit calculations shall include emergency as well as normal switching conditions as well as normal and emergency power sources described here in.
 - 1). Show short circuit calculations listing short circuit levels at each bus. Provide the same data in tabular form.
 - g. All significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc shall be included.
 - h. The time-current setting of existing adjustable relays and direct-acting trips, if applicable.
 - i. One-Line showing available fault current at each bus all the way down to the 208Y/120V panelboards.
2. Impedance Diagram:
- a. Available MVA or impedance from the utility company.
 - b. Local generated capacity impedance.
 - c. Bus impedance.
 - d. Transformer and/or reactor impedances.
 - e. Cable impedances.
 - f. Equipment impedances.
 - g. System voltages.
 - h. Grounding scheme (resistance grounding, solidly grounding, or no grounding).
 - i. Motor contribution assuming the new and existing motors as shown on the plans all running at the same time.
3. Calculations:
- a. Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.
 - b. Calculate the maximum and minimum fault currents.
 - c. A discussion section evaluating the adequacy or inadequacy of the equipment method of calculation and formulas used such that all calculations can be verified manually by the ENGINEER, with recommendations as required for improvements to the system.
 - d. Any inadequacies shall be called to the attention of the ENGINEER and recommendation made for improvements.


2.05 PROTECTIVE DEVICE COORDINATION STUDY

- A. As a minimum, the coordination study for the power distribution system shall include the following on 5-cycle, log-log graph paper:
 - 1. The time-current coordination analysis shall be performed with aid of a digital computer.
 - a. Time-current curves for each device shall be positioned to provide for maximum selectivity to minimize system disturbances during fault clearing, but still maintain a low incident energy level. Where selectivity cannot be achieved, the ENGINEER shall be notified as to the cause.
 - 2. Time-current curves for each device shall be positioned to provide for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, the ENGINEER shall be notified as to the cause.
 - 3. Time-current curves and points for cable and equipment damage.
 - 4. Circuit interrupting device operating and interrupting times.
 - 5. Indicate maximum fault values on the graph.
 - 6. Sketch of bus and breaker arrangement.

2.06 ARC FLASH HAZARD ANALYSIS

- A. The study shall be performed in accordance with the NEC and all applicable OSHA, ANSI, and IEEE standards.
- B. The CONTRACTOR shall adjust all adjustable time-current devices such that the trip settings lower the arc flash exposure and minimizing the clearing time. However, the CONTRACTOR shall adjust the time-current devices to avoid nuisance tripping.
- C. The CONTRACTOR shall utilize fault current values from the short circuit analysis to determine the Incident energy, limited approach boundary, restricted approach boundary, prohibited approach boundary and appropriate PPE required.
- D. The CONTRACTOR shall provide project specific arc-flash labeling. The arc-flash labeling shall be placed on the outside of the cover of the switchgear, combination motor starters, panelboard, switchboard, distribution panel, and all electrical panels, etc. such that it can be read without opening the electrical equipment. Mount arc-flash labels a maximum of 6'-6" AFF, include the housekeeping pad in the mounting height. The CONTRACTOR shall provide arc-flash labeling on all existing panelboards, switchboards, distribution panel, etc. where breakers are added or work is performed in or on the electrical equipment.
- E. Arc Flash Labels shall be chemical resistant, UV resistant, water resistant, scratch resistant, and made of 3.0 mil vinyl tape as manufactured by DuraLabel, Brady or approved equal. The lettering shall be performed by thermal transfer print.
 - 1. Arc Flash labels and label lettering shall be sized large enough to be legible at a distance outside the hazard area.
 - 2. Arc Flash Labels shall be placed on the door(s) of the room if the hazard area reaches or extends beyond the electrical room door(s).

3. The arc flash label shall include a DANGER header when the incident energy is above 40cal/cm², and a WARNING header for all other incident energy levels.
- F. To ensure a safe workplace, and that the labeling meets NEC, OSHA, IEEE, and NFPA requirements, use specialized arc flash software to calculate protection boundaries. These protection boundaries shall include the Flash Protection Boundary, Limited Approach Boundary, Restricted Approach Boundary and the Prohibited Approach Boundary.
- G. The arc-flash analysis shall be based on calculated fault from the Short Circuit Study at each respective bus. The arc-flash software program shall be used to calculate the available arcing fault at each bus in the system, the resultant flash protection boundary based on the applicable protective device operating times and the associated incident energy that workers may be exposed to at the specified working distances.
- H. The report shall include the following information: Arc-flash evaluation table, arc-flash and shock hazard label definitions, arc-flash evaluation information, arc-flash and shock hazard labels and definitions of terms used in the arc-flash hazard analysis.
- I. Arc Flash labels shall be similar to the following example:

 WARNING	
Arc Flash and Shock Hazard	
Appropriate PPE Required	
13 inch	Flash Hazard Boundary
0.67	cal/cm ² Flash Hazard at 18 inches
3	PPE Category
480 VAC	Shock Hazard when cover is removed
0	Glove Class
42 inch	Limited Approach
12 inch	Restricted Approach
10.692 kA	Calculated Available Fault Current
Equip. ID: Panel LP1	
Protected By: 125A CB: TX1 (480V MCC1)	
Study Date: May 4, 2016	
Upstream Protective Device: Panel HP1 Circuit 1,3,5	

2.07 LOAD FLOW STUDY

- A. SCOPE: Determine the active and reactive power, voltage, current, and power factor throughout the electrical system. Provide an analysis of all possible operating scenarios.
- B. PROCEDURE: The load flow study shall be performed in accordance with the recommended practices and procedures set forth in IEEE 399.
- C. STUDY REPORT: Results of the load flow study shall be summarized in a final report containing the following items:
 1. Basis, description, purpose, and scope of the study.

2. Tabulation of data used to model the system components and a corresponding one-line diagram.
3. Description of scenarios evaluated and the basis of each.
4. Tabulation of power and current flow versus equipment ratings. The tabulation shall identify percentage of rated load and the scenario for which the percentage is based. Overloaded equipment shall be clearly noted.
5. Tabulation of system voltage versus equipment ratings. The tabulation shall identify percentage of rated voltage and the scenario for which the percentage is based. Voltage levels outside the ranges recommended by equipment manufacturers, IEEE C84.1 or other appropriate standards shall be clearly noted.
6. Tabulation of system real and reactive power losses with area of concern clearly noted.
7. Provide One-line showing voltage at major busses down to the 208Y/120V panelboards.
8. Conclusions and recommendations.

2.08 MOTOR STARTING STUDY

- A. The motor starting study shall provide an evaluation of the electrical power system when starting the motors for all operating scenarios indicated below. The motor starting study shall evaluate all different possible operating scenarios under the worst case starting conditions. The CONTRACTOR shall coordinate with the electrical equipment manufacturers and obtain all information required to perform the motor starting analysis. The preliminary starting analysis shall determine the maximum inrush allowed when starting the motors to not drop out the site loads under the worst operating conditions.
- B. Scope:
 1. CONTRACTOR shall provide a motor starting/load flow study for the work performed at the site. The study shall evaluate all possible operating scenarios.
 - a. Operating Scenarios that shall be included in the study are listed in paragraph 2.03.
 - b. See electrical plans for detailed one-line diagram of the electrical distribution system. The CONTRACTOR shall coordinate with the Local Utility and OWNER for all voltage flicker requirements and is responsible for obtaining all pertinent data from the Local Utility/OWNER and other equipment manufacturers to perform the study.
 2. CONTRACTOR shall obtain any information required for the motor starting/load flow study including utility available fault current, utility system impedance, motor data (i.e., sub transient reactance, etc.), transformer data (i.e. impedance, X/R, etc.), cable data, etc.
 3. The study shall be submitted to the ENGINEER and approved prior to final approval of the electrical equipment shop drawings and release of any electrical equipment for manufacturing.
 4. The study shall include as a minimum the following:
 - a. Single line diagram showing voltage at all major busses down to the 208Y/120V panelboards.
 - b. Bus Voltage and power flow.

- c. Information on the computer program used for the study and also shall include a general discussion of the procedure, items, and data considered in preparing the study.
 - d. Description and analysis of all results.
 - e. Suggested changes to the equipment selection that will result in improved system performance.
5. The study shall be performed, sealed and signed by a Registered Professional Engineer licensed in the state where the electric equipment is to be installed.

END OF SECTION

1.00 GENERAL**1.01 SUMMARY****A. Section Includes:**

1. Pad-mounted, liquid-filled, medium-voltage distribution transformers, with primary and secondary bushings within or without air-terminal enclosures.

B. Related Requirements:

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

1.02 DEFINITIONS

- A. Bushing: An insulating structure including a central conductor, or providing a central passage for a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.
- B. Bushing Elbow: An insulated device used to connect insulated conductors to separable insulated connectors on dead-front, pad-mounted transformers and to provide a fully insulated connection. This is also called an "elbow connector."
- C. Bushing Insert: That component of a separable insulated connector that is inserted into a bushing well to complete a dead-front, load break or nonload break, separable insulated connector (bushing).
- D. Bushing Well: A component of a separable insulated connector, either permanently welded or clamped to an enclosure wall or barrier, having a cavity that receives a replaceable component (bushing insert) to complete the separable insulated connector (bushing).
- E. Elbow Connector: See "bushing elbow" above.

1.03 ACTION SUBMITTALS**A. Product Data:**

1. For each type of product.

- a. Include rated nameplate data, capacities, materials, weights, dimensions, minimum clearances, installed devices and features, location of each field connection, fuse time current curves, and performance for each type and size of transformer indicated.

B. Shop Drawings:

1. Submittals shall include the entire corresponding specification at the front of the document with markings of C, D, E, or N/A beside each section and sub section(s). C, D, E, or N/A will be noted as comply, deviate, exception, or not applicable. Product Data: For each type of product indicated.
2. For pad-mounted, liquid-filled, medium-voltage transformers.
 - a. Include plans and elevations showing major components and features.
 - 1). Include plan view and cross section of equipment base, showing clearances, required workspace, and locations of penetrations for grounding and conduits.
 - b. Include details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
 - c. Transformer control schematic diagrams and wiring diagrams. Project specific inter-connection wiring showing alarm contacts off of devices wired to terminal blocks for customer's use.
 - d. Transformer Guaranteed Losses at 55 degrees C.
 - e. Transformer magnetizing current magnitude and duration.
 - f. Load and no-load losses.
 - g. Include single-line diagram.
 - h. Include list of materials.
 - i. Include nameplate data and schedule.
 - j. Manufacturer of equipment.
 - k. Manufacturer's published time-current curves of transformer line-side fuses, with transformer damage curve, inrush curve, and thru fault current indicated.
 - l. Provide in writing that transformer is suitable for step-up application.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For transformers, signed by product manufacturer.
- B. Source quality-control reports.
- C. Field Test Data
 - 1. No load losses, load losses, etc.
 - 2. Field quality-control test reports.
 - 3. NETA Acceptance Testing Specification (ATS) field tests and inspections tests report.
- D. Operation And Maintenance Data
 - 1. Operation and maintenance manuals shall be prepared by the equipment manufacturer and contain the shop drawings, submittals, list of manufacturers recommended spare parts, schematics, equipment installation report, and maintenance procedures. O&M manuals shall include all field changes made during startup and testing.
 - 2. Operation and maintenance manuals shall include warranty information as well as a warranty information page that shall include information on the warranty start and end date as well as contact information for service.
 - 3. Manuals shall be prepared by the Equipment Manufacturer and shall also incorporate appropriate final certified shop drawings. Manuals may be manufacturer's standard instructions but shall be supplemented as necessary to cover any special feature not included in standard material.
 - 4. Submit preliminary manuals for review prior to start-up of equipment.
 - 5. O&M Manuals shall be submitted in both hard copy and electronic format. Electronic format shall be fully indexed with all bookmarks populated and active.
 - 6. Spare parts list
 - 7. Follow-up service reports.
- E. Seismic Qualification Data: Certificates, for pad mounted transformer, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.05 STANDARDS

- A. The applicable provisions of the latest edition of following standards shall apply as if written here in their entirety:

ANSI/IEEE C57.12.00	IEEE General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
ANSI/IEEE C57.12.10	Requirements for Transformers 230kV and Below, 833/958 through 8,333/10,417 KVA Single-Phase and 750/862 through 60,000/80,000/100,000 KVA Three-Phase Without Load Tap Charging; and 3750/4687 through 60,000/80,000/100,000 KVA with Load Tap Charging
ANSI/IEEE C57.12.22	Pad-Mounted, Compartmental-Type, Self-Cooled Three Phase Distribution Transformers with High-Voltage Bushings, 2500 kVA and Smaller; High Voltage, 34,500 GRD Y/19,920 Volts and Below; Low Voltage, 480 Volts and Below
ANSI/IEEE C57.12.26	Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, (34,500 GRD Y/19,920 Volts and Below; 2500 kVA and Smaller)
ANSI/IEEE C57.12.34	Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller) - High Voltage: 34,500 GRD Y/19,920 Volts and Below; Low-Voltage: 480 Volt 2500 kVA and Smaller
ANSI/IEEE C57.12.28	IEEE Standard for Pad-Mounted Equipment - Enclosure Integrity
ANSI/IEEE C57.12.70	Terminal Markings and Connections for Distribution and Power Transformers
ANSI/IEEE C57.12.80	Terminology for Power and Distribution Transformers
ANSI/IEEE C57.12.90	Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
ANSI/IEEE C57.13	Requirements for Instrument Transformers

ANSI/IEEE 386	Separable Insulated Connector Systems for Power Distribution Systems Above 600V
ANSI/IEEE C57.91	Guide for Loading Mineral-Oil Immersed Transformers
ANSI/IEEE C57.92	Guide for Loading Oil-Immersed Power Transformers
ANSI/IEEE C57.98	Guide for Transformer Impulse Tests
ANSI/IEEE C62.11	Metal-Oxide Surge Arresters for Alternating-Current Power Circuits
NEMA TR-1	Transformers, Regulators and Reactors
NFPA 70	National Electrical Code (NEC)
NEMA 260-1996 (2004)	Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas
10 CFR PART 431	Department of Energy – Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule

1.06 DELIVERY AND STORAGE

- A. Store transformers according to manufacturer's instructions. Equipment shall be stored per manufacturer's recommendations .

1.07 PROJECT CONDITIONS

- A. Environmental Conditions: Transformer shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 1. Ambient Temperature: -22.2 deg C (-8 deg F) to 45 deg C (113.0 deg F).
 2. Relative Humidity: 0 to 80 percent.
 3. Altitude: 710 ft.

1.08 EQUIPMENT WARRANTY

- A. Equipment Manufacturer shall warrant the equipment furnished under this Specification for a period of two (2) years against defects in materials and workmanship, equipment design, and operational failure.
- B. In the event of failure in material, workmanship, or equipment design of any part or parts of the equipment during the warranty period, and provided that the equipment has been operated and maintained in accordance with good practice, the Equipment Manufacturer shall furnish, deliver, and install the defective part or parts at Equipment Manufacturer's own expense. During the warranty period, the Owner will remove and load the Goods on a vehicle provided by the Equipment Manufacturer if it is necessary to return the Goods to the Equipment Manufacturer for correction of defects during the Warranty Period. Owner will reinstall the Goods when they are returned to the Site after defects have been corrected. The Equipment Manufacturer is to provide all parts, labor and incidental cost for making repairs, shipping the Goods to the Site and providing startup services in accordance with specification.
- C. The warranty period shall be interpreted as the twenty-four (24) month period following the installation, adjusting and acceptance testing, and the start of actual operation of the equipment or thirty-six (36) months after complete delivery, whichever occurs first.

2.00 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
- B. Comply with IEEE C2.
- C. Comply with IEEE C57.12.00.

2.02 PERFORMANCE REQUIREMENTS

- A. Windings and internal leads shall be copper, insulated and braced to prevent phase flashover during fault conditions. Transformers with wye connected primary and secondary windings shall have the neutral insulated from the secondary neutral and brought out into the primary compartment through separate bushing. Both neutral bushings shall be externally connected to the tank with removable copper straps.
- B. Transformer(s) shall be in NEMA 3R enclosures.
- C. Exposed copper connections shall be tinned copper.

- D. Surge Arresters: Comply with IEEE C62.11, Distribution Class; metal-oxide-varistor type, fully shielded, separable-elbow type, suitable for plugging into inserts provided in line-side section of transformer surge protection. Connected in each phase of incoming circuit and ahead of disconnecting device.
 - 1. Primary overvoltage protection shall be provided by externally mounted Heavy-Duty distribution M.O.V.E. deadfront primary elbow arresters for each phase rated at 15.3kV. Arresters shall be suitable for operation on a 5kV system that is low resistance grounded when connected to the generator.
- E. Winding Connections: Connection of windings and terminal markings must comply with IEEE C57.12.70.
- F. Efficiency: Comply with 10 CFR 431, Subpart K.
- G. Insulation: Transformer kVA rating must be as follows: Average winding temperature rise above 30 deg C ambient temperature must not exceed 65 deg C and 80 deg C hottest-spot temperature rise at rated kVA when tested in accordance with IEEE C57.12.90, using combination of connections and taps that give highest average winding temperature rise.
 - 1. Transformers shall be self-cooled. Winding temperature rise shall not exceed 55°C above a 30° average ambient with a maximum ambient not to exceed 40°C, operating at full rated load. The insulation system shall allow an additional 12% kVA output at 65°C average winding temperature rise by resistance, on a continuous basis, without a decrease in normal transformer life.
- H. Tap Changer: External handle, for de-energized operation.
 - 1. No load, externally operated, lockable, five position primary winding tap changer located in the secondary terminal compartment. Tap settings must be clearly visible with the compartment door in the open position. Provide transformers rated greater than 30 kVA with two (2) 2-1/2% full capacity taps below and two (2) 2-1/2% above rated voltage in primary. Tap changing shall be via an externally operated manual tap changer for operation when transformer is de-energized.
- I. Tank: Sealed, with welded-on cover. Designed to withstand internal pressure of not less than 7 psi without permanent distortion and 15 psig without rupture. Comply with IEEE C57.12.36.
 - 1. Transformer tank shall withstand internal top oil temperatures ranging from 50°C to 105°C. Tank cover shall be designed to permit access to internal components for inspection or repair. Heavy duty, non-removable lifting lugs and jacking pads shall be provided. When required, welded cooling panels or radiators shall be provided on the back and sides of the tank.
- J. Enclosure Integrity: Comply with IEEE C57.12.28 for pad-mounted enclosures that contain energized electrical equipment in excess of 600 V that may be exposed to the public.

- K. Mounting: Integral skid mounting frame, suitable to allow skidding or rolling of transformer in any direction, and with provision for anchoring frame to pad.
- L. Insulating Liquids:
 - 1. Transformer insulating fluid shall be FR3 Less flammable, edible-seed-oil based, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic. Insulating oil shall be free of P.C.B. contamination or any E.P.A. listed toxic chemical.
- M. The average audible sound level shall not exceed 63 DB for transformers rated above 75 kVA, when measured in accordance with NEMA Standard TR1.
- N. Corrosion Protection:
 - 1. Transformer coating system must be factory applied, complying with requirements of IEEE C57.12.29, in manufacturer's standard color green.
 - 2. Fabricate front sill, hood, and tank base of single-compartment transformers from stainless steel in accordance with ASTM A167, Type 304 or 304L, not less than No. 13 U.S. gage, complying with requirements of IEEE C57.12.29, standard color green.
 - 3. Base and Cabinets of Two Compartment Transformers: Fabricate from stainless steel in accordance with ASTM A167, Type 304 or 304L, not less than No. 13 U.S. gage. Coat transformer with manufacturer's standard green color coating complying with requirements of IEEE C57.12.28, in manufacturer's standard color green.

2.03 THREE-PHASE TRANSFORMERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Eaton
 - 2. Square D
 - 3. Approved Equal
- B. Transformers shall conform to 2010 standard efficiency levels for liquid immersed distribution transformers, as specified in Table I.1 of the Department of Energy ruling, "10 CFR Part 431 Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule; October 12, 2007." Manufacturer shall comply with the intent of all regulations set forth in noted ruling.
- C. Description:

1. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Comply with IEEE C57.12.26.

D. Compartment Construction:

1. Double-Compartment Construction: Individual compartments for line- and load-side sections, formed by steel isolating barriers that extend full height and depth of compartments, with hinged, lift-off doors and three-point latching, with stop in open position and provision for padlocking.
2. Transformer(s) shall be self-cooled, liquid filled tamper resistant, weatherproof, and suitable for mounting on a concrete pad. Transformer shall be cooled by natural convection.
3. Transformer coils shall be of continuous wound construction with terminations brazed or welded and shall be impregnated with non-hygroscopic, thermosetting varnish.
4. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA, IEEE, and ANSI standards.

E. Primary Fusing: Designed and rated to provide thermal protection of transformer by sensing overcurrent and high liquid temperature.

1. 150 kV BIL current-limiting fuses, conforming to requirements of IEEE C37.47.
2. Interrupting Rating: 50 000 A(rms sym) at system voltage.
3. Fuse Assembly: Bayonet-type, liquid-immersed, expulsion fuses in series with liquid-immersed, partial-range, current-limiting fuses. Bayonet fuse must sense both high currents and high oil temperature to provide thermal protection to transformer.
4. Provide bayonet fuse assembly with oil retention valve and external drip shield inside housing to eliminate or minimize oil spills. Valve must close when fuse holder is removed and external drip shield is installed.
5. Provide conspicuously displayed warning adjacent to bayonet fuse(s), cautioning against removing or inserting fuses unless transformer has been de-energized and tank pressure has been released.

F. Primary Section:

1. Bushings with spade terminals drilled for terminating number of conductors indicated on Drawings, and lugs that comply with the following requirements:
 - a. Conductors:

- 1). Tinned copper, complying with NEMA WC 70/ICEA S-95-658.
 - 2). Conductor with thermoplastic insulation rated at 600 volts. Type XHHW-2.
2. Refer to the drawings for number and size of conductors that will be connected to the secondary side of each transformer.
- G. Secondary: Dead-front design.
1. To connect secondary cable, use separable insulated connectors; Bushings must be one-piece units, with ampere and BIL ratings same as connectors.
 2. Bushing inserts and feed-through inserts:
 - a. Conform to requirements of IEEE 386.
 - b. Rated at 200 A, with voltage class matching connectors. Provide parking stand near bushing wells. Parking stands must be equipped with insulated standoff bushings for parking of energized load-break elbow connectors on parking stands.
 - c. Provide insulated protective caps for insulating and sealing out moisture from unused bushing inserts and insulated standoff bushings.
 3. Bushing configuration (refer to one-lines for configuration required):
 - a. 15kV Radial Feed Deadfront: Transformer shall be provided with three (3) high voltage bushings.
 - b. 15kV Loop Feed Deadfront: Transformer shall be provided with six (6) high voltage bushings.
 4. Ground pad.
 5. Access to liquid-immersed fuses.
 6. Dead-front surge arresters.
 7. Tap-changer operator.
 - a. Radial-feed, liquid-immersed type with voltage class and BIL matching that of separable connectors, with continuous current rating and load-break rating of 200 A, and make-and-latch rating of 12 kA(rms sym).
 8. Ground pad.
- H. Capacities and Characteristics:
1. Power Rating: Refer to drawings for kVA rating.
 2. Voltage Ratings: Primary voltage 480V, Refer to drawings for secondary voltage.

3. Taps: Comply with IEEE C57.12.26 requirements.
 4. Transformer BIL (kV): Primary: 30kV, Secondary: 95kV.
 5. Minimum Tested Impedance (Percent) at 85 deg C: 5.75%.
 6. Comply with UL listing requirements for combination classification and listing for transformer and less-flammable insulating liquid.
- I. Transformer Accessories:
1. 1-in. drain plug with sampling device.
 2. 1-in. upper filter press and filling plug.
 3. Pressure-vacuum gauge mounted on the low voltage compartment.
 4. Dial-type analog thermometer with alarm contacts and maximum temperature indicator, mounted in a sealed drywell on the low voltage compartment.
 5. Auxiliary, sealed, dry contact in thermometer for remote indication of high temperature alarm.
 6. Auxiliary, sealed, dry contact in the level gauge for remote indication of low oil level alarm.
 7. Magnetic liquid level indicator with high and low alarm contacts located on the low voltage compartment at the 25° C level mark.
 8. Automatically resetting pressure-relief device. Device flow must be as recommended by manufacturer.
 9. Stainless steel ground connection pads.
 10. Ground provisions per C57.12.34 section 9.11.
 11. Meet NEMA TR-1 sound levels.
 12. Machine-engraved nameplate, made of anodized aluminum or stainless steel on the low voltage compartment.
 13. Sudden pressure relay for remote alarm or trip when internal transformer pressure rises at field-set rate. Provide with seal-in delay.
 14. Touch-up paint.
 15. Long barrel NEMA 2-hole lugs for each phase and ground conductor for low voltage terminations. Refer to one-lines for cable sizes and number of conductors per phase.
 16. 15kV load break elbows for medium voltage terminations.

17. 18kV (15.3 MCOV) surge arresters

2.04 WARNING LABELS AND SIGNS

- A. High-Voltage Warning Label: Provide self-adhesive warning signs on outside of line-side compartment door(s). Sign legend must be "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. Word "DANGER" must be in white letters on red background and words "HIGH VOLTAGE" must be in black letters on white background.
- B. Arc Flash Warning Label: Provide self-adhesive warning signs on outside of line-side compartment door(s), warning of potential electrical arc flash hazards and appropriate personal protective equipment required.
- C. Install warning signs as required to comply with 29 CFR 1910.269.
- D. Nameplates:
 - 1. Plastic, white, .33" white letters on black background, on the front of each door on the Transformer; identifying the compartment contents for each compartment and above all devices such as protective relays, test switches, breaker control switches, indicating lights, selector switches, etc.
 - 2. Attach nameplates with a stainless-steel screw and nut at each end of the nameplate. Adhesive backed nameplates shall not be installed.
 - 3. Provide nameplates with white letters on black background on the rear compartment of each switchgear door section stating what it is associated with.

2.05 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect transformer in accordance with IEEE C57.12.90.
- B. Factory Tests and Inspections: Perform the following tests and inspections, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, before delivering to site. Affix label with name and date of qualified electrical testing laboratory's certification of system compliance on control units.
 - 1. Resistance.
 - 2. Turns ratio, polarity, and phase relation.
 - 3. Transformer no-load losses and excitation current at 100 percent of ratings.
 - 4. Transformer impedance voltage and load loss.
 - 5. Operation of devices.
 - 6. Lightning impulse.

7. Low frequency.

8. Leak.

2.06 SHOP TESTING

A. Perform manufacturers standard production testing and inspection in accordance with ANSI and/or NEMA standards. Testing shall include the following as a minimum:

1. Transformer no-load losses and excitation current at 110 percent of ratings.
2. Insulation power factor.
3. Applied potential, except that this test is not required for single-phase transformers or for three-phase Y-Y-connected transformers.
4. Induced potential.
5. Resistance measurements of windings on rated voltage connection and at tap extreme connections.
6. Ratios on rated voltage connection and at tap extreme connections.
7. Polarity and phase relation on rated voltage connection.
8. No-load loss at rated voltage on rated voltage connection.
9. Exciting current at rated voltage on rated voltage connection.
10. Impedance and load loss at rated current on the rated voltage connection of each unit.

B. Results of the above tests including no load loss data shall be submitted with final drawings in the form of certified test reports.

C. For each transformer size provided under this contract, provide as a minimum a copy of the following manufacturer's standard factory test reports:

1. Short Circuit capability of each kVA size transformer.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine pad-mounted, liquid-filled, medium-voltage transformers upon delivery.

1. Upon delivery of transformers and prior to unloading, inspect equipment for damage that may have occurred during shipment or storage.

2. Verify that tie rods and chains are undamaged and tight, and that blocking and bracing is tight. Verify that there is no evidence of load shifting in transit, and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.
3. Verify that there is no indication of external damage and no dents or scratches in doors and sill, tank walls, radiators and fins, or termination provisions.
4. Verify that there is no evidence of insulating-liquid leakage on transformer surfaces, at weld seams, on line- or load-side bushing parts, and at transformer base.
5. Verify that there is positive pressure or vacuum on tank. Check pressure gauge; it is required to read other than zero.
6. Compare transformers and accessories received with bill of materials to verify that shipment is complete. Verify that transformers and accessories conform with manufacturer's quotation and shop drawings. If shipment is incomplete or does not comply with Project requirements, notify manufacturer in writing immediately.
7. Verify presence of polychlorinated biphenyl content labeling.
8. Unload transformers carefully, observing packing label warnings and handling instructions.
9. Open termination compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.

B. Handling:

1. Handle transformers carefully, in accordance with manufacturer recommendations, to avoid damage to enclosure, termination compartments, base, frame, tank, and internal components. Do not subject transformers to impact, jolting, jarring, or rough handling.
2. Protect transformer termination compartments against entrance of dust, rain, and snow.
3. Transport transformers upright, to avoid internal stresses on core and coil mounting assembly and to prevent trapping air in windings. Do not tilt or tip transformers.
4. Verify that transformer weights are within rated capacity of handling equipment.
5. Use only manufacturer-recommended points for lifting, jacking, and pulling. Use lifting lugs when lifting transformers.
6. Use jacks only at corners of tank base plate.
7. Use nylon straps of same length to balance and distribute weight when handling transformers with crane.

8. Use spreaders or lifting beam to obtain vertical lift and to protect transformer from straps bearing against enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
9. Exercise care not to damage tank base structure when handling transformer using skids or rollers. Use skids to distribute stresses over tank base when using rollers under large transformers.

C. Storage:

1. Store transformers in accordance with manufacturer's recommendations.
2. Transformers may be stored outdoors. If possible, store transformers at final installation locations on concrete pads. If dry concrete surfaces are unavailable, use pallets of adequate strength to protect transformers from direct contact with ground. Ensure transformer is level.
3. Ensure that transformer storage location is clean and protected from severe conditions. Protect transformers from dirt, water, contamination, and physical damage. Do not store transformers in the presence of corrosive or explosive gases. Protect transformers from weather when stored for more than three months.
4. Store transformers with compartment doors closed.
5. Regularly inspect transformers while in storage and maintain documentation of storage conditions, noting discrepancies or adverse conditions. Verify that effective pressure seal is maintained using pressure gauges. Visually check for insulating-liquid leaks and rust spots.

D. Examine areas and space conditions for compliance with requirements for pad-mounted, liquid-filled, medium-voltage transformers and other conditions affecting performance of the Work.

E. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.
2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.

F. Examine concrete bases for suitable conditions for transformer installation.

G. Pre-Installation Checks:

1. Verify removal of shipping bracing after placement.
2. Remove sample of insulating liquid in accordance with ASTM D923. Insulating-liquid values must comply with NETA ATS, Table 100.4. Sample must be tested for the following:

- a. Dielectric Breakdown Voltage: ASTM D877 or ASTM D1816.
 - b. Acid Neutralization Number: ASTM D974.
 - c. Specific Gravity: ASTM D1298.
 - d. Interfacial Tension: ASTM D971.
 - e. Color: ASTM D1500.
 - f. Visual Condition: ASTM D1524.
 - g. Water in Insulating Liquids: Comply with ASTM D1533.
 - h. Power Factor or Dissipation Factor: ASTM D924.
- H. Verify that ground connections are in place and that requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance must be 5 Ω at transformer location.
- I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by Owner's representative.
- B. Tests and Inspections:
- 1. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
 - 2. General Field-Testing Requirements:
 - a. Comply with provisions of "Testing and Test Methods" Chapter in NFPA 70B.
 - b. Perform visual and mechanical inspections and electrical tests in NETA Acceptance Testing Specification (ATS). Certify compliance with test parameters.
 - c. After installing transformer but before primary is energized, verify that grounding system at transformer is tested at specified value or less.
 - d. After installing transformer and after electrical circuitry has been energized, test for compliance with requirements.
 - e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - f. Thermographic Survey in accordance with NETA Acceptance Testing Specification.

- g. Remove and replace malfunctioning units and retest as specified above.
- h. Visual and Mechanical Inspection:
 - 1). Verify equipment nameplate data complies with Contract Documents.
 - 2). Inspect bolted electrical connections for high resistance using one of the following two methods:
 - a). Use low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
 - b). Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.12.
- 3. Medium-Voltage Surge Arrester Field Tests:
 - a. Visual and Mechanical Inspection:
 - 1). Inspect physical and mechanical condition.
 - 2). Verify arresters are clean.
 - 3). Verify that ground leads on devices are individually attached to ground bus or ground electrode.
- 4. Liquid-Filled Transformer Field Tests:
 - a. Visual and Mechanical Inspection:
 - 1). Test dew point of tank gases if applicable.
 - 2). Inspect anchorage, alignment, and grounding.
 - 3). Verify bushings are clean.
 - 4). Verify that alarm, control, and trip settings on temperature and level indicators are set and operate within manufacturer's recommended settings.
 - 5). Verify that liquid level in tanks is within manufacturer's published tolerances.
 - 6). Perform specific inspections and mechanical tests recommended by manufacturer.

7). Verify presence of transformer surge arresters and that their ratings are as specified.

8). Verify that as-left tap connections are as specified.

b. Electrical Tests:

1). Perform insulation-resistance tests winding-to-winding and windings-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index; value of index may not be less than 1.0.

2). Perform power-factor or dissipation-factor tests on windings in accordance with test equipment manufacturer's published data. Maximum winding insulation power-factor/dissipation-factor values must be in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.3.

3). Measure core insulation resistance at 500 V(dc) if core is insulated and core ground strap is removable. Core insulation-resistance values may not be less than 1 MΩ at 500 V(dc).

4). Perform Optional Field Tests:

a). Perform turns-ratio tests at tap positions. Turns-ratio test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.

b). Perform excitation-current test on each phase. Typical excitation-current test data pattern for three-legged core transformer is two similar current readings and one lower current reading. Investigate and correct if test shows different pattern.

c). Measure resistance of windings at tap connections, and record temperature-corrected winding-resistance values in Operations and Maintenance Manual.

d). Perform applied-voltage test on line- and load-side windings-to-ground. Comply with IEEE C57.12.91, Sections 10.2 and 10.9. This test is not required for single-phase transformers and for three-phase wye-wye-connected transformers.

5). Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

6). Remove sample of insulating liquid in accordance with ASTM D923, and perform dissolved-gas analysis in accordance with IEEE C57.104 or ASTM D3612.

C. Nonconforming Work:

1. Equipment and devices will be considered defective if they do not pass tests and inspections.
 2. Remove and replace malfunctioning units and retest.
- D. Prepare test and inspection reports. Record as-left set points of adjustable devices.
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Test results that do not comply with requirements and corrective actions taken to achieve compliance with requirements. All corrective actions taken shall be at no additional cost to the Owner.
- E. Manufacturer Services:
1. Engage factory-authorized service representative to supervise field tests and inspections.

3.03 CLEAN AND ADJUST; VOLTAGE ADJUSTMENT

- A. When final connections have been made, check secondary voltage at transformers and make tap adjustments required to obtain correct voltage.
- B. The manufacturer shall furnish sufficient touch-up paint of the same type and color used at the factory to repair damages incurred during installation. Perform touch-up painting to achieve the original paint thickness, quality, and appearance.

3.04 FOLLOW-UP SERVICE

- A. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Owner, but not more than six months after Final Acceptance, perform the following voltage monitoring:
1. During period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at outgoing section of transformers. Use voltmeters with calibration traceable to National Institute of Science and Technology standards and with chart speed of not less than 1 inch per hour. Voltage unbalance greater than 1 percent between phases, or deviation of phase voltage from nominal value by more than plus or minus 5 percent during test period, is unacceptable.
 2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:
 - a. Adjust transformer taps.
 - b. Prepare written request for voltage adjustment by electric utility.

3. Retests: Repeat monitoring, after corrective action is performed, until satisfactory results are obtained.
4. Report:
 - a. Prepare written report covering monitoring performed and corrective action taken.

3.05 SPARE PARTS

- A. The following spare parts shall be provided:
 1. Three (3) replacement power fuses or refills.
 2. One (1) 5 gallon drum of insulating fluid.

END OF SECTION

26 13 00 MEDIUM VOLTAGE METAL CLAD SWITCHGEAR

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals necessary to manufacture, fabricate, assemble, test, and deliver complete NEMA 1 Medium Voltage Metal Clad Switchgear line-up to be installed at the Lubbock Pump Stations Numbers 4 and 8.

Location	Equipment Name
Pearson Pump Station	MV Metal Clad Switchgear "ATS-1"

1.02 QUALITY ASSURANCE

- A. IEC or dual IEC/NEMA equipment shall not be acceptable.

1. ACCEPTABLE MANUFACTURERS

a. METAL CLAD SWITCHGEAR TYPE 5 KV

- 1). General Electric
- 2). Eaton/Cutler-Hammer
- 3). Square D
- 4). All others shall submit qualifications to the Owner and the Engineer for review and approval prior to bid submittal no later than one week after bid advertisement date. Any submittals after this time period shall not be evaluated. Qualifications shall include equipment manufacturer who has had at least 10 years of successful experience in providing equipment for similar projects with a generator and pump station configurations. Qualifications shall include a list of similar projects within the last 5 years with the name of the project and contact information of the Owner.

2. DESIGN CRITERIA

- a. Metal clad switchgear shall be per the one line diagrams, breaker control schematic, and equipment elevations. Metal clad switchgear units shall all come from the same manufacturer. It shall be the responsibility of the switchgear manufacturer to assure that the busses and equipment, line up correctly with the metal enclosed switchgear. Refer to Specification 26 13 23 Medium Voltage Metal Enclosed Switchgear. The Medium Voltage Metal Clad Switchgear shall be the same manufacturer. NO EXCEPTIONS.
- b. The ratings for each of the metal clad switchgear line ups shall be:
 - 1). Nominal rms voltage class: 4.16 KV
 - 2). Maximum design voltage: 4.76 KV
 - 3). Basic impulse level: 60 KV

- 4). Power frequency withstand: 19 KV
 - 5). Rms sym. interruption capability: 40,000 A
 - 6). Closing and latching capability rms sym: 130kA Peak
 - 7). Rated interrupting time: 5 cycles
3. The equipment shall be designed for the protection and control of power circuits on a 4160 volt, 3 phase, 3 wire, 60 Hertz solidly grounded wye system. Main bus shall be tin plated copper rated for 1200A continuous duty.
 4. Control power shall be 120 VAC from a control power transformer ahead of the main circuit breakers. All units shall be 120 volts solenoid rectifier close and stored energy trip by an auto-charged capacitor device. Each unit shall contain a DC energy storage device capable of tripping the breaker not less than two times through a period of 70 hours of power failure.

B. FACTORY TESTS

1. GENERAL

- a. Switchgear sections shall be completely assembled, wired, adjusted, and tested at the factory. After complete assembly with breaker vacuum circuit interrupter in position, each unit shall be tested for operating sequence to assure accuracy of wiring, correctness of control scheme and functioning of the equipment.
- b. Factory tests shall include electrical tests as described by American National Standards Institute Standard C 37.20.
- c. The switchgear shall be assembled and shipped in sections of the largest size practicable to be unloaded and handled at the job. Breakers shall be shipped separate from switchgear units.
- d. The manufacturer shall perform all tests required by the applicable standards and shall be responsible for testing all control and relaying circuits within the switchgear to ensure proper function performance and operable condition.
- e. The switchgear shall be tested and certified in accordance with the applicable requirements of ANSI/IEEE C37.20.2 and ANSI C37.55. The switchgear unit shall be tested with the breakers included. "Test" breakers will not be acceptable.
- f. All AC high-voltage circuit breakers shall be tested and certified in compliance with the applicable requirements of ANSI/IEEE C37.09 and ANSI C37.54.
- g. All instrument transformers furnished for metering and relaying service shall be tested and certified in accordance with the applicable requirements of ANSI/IEEE C57.13.
- h. All busses and power circuit breakers shall undergo a one-minute, 60 Hz dielectric withstand test. All control circuits shall undergo a one-minute insulation resistance test.
- i. Proper wiring of protective relays shall be checked by injecting secondary current into the associated current transformer circuits and verifying that the relays respond properly.

- j. Components manufactured in different factories shall be shipped to the main switchgear assembly point for testing at the manufacturer's expense. Additional testing of components is limited to those tests associated with test of completed equipment.
- k. Each unit shall be tested for operating sequence to assure accuracy of wiring, correctness of control scheme and functioning of the equipment.
- l. Factory tests for medium voltage metal enclosed switchgear shall include electrical tests as described by NEMA ICS 1-109 and ANSI C19.3.
- m. A statement of calibration shall be provided to cover all meters and relays.
- n. Provide copy of the certified test report to Engineer for approval prior to the switchgear being shipped to the jobsite.
- o. Detailed functional testing of switchgear main, tie and generator breaker controls for all possible operating scenarios.

C. FACTORY INSPECTION AND TESTS

1. GENERAL

- a. Equipment furnished under these specifications shall be subject to inspection during manufacturing by representatives of the Owner who shall be afforded proper facilities for determining compliance with the specifications.
- b. The Owner may, at his option, elect to have the factory test witnessed by the Owner, or a designated representative of the Owner. If the option is taken to witness the test, then payment will be in accordance with the appropriate item of the Proposal. The costs for a maximum of three representatives for the Factory Inspection and Test shall be included in the base bid.
- c. If tests are to be witnessed by the Owner or Owner's representative, the manufacturer shall notify the Owner at least 30 days in advance of the dates that tests will be made, so that the Owner can make arrangements for his representative to be present. The cost for the travel, lodging expenses, meals and transportation for ENGINEER personnel (one maximum) to witness the factory switchgear inspections and tests shall also be included in the bid price. The Manufacturer or Vendor will pay for the cost of the representative's (travel lodging, meals and other expenses for the tests, for a maximum of one trip. The manufacturer shall bear all other costs for performing the witnessed test. If a test must be re-run due to failure in meeting the specified requirements, then the witness expenses for the re-test shall be borne by the manufacturer.
- d. Witness tests shall be conducted in continental United States. No testing shall be conducted in Mexico nor any other foreign country.
- e. All travel arrangements are subject to approval by the OWNER and ENGINEER. The Equipment Manufacturer shall be responsible for making all travel arrangements.
- f. Switchgear manufacturer shall provide to the Engineer a complete list of all tests to be performed on the switchgear as a formal submittal to the Engineer prior to the switchgear being tested.

- g. The Contractor shall notify the Owner a minimum of one month in advance of the dates when equipment is scheduled for inspections and tests so that the Owner can schedule accordingly.
 - 1). A detailed testing package shall be submitted at bid time listing dates and times of each component of the test with copies of all relevant standards used during the testing. A Manufacturer's technical representative shall be present throughout the testing period to aid the Engineer in performing and verifying all calculations. The technical representative shall be fully versed in the testing methods and calculations and shall be capable of certifying test results.
- h. The costs to perform the factory inspections and tests shall be included in the bid price. The travel and lodging expenses for Owner/Engineer personnel (one maximum) to witness the tests shall also be included in the bid price.
- i. If an inspection and/or test must be re-run due to failure in meeting the specified requirements, then the witness labor and travel expenses for the re-test shall be borne by the Manufacturer or Vendor
- 2. Witnessed factory tests shall include a test and demonstration of all equipment functions, per manufacturer's standard testing procedures. The purpose of the test shall be to verify the functionality, performance and stability of each switchgear lineup. The test shall include, but not be limited to, a complete operational test demonstrating all controls, sequence of operations, trips, inputs, outputs, etc., shown per the plans and specifications. A clearly labeled test box with dedicated switches, lights, etc. for each I/O shall be provided and used to demonstrate all controls, trips, inputs, outputs, etc. The manufacturer shall submit two weeks in advance of the day that test will be made a detailed testing plan. This plan shall be subject to the Engineer's approval.
- 3. The switchgear manufacturer shall provide the actual test data, observations and certification that the tests have been completed prior to shipment to the Engineer for approval.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with this section, the General Requirements, Section 01 33 00 "Document management" and shall include the following minimum information:
 - 1. Pre-Submittal Meeting
 - a. A pre-submittal virtual meeting shall be held before any shop drawings are submitted. Contractor shall determine the exact number of people attending the meeting per the specification requirements and set up the virtual meeting.
 - b. Any shop drawings submitted before the pre-submittal meeting will be rejected and sent back Not Approved, Revise and Re-submit. The Switchgear Supplier shall bring with them a detailed list of the items their submittal will include for review by the Engineer or a bootleg copy of the actual submittal.
 - c. As a minimum the following shall attend the meeting:
 - 1) Consulting Engineer,
 - 2) General Contractor,
 - 3) Electrical Contractor,

- 4) Switchgear Supplier and Engineer. Representatives from the Switchgear Supplier shall include:
 - a) The Project Manager who will be responsible for putting together the submittal and who will be responsible for the project at the factory, no exceptions.
 - b) The Project Engineer at the factory who has technical knowledge of the equipment, no exceptions.
 - c) A sales person may attend, but not as a substitute for the Project Manager and/or Project Engineer.

A. Shop Drawings shall include:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (in the margin adjacent to the beginning of the paragraph) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
2. Complete description of all equipment, including catalogs, cuts and pertinent engineering data. Clearly identify on cutsheets the model number of the equipment being provided. Complete Bill of Material identifying make and model number of all major components.
3. Manufacturer of equipment
4. Manufacturer's type
5. Outline dimensions of line-up.
6. Provide overall outline drawing showing Metal-Clad Switchgear and Metal-Enclosed Switchgear together.
7. One and three line diagrams.
8. Front and rear elevation drawings clearly showing layout of all devices and mounting heights.
9. Clearly show dimensions from the top and bottom of the switchgear enclosure to the 4160V bus for terminating 5kV field cables.
10. Project specific wiring diagrams / interconnection diagrams / terminal strip layout showing customer connections. Terminal strip layout shall be provided as part of initial submittal.
11. Project specific control schematics.

12. Mimic bus layout.
 13. Nameplate schedule.
 14. Electrical interlock scheme with detailed written sequence of operations for main, and generator breakers.
 15. Detailed sequence of operations for PLC breaker/generator controls for Engineer's approval.
 16. HMI Screen Shots
 17. Detailed information on remote racking device.
 18. Weight of line-up
 19. BIL test data on previously tested equipment of the same design
 20. Copy of PLC program for switchgear breaker controls in O&M Manuals. Provide a copy of the final PLC program burned in on a CD to the Owner.
 21. Spare parts list
 22. Equipment Installation Report
- B. Where the Supplier's product differs from the specified requirements and/or catalog description, each point of difference shall be clearly stated. This requirement is set forth to facilitate the review of submittals and not to be construed by the Supplier as waiving any of the requirements of the specifications. Setting and foundation plans and dimension sheets for the equipment offered shall be submitted with each submittal.
- C. FACTORY TEST DATA
1. Submit factory test reports as a formal submittal to the Engineer for approval prior to shipping the equipment.
- D. FIELD TEST REPORTS
1. Submit Equipment Installation Report certifying the equipment is properly installed, is in accurate alignment, is free from undue stress from connecting appurtenances, that it has been operated under full load conditions, and that it is operating satisfactorily.
- E. OPERATION AND MAINTENANCE MANUALS
1. Submit Manuals with instructions for installation, adjustment, lubrication, operation and maintenance of the equipment in accordance with the specific conditions.
 2. List all factory setting relay and provide relay-setting and calibration instructions, including software, where applicable. O&M manuals shall include a hard copy of the power meter settings.
 3. Operation and maintenance manuals shall be prepared by the equipment manufacturer and shall contain the final certified approved shop drawings, submittals, list of manufacturer recommended spare parts, schematics, and maintenance procedures, and field test data. O&M manuals shall include all field changes made during startup and testing.
 4. Manuals may be manufacturer's standard instructions, but shall be supplemented as necessary to cover any special feature not included in standard material.

5. Manuals shall be prepared by the Equipment Manufacturer and shall also incorporate appropriate final certified shop drawings and test data. Manuals may be manufacturer's standard instructions, but shall be supplemented as necessary to cover any special feature not included in standard material.
6. O&M manuals shall include a single document that clearly summarizes and states when the routine maintenance per the manufacturer's recommendations is to be performed on the switchgear.
7. Submit preliminary manuals for review prior to start-up of equipment.
8. A hard copy of the breaker PLC program shall be provided in the final O&M Manuals
9. O&M Manuals shall be submitted in both hard copy and electronic format. Electronic format shall be fully indexed. O&M Manuals shall be provided in accordance with Section 01 33 04 "OPERATIONS AND MAINTENANCE DATA".

1.04 STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:

ANSI	American National Standards Institute
C37.010	Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
C37.100	Definitions for Power Switchgear
C37.04	Rating Structure for AC High-Voltage Circuit Breakers
C37.06	Preferred Ratings for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
C37.07	Factors for Reclosing Service
C37.09	Test Procedure for AC High Voltage Circuit Breakers
C37.11	Power Circuit Breaker Control
C37.20.2	Metal-Clad and Station-Cubicle Switchgear
C37.20.3	Standard for Metal-Enclosed Interrupter Switchgear
C37.20.4	Standard for Indoor AC Medium - Voltage Switches used in Metal-Enclosed Switchgear
C37.21	Application Guide for Metal-Enclosed Power Switchgear
C37.54	Conformance Testing of Indoor AC High-Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear Assemblies
C37.13	Standard Requirements for Instrument Transformers
C37.55	Conformance Testing of Metal-Clad Switchgear
C37.24	Guide for Evaluating the Effect of Solar Radiation
NEMA	National Electrical Manufacturers Association
ICS 1	Industrial Control and Systems - General Requirements

ICS 3	Industrial Control and Systems - Factory-Built Assemblies
SG-4	Power Circuit Breakers
SG-5	Power Switchgear Assemblies

1.05 DELIVERY, STORAGE AND HANDLING

- A. Follow the Manufacturer's directions for the delivery, storage and handling of equipment and materials. Tightly cover equipment and materials and protect it from dirt, water, chemical or mechanical injury and theft. Switchgear shall be stored indoors in a climate controlled (heated and air conditioned) building. Damaged equipment shall not be accepted. Upon installation, protect the materials until the work is completed and accepted by the OWNER. Manufacturer shall be responsible for delivering the equipment to the jobsite in Lubbock, Texas.
- B. The metal-clad 4160V switchgear shall be designed to be off-lifted with a four point hookup and a single point lift. The switchgear size may require more hookup points and a two point lift. Spreader bar, slings, and shackles required to off-load the switchgear. Should transportation require shipping splits, each open area of the switchgear shall be sealed with temporary two (2) inch thick wooden framing and a plywood cover for protection during transportation and storage at the job site. Seams in the temporary cover shall be sufficiently caulked on the exterior.

2.00 PRODUCTS

2.01 METAL CLAD 5KV SWITCHGEAR

A. GENERAL

- 1. The switchgear shall be fabricated of sheet steel and completely enclosed.
- 2. Equipment, including instrument transformers, instruments, switches, controls, etc., shall be furnished for each unit. Instruments, switches, etc., as required shall be mounted on the front face of the switchgear and arranged in an approved, logical and symmetrical manner.
- 3. Each metal-clad switchgear unit shall consist of a stationary element and a removable element. Stationary element shall include insulated copper busses, insulated copper connections, instrument transformers, primary disconnecting devices, automatic shutters, steel barriers between compartments, a manually or electrically operated mechanism for moving the circuit breaker to and from the connected position, mechanical interlocks, ground bus, terminal blocks and wiring for control and secondary connections, control fuses, and provision for connecting cables. The stationary units shall be constructed of welded structural shaped steel members together with formed sections of smooth panel sheet steel approximately 1/8" thick. Each unit shall be completely enclosed by a hinged panel door and removable plates permitting access to all compartments. The structures shall be rigid and self-supporting and so designed that units can readily be added in the future. The equipment shall be arranged so that all components, except potential or control transformers, may be removed from the front. Hinged-back access doors shall be provided.

4. The removable element shall consist of the circuit breaker, primary disconnecting devices, mechanical interlocks, secondary disconnecting devices, and control wiring. A circuit breaker of the size specified shall be furnished with each unit as shown on the drawings.
5. The circuit breaker shall be isolated from all other primary equipment and arranged so that it may be completely disconnected from the line and bus for test and inspection. All removable elements of like rating and having similar features shall be interchangeable.
6. Each circuit breaker manufacturer shall provide a remote racking device that is connected externally to the switchgear breaker compartment. Remote racking devices shall be provided with sufficient cable to stand twenty-five feet away and still remotely rack in/out the circuit breaker.
7. The busses, circuit breaker and instrument transformers shall be mounted in separate grounded metal compartments. Control equipment shall be effectively isolated from the primary device. The busses shall be rigidly supported by insulating material of high mechanical and di-electric strength. Contact surfaces of bolted joints shall be silver plated. Primary circuits and joints shall be insulated. Material shall be included for insulating the bus and connection joints between adjacent metal-clad units separated for shipment.
8. A tin plated copper ground bus shall extend through the stationary structure. It shall have a momentary rating at least equal to the highest momentary rating of any circuit breaker in the structure assembly. Each stationary unit shall be grounded directly to the ground bus.
9. The units shall be wired at the factory. Secondary and control connections shall be made with #14 gauge SIS wire. Wires shall be tagged (or shall terminate at marked terminals) with the designation given on the wiring diagrams.
10. A control power bus shall run the length of the metal-clad switchgear. Control power shall be derived from a control power transformer located in each main breaker section and generator breaker section. The source of control power shall be switched via an automatic transfer switch and run to a 120/240V power panel with a main circuit breaker located in the 4160V switchgear. Circuits out of the power panel shall feed switchgear devices.
11. Terminal blocks shall be supplied for secondary and control connections leaving the metal-clad structure. A fused disconnect switch, complete with fuses, shall be provided for each unit. The main breaker and generator breaker compartment shall contain a fused disconnect switch complete with fuses for the control bus.
12. Switchgear enclosures shall be large enough to accommodate stress cones for incoming conductors without exceeding minimum cable bending radius requirements per the NEC or the cable manufacturer, whichever is more stringent.

B. CIRCUIT BREAKERS

1. The circuit breakers shall be of the vacuum interrupting type complete with solenoid operation mechanism, auxiliary switches, and interlocks mounted on a mobile frame. The frame shall be fabricated from formed steel plates electrically welded to form a rugged support for the equipment. A steel barrier shall separate the high-voltage parts of the circuit breaker from the operating mechanism and control devices. The frame shall have four wheels with bearings and a flange construction which shall engage with the rail as the unit is rolled into the housing.
2. The breaker unit shall move between the "test" position and "operating" position by means of a worm gear levering device operated by a removable hand crank. The device shall be mechanically interlocked with the breaker closing mechanism so that a closed breaker cannot be removed from the "operating" position or inserted from the "test" position.

C. EQUIPMENT

1. Pearson Pump Station ATS-1

a. Utility Main Breaker Unit: Utility main breaker unit shall contain the following:

- 1 - Metal-clad stationary unit
- 1 - Time-delay Switch, circuit breaker control with lamps (SC-52)
- 1 - Solid state protective relay – Multilin SR850 Feeder Protection Relay
- 1 - Power circuit breaker, electrically operated, 1200 ampere, removable element (52)
- 3 – Multi-Ratio Current transformers, 1200:5 tapped at 400:5 (3 – standard accuracy for SR845)
- 1 - Ground fault current transformer 50:5
- 1 - Standby power trip unit
- 1 - Three phase insulated busses, 1200 A., with necessary supports
- 1 - Control Power Transformer
- 1 - Control Power Bus, 120 Volts AC
- 1 - Ground bus
- 1 - Three phase station - type lightning arrester.
- 1 - Three phase surge capacitor
- 2 - Drawout type potential transformers with fuse mountings and one set of current limiting fuses.
- 1 - Drawout type control power transformers with fuse mountings and one set of current limiting fuses connected to a low voltage automatic transfer switch and main circuit breaker panelboard.

b. Generator Main Breaker Unit: Generator main breaker unit shall contain the following:

- 1 - Metal-clad stationery unit
- 1 – Time-delay Switch, circuit breaker control with lamps (SC-52)
- 1 - Solid state protective relay - Multilin 850 Feeder Protection Relay
- 1 - Power circuit breaker, electrically operated, 1200 ampere, removable element (52)
- 3 – Multi-Ratio Current transformers 1200:5 tapped at 200:5
- 1 - Ground fault current transformer 50:5
- 1 - Standby power trip unit
- 1 - Three phase insulated busses, 1200 A., with necessary supports
- 1 - Control power bus, 120 volts AC

- 1 - Ground bus
 - 1 - Three phase station - type lightning arrester.
 - 1 - Three phase surge capacitor
 - 2 - Drawout type potential transformers with fuse mountings and one set of current limiting fuses.
 - 1 - Drawout type control power transformers with fuse mountings and one set of current limiting fuses connected to a low voltage automatic transfer switch and main circuit breaker panelboard.
- c. Feeder Breaker Unit: Feeder main breaker unit shall contain the following:
- 1 - Metal-clad stationery unit
 - 1 - Time-delay Switch, circuit breaker control with lamps (SC-52)
 - 1 - Solid state protective relay - Multilin 850 Feeder Protection Relay
 - 1 - Power circuit breaker, electrically operated, 1200 ampere, removable element (52)
 - 3 - Multi-Ratio Current transformers 1200:5 tapped at 400:5
 - 1 - Ground fault current transformer 50:5
 - 2 - Standby power trip unit
 - 1 - Three phase insulated busses, 1200 A., with necessary supports
 - 1 - Control power bus, 120 volts AC
 - 1 - Ground bus
 - 1 - Three phase station - type lightning arrester.
 - 1 - Three phase surge capacitor
 - 2 - Drawout type potential transformers with fuse mountings and one set of current limiting fuses.
 - 1 - Drawout type control power transformers with fuse mountings and one set of current limiting fuses connected to a low voltage automatic transfer switch and main circuit breaker panelboard.
2. 1200A Transition section for connecting to the Metal Enclosed Switchgear.
3. Bus Potential Transformers:
- 2 - Drawout type potential transformers with fuse mountings and one set of current limiting fuses installed on each main 4160V bus. See one-line diagram for more information.
4. Main Breaker Unit Generator Breaker Unit shall be electrically interlocked and controlled via the breaker PLC per the following:
- a. The main breaker and generator breaker cannot be closed at the same time. Under no circumstances shall the generator breaker be closed to allow paralleling with the Utility.
 - b. Upon loss of incoming power to the main, the breaker PLC controls shall send a signal to open the main circuit breaker, remotely start the generator and the generator breaker shall close. Upon restoration of Utility power, the main breakers shall close, tie breaker shall open and the generator breaker shall open. The generator shall transition into a cool down mode (30 minutes) and perform an orderly shutdown of the generator and the generator breaker shall open.

- c. Refer to paragraph 2.01.S (Automatic Load Transfer Controls) of this specification for more details on operating scenarios.
- 5. Controls, indicating lights, selector switches, 86 lockout relay, test switch, and protective relays shall be located on the door. In addition to the required indicating lights and selector switches associated with automatic/manual breaker controls, the following door-mounted control switches and indicating lights shall be supplied and mounted on the door for each breaker:
 - a. Breaker control switch with indicating lights
 - 1). Red - Closed
 - 2). Green - Open
 - b. White indicating light (breaker spring charging motor charged).
- D. INSTRUMENT CURRENT TRANSFORMERS: Substantial and well built. Insulation shall meet the requirements of the IEEE standards. At normal rated amperes, under usual service conditions, no part of the transformer shall exceed the heating limits specified in the IEEE standards. Each current transformer shall be capable of carrying continuously, its rated primary amperes, under conditions of accidental open secondary circuit, without damage to the primary insulation. Accuracy shall meet or exceed requirements of ANSI C37.20.2, Table 5. Current Transformers shall be metering accuracy rated gong to power meter. Accuracy shall be 0.2% ANSI Accuracy Class with a B0.1 Meter Burden. Current transformers connected to the power meter shall be ANSI metering accuracy class current transformers (C400). All other current transformers shall have an ANSI accuracy classification of C200.
- E. INSTRUMENT POTENTIAL TRANSFORMERS: Substantial and well built. Insulation shall meet the requirements of the IEEE standards. At normal ratings under usual service conditions no part of the transformer shall exceed the heating limits specified in the IEEE Standards. Number of potential transformers shown on the plans is the minimum required; Coordinate with relay manufacturer for number of potential transformers required.
- F. BREAKER CONTROL SWITCH: Switch shall be a time-delay Electroschwitch, model TD-CSR. Provide control description for the control device on the front of each section of the Metal Clad enclosure that details the operation of the time-delay switch located near each time-delay switch.
- G. FEEDER PROTECTIVE RELAYS (FPR)
 - 1. Furnish and install where shown on the plans a feeder management and protective relay.
 - 2. Protective functions shall include: Phase overload standard curves (51), overload by custom programmable curve (51), short circuit (50), overcurrent (50), Directional Power (32), ground fault (50g/50n/51g/51n), under voltage (27) and over voltage (59).
 - 3. Management functions shall include Statistical Data, Pre-trip Data, ability to learn, display and integrate critical parameter to maximize feeder protection and communication with external devices.

4. The relay shall be installed in a drawout case with wiring terminated at the rear of the fixed case. Shorting contacts shall be provided for the CT inputs and output relay contacts to allow for removal of the relay for bench testing without feeder shutdown. A test plug shall be provided for testing while in the case.
 5. The feeder protective relays shall be Multilin SR850 Feeder Protection Relay. See one-line diagram for more information.
 6. Provide GE 515 Blocking and Test Module (both current and voltage inputs) for testing of Multilin 850 Relays.
 7. Communications protocol shall be Ethernet. Manufacturer shall provide all hardware, firmware and software to permit communications using Ethernet
- H. CONTROL RELAYS: Industrial type; contacts rated for 10 amps at 600 VAC; Allen-Bradley Bulletin 700 Type PK, Square D Class 8501 Type X, or approved equal. Relays shall have the capability of having contact decks added in the field. Contacts shall be field convertible to normally open or normally closed. Coils and contacts shall each be replaceable without replacing any other part of the relay.
- I. INDICATING LIGHTS, SELECTOR SWITCHES, PUSHBUTTONS: Heavy duty and oil tight; Square D Class 9001 (30.5mm) or approved equal. Pilot lights shall be push to test (LED type) and shall be Square D SK or approved equal.
- J. PROGRAMMABLE LOGIC CONTROLLER (PLC): The PLC for the switchgear breaker controls shall as required by the Switchgear Manufacturer. The PLC shall communicate via Ethernet with the Owner's PLC. All alarms, breaker open/close status, run status, etc. shall be communicated via Ethernet to the Owner's PLC. Provide all hardware and software as required.
- K. UNINTERRUPTIBLE POWER SUPPLY (UPS): UPS to be used for Main breaker and Generator breaker protective relaying control power, PLC control and breaker opening and closing. UPS shall be of the on-line, double-conversion technology type. Provide all hardware and software as required to communicate via Ethernet. UPS shall be suitable for operating in a 0 to 40 deg C ambient temperature. The UPS shall be equal to Liebert GXT3-2000RT120 or approved equal.
- L. INFRARED INSPECTION WINDOWS: The rear of each breaker section shall be provided with an infrared inspection window encompassing all three phases. The window shall be permanently fitted into the indicated electrical equipment to give permanent access for infrared inspections. Window material must be transparent to visual, infrared and ultra violet energy (corona) bands. Window shall be manufactured by IRISS and shall be Platinum Series CAP-CT-12 model.
- M. Mimic Bus
1. Provide an approved mimic bus on front of each switchgear assembly. Color shall be black for the Normal Power system and red for the Essential Electrical System, 1/8" x 1/2" (color selected by purchaser) acrylic mimic bus. Plastic tape shall not be used. Use symbols similar to one line diagram shown on drawings. Plastic or metal strips shall be mounted with plated screws. Mimic bus shall be on each compartment applied to the front of the switchgear shall functionally represent the one-line diagram power circuits including CPT's, PT's, etc.

- N. EQUIPMENT ACCESSORIES: Furnish the following with the switchgear accessories and testing equipment:
- 1 - Test jumper set (Electrical Control Panel to operate circuit breaker which has been racked out of the Switchgear.
 - 2 - Closing levers for maintenance closing of circuit breakers in the test position.
 - 2 - Removable hand cranks for operation of the levering-in device.
 - 2 - Sets of special wrenches for the primary disconnecting devices.
 - 2 - Sets of test plugs for meters and relays.
 - 6 - Spare fuses of each type and size for Switchgear.
 - 1 - Breaker lifting device for removing circuit breakers.
 - 1 - Remote breaker racking device with 25' cable
- O. FINISH: After fabrication, metal structures shall be thoroughly cleaned, bonderized as a unit and then given a primary coat, a coat of rust preventative and a finishing coat of quick-drying lacquer. Unless otherwise specified, the color of the panels and the exteriors of structures shall be gray ANSI-61. Instruments, relays, and meters shall have dull black standard finish.
- P. CONTROL WIRING: Necessary small wiring, potential busses, fuses, and terminal blocks within each unit shall be furnished installed. Provisions shall be made for Owner's control conduit to the units. Secondary and control wiring within the high voltage compartment shall be completely shielded in a protective metal covering.
- Q. AUTOMATIC LOAD TRANSFER CONTROLS
1. The Automation and Controls shall consist of the automation hardware and software required for the control of the Engine-Generator and associated Transfer Controls. The System shall include all Processors, HMI (Human / Machine Interface) Touchscreens, Power Transducers, Supervisory Network and all ancillary control equipment within the Generator Control Switchgear necessary to automatically execute the specified Functional Sequence of Operations.
 - a. The Automation shall log all events and alarms with device, condition, and time/date stamp. These shall be displayed at the HMI and OWS.
 - 1). Trending
 - 2). The HMI Automation shall support real time trending.
 - a). Real Time Trending shall display the following:
 - b). Load kW, kVA, kVAR, PF, Volts, Amps and frequency
 - c). Generator kW, kVA, kVAR, PF, Volts, Amps and frequency
 - b. The following additional metering shall be provided for each Engine:
 - 1). Engine RPM Meter
 - 2). Engine Battery Voltage Meter
 - 3). Engine Oil Pressure Gauge

- 4). Engine Coolant Temperature Gauge
 - 5). Engine Running Hour Meter
 - 6). Engine Start Counter
 - 7). Atmospheric Pressure
 - 8). Boost Pressure
 - 9). Air Filter Restriction
 - 10). Left Turbo Inlet Pressure
 - 11). Right Turbo Inlet Pressure
 - 12). Engine Hour meter
 - 13). Total Fuel Burned
 - 14). Engine Coolant Level Status
 - 15). Local Engine Control Switch Position
 - 16). Overspeed Switch Status
 - 17). Remote Emergency Stop Actuated
 - 18). Percent Engine Load
 - 19). Oil Filter Pressure Differential
 - 20). Fuel Filter Pressure Differential
 - 21). Aftercoolant Temperature
 - 22). Right Exhaust Temperature
 - 23). Left Exhaust Temperature
 - 24). Crankcase Air Pressure
 - 25). Filtered Fuel Pressure
 - 26). Right Air Filter Restriction
 - 27). Left Air Filter Restriction
 - 28). Fuel Consumption Rate
 - 29). Engine Oil Temperature
- c. The following metering shall be provided for each distribution breaker:
- 1). Voltmeter
 - 2). Ammeter
 - 3). Kilowatt meter
 - 4). Kilovar meter
 - 5). Frequency Meter
 - 6). Power Factor Meter

2. Provide the necessary automatic transfer controls and wiring in the 4160V switchgear for a complete and operational unit as indicated below. Automatic transfer of the load from normal source – Main breaker to the generator source (Generator breaker) when the normal source “fails” and back to normal source when the source is restored shall include the following:
 - a. Automatic Transfer to Generator source, and request to Re-transfer to Normal Source. The request to re-transfer to normal source shall send a signal via SCADA notifying the Operator that the normal power source is available and to allow the operator to perform an orderly shutdown of the pumps at the pumps station. The operator shall give permission for the switchgear to transfer to normal power. After permission is granted, the generator shall be allowed to shutdown and the switchgear shall be allowed to transfer to normal utility power.
 - b. Open Transition with control program interlocking to prevent paralleling.
 - c. Bypass of Retransfer delay if alternate source fails, a “GENERATOR FAIL” light shall illuminate if alternate source fails, and a pair of normally open dry 5A contacts shall close (for customers use).
 - d. Electrically interlocked Main breaker and Generator breaker.
 - e. Time Delay on transfer to Generator source shall be 5 seconds (field adjustable).
 - f. Time Delay for Retransfer to Normal source shall be adjustable from 0 to 60 minutes; factory set for 30 minutes. Provide automatic defeat on loss of voltage or sustained under voltage of emergency source, provided normal supply has been restored. Provide a countdown timer on the transfer control HMI that shows the amount of time left for retransfer to the normal source.
 - g. 4-20ma output signal that shall transmit the Time to retransfer power, this time shall be the amount of time remaining to retransfer the power to the Main source once normal power is stabilized and available. This screen shall remain open the entire time during the retransfer period. This signal shall also be sent back to SCADA.
 - h. Two (2) normally open dry 5A contacts shall be provided for customer’s use. The contacts shall close when the normal source is in use.
 - i. Two (2) normally open dry 5A contacts shall be provided for customer’s use. The contacts shall close when the generator source is in use.
 - j. Two (2) normally open dry 5A contacts shall be provided for customer’s use. The contacts shall close when there is a transfer failure.
 - k. Under Voltage Sensing for Each Phase of both Normal and Generator Sources: Senses low phase-to-ground voltage on each phase. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

- l. Voltage/Frequency Lockout Relay: Prevents premature transfer to generator set. Pickup voltage is adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency is adjustable from 90 to 100 percent of nominal. Factory set at 95 percent.
- m. Test Switch: Simulates normal-source failure. This shall be separate from the HMI system.
- n. Switch-Position Pilot Lights (push-to-test): Indicate source to which load is connected. This shall be separate from the HMI system.
- o. Source-Available Indicating Lights: Supervise sources via switchgear, normal and generator source sensing circuits. This shall be separate from the HMI system.
- p. Normal Power Supervision: Green light (push-to-test) with nameplate engraved "Normal Source Available". This shall be separate from the HMI system.
- q. Generator Power Supervision: Red light (push-to-test) with nameplate engraved "Backup Source Available". This shall be separate from the HMI system.
- r. Normal Power Mode: Green light (push-to-test) with nameplate engraved "Normal Source Mode". This signal shall be sent to SCADA.
- s. Generator Power Mode: Red light (push-to-test) with nameplate engraved "Backup Source Mode". This signal shall be sent to SCADA.
- t. Transfer Failure: Red light (push-to-test) with nameplate engraved "Transfer Failure". The light shall illuminate and a signal sent to SCADA when the ATO fails to transfer from the Utility source to the Generator source or vice versa.
- u. Unassigned Auxiliary Contacts: Four normally open single-pole, double-throw contacts for each switch position, rated 10A at 120VAC.
- v. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency source regardless of condition of normal source. Pilot light (push-to-test) indicates override status. This shall be separate from the HMI system.
- w. Engine Starting Contacts: One isolated, normally closed and one isolated normally open rated at 10A. Initiates startup at remote engine-generator controls.
- x. Engine Shutdown Contacts: Time delay adjustable from 0 to 5 minutes; factory set for five minutes. Initiates shutdown at remote engine-generator controls after retransfer of load to normal source.
- y. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfer and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 30 minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - 1). Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.

- 2). Automatic exerciser shall have the capability to be turned on/off manually and allow for manual exercise of the generator.
 - z. All transfer controls shall have the ability to be operated in the manual mode – switch between utility power and generator power manually.
 - aa. All alarms, run status, breaker position, etc. shall be communicated via Ethernet to the Owner's PLC.
 - bb. Switchgear manufacturer shall develop a detailed sequence of operations for all different operating scenarios and coordinate with the Owner and Engineer.
- 3. Switchgear manufacturer shall field verify control wiring requirements with the generator manufacturer to insure a complete and operational system. Switchgear manufacturer shall provide all required terminations for control wiring for generator.
- 4. HMI – HUMAN/MACHINE INTERFACE
 - a. The HMI shall be GE or approved equal.
 - b. The Automation interface shall be via a touchscreen with the following characteristics:
 - 1). Color, 12" (diagonal) LCD TFT display capable of displaying both text and graphics.
 - 2). Resistive touchscreen interface.
 - c. The display shall support a minimum resolution of 800x600 pixels, 256 displayable colors.
- 5. HMI Screen Listing.
 - a. The ATO Automation shall provide the following screens. The screens shall provide all of the information, metering, control, annunciators settings and indications listed below
 - 1). Main Menu Screen with a complete listing of major screens.
 - 2). System Overview Screen with a dynamic graphic display of the electrical one line.
 - 3). System Control Screen.
 - 4). System Metering Screen with graphical presentation of all functions.
 - 5). System Settings Screen.
 - 6). Generator Control Screen for the generator.
 - 7). Generator Metering Screen for the generator with graphical presentation of all functions specified
 - 8). Generator Settings Screen.
 - 9). Generator Demand Priority Control and Status Screen.
 - a). Engine Monitoring (Engine Meter/Gauge) Screen for each generator that shall contain a graphical representation of all of the engine gauges and data specified.

- b). Generator Engine Air / Cool Screen
- c). Generator Engine Oil / Fuel Screen
- 10). Time to retransfer screen, this screen shall display the amount of time remaining to retransfer the power to the Main source once normal power is stabilized and available. This screen shall remain open the entire time during the retransfer period. This signal shall also be sent back to SCADA.
- 11). Exercise Time screen, this screen shall display the amount of time remaining for the exercise of the generator. This screen shall remain open the entire time during the exercise period. This signal shall also be sent back to SCADA.
- 12). Annunciator Menu Screen
 - a). System Annunciation Screen that shall contain all of the Status, Lamp Test and Alarm points specified.
 - b). Generator Annunciator Screen for the generator that shall contain: Status, Lamp Test, Pre-Alarms and Shutdown faults specified
- 13). Report Menu Screen
 - a). Generator Settings Report Screen
- 14). Password Entry screen that shall contain a numeric keypad for password entry.
- 15). Alarm Summary Screen that shall contain a time/date stamped System Alarm Summary.

R. NAMEPLATES:

- 1. Plastic, white .33" letters on black background, on the front of each door on the switchgear; identifying the compartment contents for each compartment.
- 2. Attach nameplates with a stainless steel screw and nut at each end of the nameplate. Adhesive backed nameplates shall not be installed.

S. ENCLOSURE:

- 1. The switchgear described in these specifications shall be weatherproof, aisleless construction for outdoor service. Each shipping group shall be mounted upon an integral base frame with a weatherproof enclosure for assembly in the field into a complete metal-enclosed switchgear assembly with a weatherproof door provided on the breaker drawout side of each vertical section.
- 2. Outdoor rated enclosure shall be a non-walk-in design and provided with 120V heater controlled by a thermostat. Heater power supply shall be supplied from as indicated on drawings.

3.00 EXECUTION

3.01 INSTALLATION

- A. The manufacturer's representative has responsibilities to direct the installation and field testing of the equipment as described in this section. Installation of the equipment to be performed by the Construction Contractor who shall be required to assemble the equipment and install it in accordance with manufacturer's recommendations. Installation, Operation and Maintenance instructions which shall be furnished by the vendor or manufacturer and the installation drawings for this project. Manufacturer's representative in conjunction with the Construction Contractor shall submit a written plan of action for the installation of the switchgear. Plan of action shall be submitted for approval by the Owner.
- B. Furnish the services of an experienced service person who shall be experienced in the assembly and wiring of the metal clad switchgear units of similar size and character. He also shall assist in the adjustment and testing of the equipment and shall be able to modify and program the switchgear PLC breaker automatic load transfer control schemes during the testing, checkout and start-up.
- C. Adjust the calibration of protective relays according to the schedule and test the settings. Prepare a card index for the relays, the settings, the test results and marked thereon, and submit to the Owner.
- D. Instruct the operating and maintenance personnel in principle of operation of all major devices and the care and maintenance of components included in the switchgear.
- E. Time spent on the job by the service person shall be adequate for performing the above functions but shall in no case be less than that tabulated below:

Field start-up/testing, days:	6 - (8-hour days which does not include travel time)
Training days:	1 - (8-hour days which does not include travel time)
- F. Field start-up/testing shall include programming of the protective relay settings based on short circuit and relay coordination study provided by others.
- G. In addition, a Relay Specialist shall be provided from the Relay Manufacturer for a 1-day training class. Training shall be one 8-hour day (excluding travel time). Training sessions for switchgear and relays shall follow the method below:
- H. Training shall include theory of operation, application and troubleshooting. A training outline and manual of training course material shall be provided to the Owner two weeks in advance of the course. Training shall be for four members of the Owner's staff. Eight-hour training sessions shall be broken into two segments each of 4-hours with a 15 minute break every two hours. Lunch break shall be one hour. Training session shall be coordinated and scheduled with Owner.
- I. Training shall not take place until equipment is online and fully operational.
- J. When requested within the equipment warranty period, provide an additional training session from that indicated above for the Owner's Representative at the jobsite or other office location chosen by the Owner. Each eight hour training session shall be broken up into two segments each of 4-hours with a 15 minute break every two hours. Lunch break will be one hour. Training sessions shall be scheduled and coordinated with the Owner.
- J. All costs (travel expenses, testing equipment, etc.) required for the start-up, testing and training shall be the responsibility of the equipment manufacturer.

3.02 FIELD QUALITY CONTROL

- A. Upon completion of the installation, perform continuity tests and functional checkout to assure the proper operation of all equipment. The manufacturer's representative shall be available to assist the Contractor in checking the operation of the metal clad switchgear.
- B. Functional checkout shall include all possible operating scenarios of the main breaker, tie breaker and generator breaker combinations and automatic throw over schemes.
- C. Start-up procedures, testing and trouble shooting of the metal clad switchgear shall be performed under the supervision of the manufacturer's representative. Energization of the metal clad switchgear shall not be permitted without the manufacturer's representative's permission.
- D. No equipment is to be energized until the power system studies have been performed by the installation Contractor, the protective relays and breakers have been set per the short circuit and relay coordination study and the arc flash labels have been installed on the equipment. No exceptions.
- E. The manufacturer's representative shall submit an equipment installation report certifying the equipment if properly installed, has been tested and operated under all conditions which may be encountered during operation and is operating satisfactorily.
- F. Tests shall be conducted to assure proper operation of all circuits. The manufacturer's representative shall assist in correcting any deficiencies at no expense to the Owner.

3.03 CLEAN AND ADJUST

The manufacturer shall furnish sufficient touch-up paint of the same type and color used at the factory to repair damages incurred in installation. Perform touch up painting to achieve the original paint thickness, quality and appearance.

3.04 WARRANTY

- A. Manufacturer shall warrant the equipment furnished under this specification for a period of two (2) years against defects in materials and workmanship and operational failure.
- B. In the event of failure of any part or parts of the equipment during the first 2 years of service, provided that the equipment has been operated and maintained in accordance with good practice, the Manufacturer shall furnish, deliver and install the defective part or parts at his own expense.
- C. The first year of service shall be interpreted as the 24-month period following the installation, adjusting and acceptance testing, and the start of actual operation of the equipment, or 30 months after delivery, whichever occurs first.

3.05 FIELD TESTING

- A. Testing: All testing required shall be per Specification 26 01 26 Testing of Electrical Systems.
- B. General Field Testing Requirements:
 - 1. Comply with the provisions of NFPA 70B, "Testing and Test Methods."
 - 2. After installing switchgear and after electrical circuitry has been energized, test for compliance with requirements.

3. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
- C. Medium-Voltage Switchgear Assembly Field Tests:
1. Visual and Mechanical Inspection:
 - a. Verify that fuse and circuit breaker sizes and types correspond to Drawings and coordination study.
 - b. Verify that current and voltage transformer ratios correspond to Drawings.
 - c. Inspect bolted electrical connections for high resistance using one of the following two methods:
 - 1). Use a low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2). Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS, Table 100.12.
 - d. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
 - 1). Attempt closure on locked-open devices. Attempt to open locked-closed devices.
 - e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - f. Inspect insulators for evidence of physical damage or contaminated surfaces.
 - g. Verify correct barrier and shutter installation and operation.
 - h. Exercise active components.
 - i. Inspect mechanical indicating devices for correct operation.
 - j. Verify that filters are in place and vents are clear.
 - k. Perform visual and mechanical inspection of instrument transformers according to according to Article "Instrument Transformer Field Tests."
 - l. Inspect control power transformers
 - 1). Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
 - 2). Verify that primary and secondary fuse or circuit breaker ratings match drawings.
 - 3). Verify correct functioning of drawout disconnecting and grounding contacts and interlocks.
 2. Electrical Tests:

- a. Perform dc voltage insulation-resistance tests on each bus section, phase to phase and phase to ground, for one minute. If the temperature of the bus is other than plus or minus 20 deg. C, adjust the resulting resistance as provided in NETA ATS, Table 100.11.
 - 1). Insulation-resistance values of bus insulation shall be according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Investigate and correct values of insulation resistance less than manufacturer's recommendations or NETA ATS, Table 100.1.
 - 2). Do not proceed to the dielectric withstand voltage tests until insulation-resistance levels are raised above minimum values.
- b. Perform a dielectric withstand voltage test on each bus section, each phase to ground with phases not under test grounded, according to manufacturer's published data. If manufacturer has no recommendation for this test, it shall be conducted according to NETA ATS, Table 100.2. Apply the test voltage for one minute.
 - 1). If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric withstand test, the test specimen is considered to have passed the test.
- c. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500 V dc for 300-volt rated cable and 1000 V dc for 600-V rated cable. Test duration shall be one minute. For units with solid-state components or control devices that cannot tolerate the applied voltage, follow the manufacturer's recommendation.
 - 1). Minimum insulation-resistance values of control wiring shall not be less than two megohms.
- d. Control Power Transformers:
 - 1). Perform insulation-resistance tests. Perform measurements from winding to winding and each winding to ground. Insulation-resistance values of winding insulation shall be according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Investigate and correct values of insulation resistance less than manufacturer's recommendations or NETA ATS, Table 100.1.
 - 2). Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to a rated secondary voltage source. Verify correct potential at all devices>
 - 3). Verify correct secondary voltage by energizing the primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.
 - 4). Verify correct function of control transfer relays located in the switchgear with multiple control power sources.
- e. Voltage Transformers:
 - 1). Perform secondary wiring integrity test. Verify correct potential at all devices.

- 2). Verify secondary voltages by energizing the primary winding with system voltage.
 - f. Perform current-injection tests on the entire current circuit in each section of switchgear.
 - 1). Perform current tests by secondary injection with magnitudes such that a minimum current of 1.0 A flows in the secondary circuit. Verify correct magnitude of current at each device in the circuit.
 - 2). Perform current tests by primary injection with magnitudes such that a minimum of 1.0 A flows in the secondary circuit. Verify correct magnitude of current at each device in the circuit.
 - g. Perform system function tests according to "System Function Tests" Article.
 - h. Perform phasing checks on double-ended or dual-source switchgear to ensure correct bus phasing from each source.
- D. Medium-Voltage Vacuum Circuit Breaker Field Tests:
1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and required clearances.
 - c. Verify that maintenance devices such as special tools and gages specified by the manufacturer are available for servicing and operating the breaker.
 - d. Verify the unit is clean.
 - e. Perform mechanical operation tests on operating mechanism according to manufacturer's published data.
 - f. Measure critical distances on operating mechanism as recommended by the manufacturer. Critical distances of the operating mechanism shall be according to manufacturer's published data.
 - g. Verify cell fit and element alignment.
 - h. Verify racking mechanism operation.
 - i. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - j. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - k. Record as-found and as-left operation counter reading. Operation counter shall advance one digit per close-open cycle.
 2. Electrical Tests:

- a. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to ground with switch closed, and across each open pole. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Insulation-resistance values shall be according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Investigate and correct values of insulation resistance less than this table or manufacturer's recommendations. Dielectric-withstand-voltage tests shall not proceed until insulation-resistance levels are raised above minimum values.
- b. Perform a contact/pole-resistance test. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value. Microhm or dc millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's published data is not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- c. Perform minimum pickup voltage tests on trip and close coils according to manufacturer's published data. Minimum pickup voltage of the trip and close coils shall comply with manufacturer's published data. In the absence of the manufacturer's published data, comply with NETA ATS, Table 100.20.
- d. Verify correct operation of any auxiliary features, such as electrical close and trip operation, trip-free operation, and anti-pump function. Auxiliary features shall operate according to manufacturer's published data.
- e. Trip circuit breaker by operation of each protective device. Reset trip logs and indicators.
- f. Perform power-factor or dissipation-factor tests on each pole with the breaker open and each phase with the breaker closed. Power-factor or dissipation-factor values shall comply with manufacturer's published data.
- g. Perform vacuum bottle integrity (dielectric-withstand-voltage) test across each vacuum bottle, with the contacts in the "open" position according to manufacturer's published data. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the vacuum bottle integrity test, the test specimen is considered to have passed the test.
- h. Perform a dielectric-withstand-voltage test according to manufacturer's published data. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric-withstand-voltage test, the test specimen is considered to have passed the test.

E. Instrument Transformer Field Tests

1. Visual and Mechanical Inspection:
 - a. Verify that equipment nameplate data complies with Contract Documents.
 - b. Inspect physical and mechanical condition.
 - c. Verify correct connection of transformers with system requirements.

- d. Verify that adequate clearances exist between primary and secondary circuit wiring.
 - e. Verify the unit is clean.
 - f. Inspect bolted electrical connections for high resistance using one of the following two methods:
 - 1). Use a low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections.
 - 2). Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - g. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS, Table 100.12.
 - h. Verify that all required grounding and shorting connections provide contact.
 - i. Verify correct operation of transformer withdrawal mechanism and grounding operation.
 - j. Verify correct primary and secondary fuse sizes for voltage transformers.
 - k. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
2. Electrical Tests of Current Transformers.
- a. Perform insulation-resistance test of each current transformer and its secondary wiring with respect to ground at 1000 V dc for one minute. For units with solid-state components that cannot tolerate the applied voltage, follow manufacturer's recommendations. Investigate and correct values of insulation resistance less than manufacturer's written recommendations or NETA ATS, Table 100.5.
 - b. Perform a polarity test of each current transformer according to according to IEEE C57.13.1. Polarity results shall agree with transformer markings.
 - c. Perform insulation-resistance tests on the primary winding with the secondary grounded. Test voltages shall be according to according to Table 100.5.
 - d. Perform dielectric withstand tests on the primary winding with the secondary grounded. Test voltages shall be according to according to Table 100.9.
 - e. Perform power-factor or dissipation-factor tests according to test equipment manufacturer's published data.
 - f. Verify that current transformer secondary circuits are grounded and have only one grounding point according to IEEE C57.13.3. That grounding point should be located as specified by the engineer in the project drawings.
3. Electrical Tests of Voltage Transformers

- a. Perform insulation-resistance tests winding-to-winding and each winding to ground. Test voltages shall be applied for one minute according to Table 100.5. For units with solid-state components that cannot tolerate the applied voltage, follow manufacturer's recommendations. Investigate and correct values of insulation resistance less than manufacturer's recommendations or NETA ATS, Table 100.5.
- b. Perform a polarity test on each transformer to verify the polarity marks or H1- X1 relationship as applicable. Polarity results shall agree with transformer markings.
- c. Measure voltage circuit burdens at transformer terminals. Measured burdens shall be compared with and shall match instrument transformer ratings.
- d. Perform a dielectric withstand test on the primary windings with the secondary windings connected to ground. The dielectric voltage shall be according to Table 100.9. The test voltage shall be applied for one minute. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric withstand test, the primary windings are considered to have passed the test.
- e. Verify that voltage transformer secondary circuits are grounded and have only one grounding point according to IEEE C57.13.3. Test results shall indicate that the circuits are grounded at only one point.

F. Ground Resistance Test

1. Visual and Mechanical Inspection.

- a. Verify ground system complies with Contract Documents and NFPA 70 Article 250, "Grounding and Bonding."
- b. Inspect physical and mechanical condition. Grounding system electrical and mechanical connections shall be free of corrosion.
- c. Inspect bolted electrical connections for high resistance using one of the following two methods:
 - 1). Use a low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2). Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS, Table 100.12.
- d. Inspect anchorage

2. Electrical Tests

- a. Perform fall-of-potential or alternative test according to IEEE 81 on the main grounding electrode or system. The resistance between the main grounding electrode and ground shall be no more than 5 ohms.

- b. Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and derived neutral points. Investigate point-to-point resistance values that exceed 0.5 ohm. Compare equipment nameplate data with Contract Documents.
 - c. Inspect physical and mechanical condition
- G. Medium-Voltage Surge Arrester Field Tests
 - 1. Visual and Mechanical Inspection:
 - a. Verify that equipment nameplate data complies with Contract Documents.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and clearances.
 - d. Verify the arresters are clean.
 - e. Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.
 - f. Verify that the stroke counter is correctly mounted and electrically connected if applicable. Record the stroke counter reading.
 - 2. Electrical Test:
 - a. Perform an insulation-resistance test on each arrester, phase terminal-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Replace units that fail to meet recommended minimum insulation resistance listed in the table.
 - b. Perform a watts-loss test. Evaluate watts-loss values by comparison with similar units and test equipment manufacturer's published data.
 - c. Test grounding connections. Resistance between the arrester ground terminal and the ground system shall be less than 0.5 ohm.
- H. Microprocessor-Based Protective Relay Field Tests:
 - 1. Visual and Mechanical Inspection:
 - a. Record model number, style number, serial number, firmware revision, software revision, and rated control voltage.
 - b. Verify operation of light-emitting diodes, display, and targets.
 - c. Record passwords for each access level.
 - d. Clean the front panel and remove foreign material from the case.
 - e. Check tightness of connections.
 - f. Verify that the frame is grounded according to manufacturer's instructions.
 - g. Set the relay according to results in 26 05 73.01 ELECTRICAL POWER SYSTEM STUDIES.
 - h. Download settings from the relay. Print a copy of the settings for the report and compare the settings to those specified in the coordination study.

2. Electrical Tests:

- a. Perform insulation-resistance tests from each circuit to the grounded frame according to manufacturer's published data.
- b. Apply voltage or current to analog inputs, and verify correct registration of the relay meter functions.
- c. Functional Operation: Check functional operation of each element used in the protection scheme as follow:
 - 1). Timing Relay:
 - a). Determine time delay.
 - b). Verify operation of instantaneous contacts.
 - 2). Volts/Hertz Relay:
 - a). Determine pickup frequency at rated voltage.
 - b). Determine pickup frequency at a second voltage level.
 - c). Determine time delay.
 - 3). Undervoltage Relay:
 - a). Determine dropout voltage.
 - b). Determine time delay.
 - c). Determine time delay at a second point on the timing curve for inverse time relays.
 - 4). Current Balance Relay:
 - a). Determine pickup of each unit.
 - b). Determine percent slope.
 - c). Determine time delay.
 - 5). Negative Sequence Current Relay:
 - a). Determine negative sequence alarm level.
 - b). Determine negative sequence minimum trip level.
 - c). Determine maximum time delay.
 - d). Verify two points on the I-two-squared-t curve.
 - 6). Phase Sequence or Phase Balance Voltage Relay:
 - a). Determine positive sequence voltage to close the NO contact.
 - b). Determine positive sequence voltage to open the NC contact (undervoltage trip).
 - c). Verify negative sequence trip.
 - d). Determine time delay to close the NO contact with sudden application of 120 percent of pickup.

- e). Determine time delay to close the NC contact upon removal of voltage when previously set to rated system voltage.
- 7). Instantaneous Overcurrent Relay:
 - a). Determine pickup.
 - b). Determine dropout.
- 8). Time Overcurrent:
 - a). Determine minimum pickup.
 - b). Determine time delay at two points on the time current curve.
- 9). Ground Detector Relay:
 - a). Determine maximum impedance to ground causing relay pickup.
- d. Control Verification:
 - 1). Functional Tests:
 - a). Check operation of all active digital inputs.
 - b). Check output contacts or silicone-controlled rectifiers (SCRs), preferably by operating the controlled device, such as circuit breaker, auxiliary relay, or alarm.
 - c). Check internal logic functions used in protection scheme.
 - d). Upon completion of testing, reset min/max recorders, communications statistics, fault counters, sequence-of-events recorder, and event records.
 - 2). In-Service Monitoring: After the equipment is initially energized, measure magnitude and phase angle of inputs and verify expected values.
- I. Switchgear will be considered defective if it does not pass tests and inspections.
- J. Remove and replace defective units and retest.
- K. Prepare test and inspection reports. Record as-left set points of adjustable devices. Submit as a part of 26 01 26 Testing of Electrical Systems.

3.06 SYSTEM FUNCTION TESTS

- A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.
 - 1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
 - 2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
 - 3. Verify the correct operation of sensing devices, alarms, and indicating devices.

SUBMITTAL DATA SHEET FOR

26 13 00, MEDIUM VOLTAGE METAL-CLAD SWITCHGEAR

Submit the following data with Bid Proposal and with Shop Drawing:

Item No.	Description	4160V METAL-CLAD SWITCHGEAR
1	Manufacturer:	
2	Total Equipment Dimensions for ATS-1 Switchgear Line-up (inches): Length x Width x Height	
3	Total Weight for ATS-1 Switchgear Line-up (lbs.):	

END OF SECTION

26 22 13 LOW VOLTAGE DISTRIBUTION TRANSFORMERS

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment, and incidentals necessary to install transformers. Electrical work shall be in accordance with Section 26 05 00, "Common Work Results for Electrical".

1.02 QUALITY ASSURANCE

- A. Transformers shall comply with the specifications and shall be produced by the following Manufacturers:
 - 1. Cutler-Hammer
 - 2. GE by ABB
 - 3. Square D
 - 4. Siemens
- B. All others shall submit qualifications to the Owner and the Engineer for review and approval prior to bid submittal no later than one week after bid advertisement date. Any submittals after this time shall not be evaluated. Qualifications shall include equipment manufacturer who have had at least 10 years of successful experience in providing equipment for similar projects with a generator and pump station configurations. Qualifications shall include a list of similar projects within the last 5 years with the name of the project and contact information of the Owner.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management", and shall include:
 - 1. Bill of Material
 - 2. Equipment Data Sheets showing impedance weights, dimensions, etc. for each transformer.
 - 3. Product data on specified product documenting the following:
 - a. Dimensions
 - b. Weight
 - c. KVA
 - d. Voltage
 - e. % Impedance
 - f. Magnetizing current magnitude and duration
 - g. Taps
 - h. Insulation Class

- i. Sound Level
- j. Wiring Diagram
- k. Installation Instructions

1.04 STANDARDS

A. The applicable provisions of the following standards shall apply as if written here in their entirety:

ANSI/IEEE C57.96	Distribution and Power Transformers, Guide for Loading Dry-Type appendix to ANSI C57.12 standards
ANSI/IEEE C89.2	Dry Type Transformers for General Applications
IEEE C57.12.01	General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and / or Resin-Encapsulated Windings
IEEE C57.12.91	Test Code for Dry-Type Distribution and Power Transformers UL 506, Specialty Transformers
NEMA/ANSI ST20	Dry type transformers for General Applications
IEEE	Institute of Electrical and Electronic Engineers
NEMA TR1	Transformers, Regulators and Reactors
NEMA TP-1 2002	Guide for Determining Energy Efficiency for Distribution Transformers

2.00 PRODUCTS

A. DRY TYPE TRANSFORMERS

1. Provide dry type, 3-phase, delta wye connected transformers with KVA rating as required.
2. Transformers shall be suitable for indoor or outdoor installation as indicated on the plans, or as required by conditions. Transformers 75 KVA and less shall be suitable for floor, wall or trapeze mounting. Transformers larger than 75 KVA shall be suitable for floor or trapeze mounting.
3. Transformer shall be enclosed in a steel enclosure with covers secured with captive type hardware. Transformer shall be cooled by natural convection of air. The transformer enclosure shall be degreased, cleaned, phosphatized, primed, and finished with a gray baked on enamel.
4. The average audible sound level shall not exceed 50 DB for transformers rated at 75 KVA and below, nor 60 DB for transformers rated above 75 KVA, when measured in accordance with NEMA Standard TR1.
5. The percent impedance for transformers shall not exceed 4.6 for up to 112 1/2 KVA 6 for 150 KVA to 750 KVA.
6. The transformers shall have the following characteristics:
 - a. Class H insulation
 - b. 150-degree Centigrade temperature rise rating at 40 degrees C ambient at full rated load.

- c. Compartment for primary and secondary connections.
 - d. Transformer coils shall be of continuous copper wound construction with terminations brazed or welded. Coils shall be impregnated with non-hygroscopic, thermosetting varnish.
 - e. The maximum temperature of top of the enclosure shall not exceed 50 degrees C rise above a 40 degrees C ambient.
 - f. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible copper grounding conductor sized in accordance with applicable NEMA, IEEE, or ANSI standards.
 - g. Transformers shall have two (2) 2-1/2% full ampacity taps below and two (2) 2-1/2% taps above rated voltage in primary.
 - h. The basic impulse level shall be 10 KV for transformers less than 30 KVA, 30 KV for transformers 300 KVA and larger.
 - i. Transformer primary and secondary windings shall be copper. Aluminum windings shall not be permitted.
 - j. Transformers shall have efficiencies in accordance with NEMA TP-1. Provide written documentation as part of submittal process stating this and showing actual transformer efficiencies.
7. Single-phase transformer efficiency @ 35% and 75°C per the NEMA Premium program tested per 10 C.F.R. Part 431 ("Test Procedures for Distribution Transformers"). Shall be at a minimum
- a. 15 kVA: 97.7%
 - b. 25 kVA: 98.0%
 - c. 37.5 kVA: 98.2%
 - d. 50 kVA: 98.3%
 - e. 75 kVA: 98.5%
 - f. 100 kVA: 98.6%
 - g. 167 kVA: 98.7%
 - h. 250 kVA: 98.8%
 - i. 333 kVA: 98.9%
8. Three-phase transformer efficiency, total losses, shall not exceed losses @ 35% and 75°C per the NEMA Premium program tested per 10 C.F.R. Part 431 ("Test Procedures for Distribution Transformers"). Shall not exceed
- a. 15 kVA: 97.88% 112.30 W; 121.28 W
 - b. 30 kVA: 98.24% 185.52 W; 200.35 W
 - c. 45 kVA: 98.38% 256.42 W; 276.93 W
 - d. 75 kVA: 98.59% 362.89 W; 391.92 W

- e. 112.5 kVA: 98.73% 500.31 W; 540.33 W
- f. 150 kVA: 98.80% 576.14 W; 622.22 W
- g. 225 kVA: 98.95% 764.14 W; 825.26 W
- h. 300 kVA: 99.02% 1010.010 W; 1090.81 W.

3.00 EXECUTION

3.01 LOCATION

- A. Electrical Contractor to verify proper location for the unit.
- B. The transformer shall be installed in a location where the sides with ventilated openings are a minimum distance of six inches from noncombustible structures or equipment to ensure adequate air circulation.

3.02 INSTALLATION

- A. Set the transformer plumb and level. Provide solderless lug bonding connection on the inside of the transformer enclosure in accordance with the NEC. Make primary and secondary connections with liquid tight flexible metal conduit to isolate transformer noise from the building structure or conduit system.
- B. When final connection has been made, check secondary voltage at dry transformers and make tap adjustments required to obtain correct voltage.
- C. Perform the following isolation procedures in addition to those provided by the transformer Manufacturer. Provide pad-type vibration isolators or waffle pads sized to load 50 pounds per square inch. Install one (1) at each corner of the transformer at floor mount or trapeze installations. Locate pads between hanger and wall for wall hung installations
- D. For critical installations, spring type isolation may be required by the Engineer consisting of steel, spring-type isolators, sized for 1/2" deflection based on the weight of the transformer. Install at each corner or in hanger rods so that vibration is not transmitted to the building structure.
- E. Secure transformer to concrete base according to manufacturer's written instructions.
- F. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

3.03 CONNECTIONS

- A. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems".
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- C. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.04 FIELD QUALITY CONTROL

- A. Inspect installed dry type transformers for anchoring, alignment, grounding, and physical damage.
- B. Check tightness of all accessible mechanical and electrical connections with calibrated torque wrench. Minimum acceptable values are specified in manufacturer's instructions.

3.05 CLEANING

- A. Repaint scratched or marred exterior surfaces to match original finish.

3.06 TESTING

- A. Testing: All testing required shall be per Specification 26 01 26 Testing of Electrical Systems.
- B. Transformers furnished to this specification shall receive the following production tests:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS for dry-type, air-cooled, low-voltage transformers. Certify compliance with test parameters.
 - 2. Applied Potential;
 - 3. Induced Potential;
 - 4. No Load Losses;
 - 5. Voltage Ratio;
 - 6. Polarity;
 - 7. Continuity
- C. Manufacturer shall perform the following additional tests on units identical to the design type being supplied to this specification. Manufacturer shall provide on request test data sheets to prove performance of these tests.
 - 1. Sound Levels
 - 2. Temperature Rise Tests
 - 3. Full-Load Losses
 - 4. Regulation
 - 5. Impedance

3.07 ADJUSTING

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

END OF SECTION

26 27 26 WIRING DEVICES

1.00 GENERAL

1.01 WORK INCLUDED

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Straight-blade convenience, hospital-grade receptacles.
 - 2. GFCI receptacles.
 - 3. Pendant cord-connector devices.
 - 4. Cord and plug sets.
 - 5. Toggle switches.
 - 6. Wall plates.

1.03 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:
 - 1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
 - 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
 - 3. Leviton: Leviton Mfg. Company, Inc.
 - 4. Pass & Seymour: Pass& Seymour/Legrand.
- B. EMI: Electromagnetic interference.
- C. GFCI: Ground-fault circuit interrupter.
- D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- E. RFI: Radio-frequency interference.

1.04 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
 - 1. Product Data: For each type of product.
 - 2. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

2.00 PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.
- D. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 STRAIGHT-BLADE RECEPTACLES

- A. Hospital-Grade, Duplex Convenience Receptacles:
 - 1. 125 volts, 20 amps; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement SD, and FS W-C-596.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
 - 3. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.

2.03 GFCI RECEPTACLES

- A. General Description:
 - 1. 125 volts, 20 amps, straight blade, feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.

- c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
- C. Hospital-Grade, Duplex GFCI Convenience Receptacles: Comply with UL 498 Supplement SD.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).

2.04 PENDANT CORD-CONNECTOR DEVICES

- A. Description:
 - 1. Matching, locking type plug and receptacle body connector.
 - 2. NEMA WD-6 Configurations L5-20P and L5-20R, heavy duty grade, FS W-C-596.
 - 3. Body: Nylon, with screw-open, cable gripping jaws and provision for attaching external cable grip.
 - 4. External Cable Grip: Woven wire-mesh type made of high strength, galvanized steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.05 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 Volts, 20 Amps:
 - 1. Weatherproof Switches: Fitted with single switch as specified, and weather proof cover with spring door cover; grey in color for all areas. Switch ratings shall be as identified below for the number of poles required.
 - 2. Motor Rated Switches: HP rated switches approved for motor control or disconnect service when controlling or disconnecting motor loads in excess of 1/4 HP; 20-amp switches for loads exceeding 10 amps.
 - 3. Single-Pole:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1). Eaton (Arrow Hart).
 - 2). Hubbell Incorporated; Wiring Device-Kellems.
 - 3). Leviton Manufacturing Co., Inc.
 - 4). Pass & Seymour/Legrand (Pass & Seymour).
 - 4. Two-Pole:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1). Eaton (Arrow Hart).
 - 2). Hubbell Incorporated; Wiring Device-Kellems.
 - 3). Leviton Manufacturing Co., Inc.
 - 4). Pass & Seymour/Legrand (Pass & Seymour).
- 5. Three-Way:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1). Eaton (Arrow Hart).
 - 2). Hubbell Incorporated; Wiring Device-Kellems.
 - 3). Leviton Manufacturing Co., Inc.
 - 4). Pass & Seymour/Legrand (Pass & Seymour).
- 6. Four-Way:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1). Eaton (Arrow Hart).
 - 2). Hubbell Incorporated; Wiring Device-Kellems.
 - 3). Leviton Manufacturing Co., Inc.
 - 4). Pass & Seymour/Legrand (Pass & Seymour).
- C. GFCI, Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125V, 15 A; comply with NEMA WD 1, NEMA WD 6 configuration 5-15R, UL 498, and UL 943 Class A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Pass & Seymour/Legrand (Pass & Seymour).

2.06 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: 0.035-inch thick, satin-finished, Type 302 stainless steel .
 - 3. Material for Unfinished Spaces: Galvanized steel.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

- C. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- D. Service Plate: Rectangular, die cast aluminum with satin finish.
- E. Power Receptacle: NEMA WD 6 Configuration 5-20R.

2.07 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
- B. Wall Plate Color: 304 Stainless Steel

3.00 EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- D. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-amp circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.02 GFCI RECEPTACLES

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

3.03 IDENTIFICATION

- A. Comply with Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.04 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 volts.
 2. Percent Voltage Drop Under 15-Amp Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION

26 32 13 ENGINE GENERATORS

1.00 GENERAL

1.01 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. This Section includes packaged engine-generator sets for standby power supply with the following features:
 - 1. Battery charger.
 - 2. Sub-base fuel tank.
 - 3. Engine generator set.
 - 4. Muffler.
 - 5. Work platforms and railing.
 - 6. Outdoor enclosure.
 - 7. Remote annunciator.
 - 8. Starting batteries.
 - 9. Fuel Maintenance system.
 - 10. Generator Set Controller and Panel.
- C. The engine manufacturer's authorized distributor shall supply the complete power system to include the generator and related components specified in this section, so that there is one source of responsibility for coordination and testing.

1.02 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- B. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage.
- C. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

1.03 SUBMITTALS

1.04 A COPY OF THIS SPECIFICATION SECTION, WITH ADDENDUM UPDATES INCLUDED, AND ALL REFERENCED AND APPLICABLE SECTIONS, WITH ADDENDUM UPDATES INCLUDED, WITH EACH PARAGRAPH CHECK-MARKED TO INDICATE SPECIFICATION COMPLIANCE OR MARKED TO INDICATE REQUESTED DEVIATIONS FROM SPECIFICATION REQUIREMENTS. CHECK MARKS (IN THE MARGIN ADJACENT TO THE BEGINNING OF THE PARAGRAPH) SHALL DENOTE FULL COMPLIANCE WITH A PARAGRAPH AS A WHOLE. IF DEVIATIONS FROM THE SPECIFICATIONS ARE INDICATED AND, THEREFORE REQUESTED BY THE CONTRACTOR, EACH DEVIATION SHALL BE UNDERLINED AND DENOTED BY A NUMBER IN THE MARGIN TO THE RIGHT OF THE IDENTIFIED PARAGRAPH. THE REMAINING PORTIONS OF THE PARAGRAPH NOT UNDERLINED WILL SIGNIFY COMPLIANCE ON THE PART OF THE CONTRACTOR WITH THE SPECIFICATIONS. THE SUBMITTAL SHALL BE ACCOMPANIED BY A DETAILED, WRITTEN JUSTIFICATION FOR EACH DEVIATION. FAILURE TO INCLUDE A COPY OF THE MARKED-UP SPECIFICATION SECTIONS, ALONG WITH JUSTIFICATION(S) FOR ANY REQUESTED DEVIATIONS TO THE SPECIFICATION REQUIREMENTS, WITH THE SUBMITTAL SHALL BE SUFFICIENT CAUSE FOR REJECTION OF THE ENTIRE SUBMITTAL WITH NO FURTHER CONSIDERATION.

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified, including work platforms and railing.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.
5. Generator sizing analysis.
 - a. Detailed sizing analysis shall clearly identify assumptions made for loads being started/operated by the generator.

- 1). The maximum voltage drop allowed shall be 15%.

- 2). The generator shall be sized as follows:
 - a). The generator shall be sized to start and run one (1) 250HP pump/motor and all other connected ancillary loads/equipment. Manufacturer shall certify that the generator will not stall under these conditions.
- 3). Ambient temperature shall be a maximum of 122 degrees Fahrenheit.
- 4). Calculations shall be for a Diesel Fuel generator set.
- b). The generator manufacturer and Contractor shall be responsible for obtaining all information to run the generator sizing analysis, including nameplate rating listed on the motors. The manufacturer/Contractor shall be responsible for obtaining actual load data.
- c). The kW rating shown on the plans is anticipated, but shall not be used to determine the actual size of the generator provided for this project.
6. Provide a detailed layout of the generator enclosure that shows the location of the terminal box, generator control panel, lights, receptacles, panelboard, work platforms, etc.
7. Provide cut sheets for all equipment being provided for the generator including but not limited to:
 - a. Generator and Enclosure.
 - b. Work Platforms/railings.
 - c. Panelboard.
 - d. Exhaust Fans and louvers.
 - e. Conduits.
 - f. Wiring.
 - g. Lights.
 - h. Switches.
 - i. Receptacles.
 - j. Batteries and charging system.
 - k. Fuel Maintenance System.
 - l. Starters, disconnects, pushbutton, etc.
 - m. Maintenance/service platform.

- n. Provide a detailed panelboard schedule for the panelboard provided in the generator enclosure.
- 8. Certified summary of prototype-unit test report.
- 9. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
- 10. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
- 11. Report of sound generation.
- 12. Report of exhaust emissions showing compliance with applicable regulations.
- C. Field quality-control test reports: Indicate and interpret test results and inspection records relative to compliance with performance requirements. Provide load bank and 3rd Party Sound testing results. All Generator Testing Report(s) shall be submitted to Engineer for approval no later than two weeks after testing has been conducted.
- D. Equipment installation report.
- E. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
- F. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with ASME B15.1.

- F. Comply with NFPA 37.
- G. Comply with NFPA 70.
- H. Comply with NFPA 110 requirements.
- I. Comply with UL 2200.
- J. Engine Exhaust Emissions: Comply with applicable Federal, State and Local government requirements.
- K. Comply with NEMA MG-1 and SG-1.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: 0 to 40 deg C.
 - 2. Relative Humidity: 0 to 80 percent.
 - 3. Altitude: Sea level to 710 feet.

1.07 COORDINATION

- A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

1.09 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. In accordance with OCA 252:565-7-4(b)(1), post a complete set of operational instructions, emergency procedures and maintenance schedules at the pump station.

1.10 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: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Generator manufacturers:

1. Caterpillar; Engine Div.
2. Onan/Cummins Power Generation; Industrial Business Group.
3. Kohler

2.02 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- C. Capacities and Characteristics:
 1. Power Output Ratings: minimum of 500kW/625kVA but generator manufacturer shall verify rating based on loads identified below.
 2. Output Connections: 480V, three-phase, three wire.
 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 0.5 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 33 percent variation for 100 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 11 percent variation for 100 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

E. Loads and steps:

1. Generator manufacturer shall provide a detailed sizing analysis to the Engineer for approval. Detailed sizing analysis shall clearly identify assumptions made for loads being started/operated by the generator. When conducting the generator sizing analysis the voltage drop of the generator shall be set at a maximum of 20%. The generator manufacturer and Contractor shall be responsible for obtaining all information to run the generator sizing analysis. Any changes to the generator size shall be brought to the Engineer's attention. Sizing analysis shall be submitted to the Engineer with the generator's initial submittal. Ambient Temperature: 0 to 40 deg C.
2. Step 1
 - a. 150KVA Transformer
 - b. Panelboard "P2"
 - c. Panelboard "L2"

3. Step 2

- a. Pump No.1 – 250HP 18 Pulse VFD.

2.03 ENGINE

- A. Comply with NFPA 37.
- B. Fuel: Fuel oil, Grade DF-2.
- C. Rated Engine Speed: 1800 rpm.
- D. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements and comply with the sound level specified for sound attenuation enclosure.
- E. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- F. Starting System: 24-V electric, with negative ground.
 - 1. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 - 2. Cranking Cycle: As required by NFPA 110 for system level specified.
 - 3. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
 - 4. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 - 5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.

2.04 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pump.
- B. Radiator: Rated for specified coolant.
- C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent distilled water, with anticorrosion additives as recommended by engine manufacturer.
- D. Expansion Tank: Constructed of welded steel plate and equipped with gage glass and pet-cock.
- E. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

- F. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - 1. Rating: 50-psig (345-kPa) maximum working pressure with 180 deg F (82 deg C) coolant, and non-collapsible under vacuum.
 - 2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
 - 3. The generator shall be rated for continuous standby duty with a temperature rise of 125 deg C.

2.05 GOVERNOR

- A. The engine governor shall be an electronic Engine Control Module (ECM) with 24-volt DC Electric Actuator. The ECM shall be enclosed in an environmentally sealed, die-cast aluminum housing which isolates and protects electronic components from moisture and dirt contamination. Speed droop shall be adjustable from 0 (isochronous) to 10%, from no load to full rated load. Steady state frequency regulation shall be +/- 0.25%. Speed shall be sensed by a magnetic pickup off the engine flywheel ring gear. A provision for remote speed adjustment shall be included. The ECM shall adjust fuel delivery according to exhaust smoke, altitude and cold mode limits. In the event of a DC power loss, the forward acting actuator will move to the minimum fuel position.

2.06 FUEL OIL STORAGE

- A. Comply with NFPA 30.
- B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
 - 1. Tank level indicator.
 - 2. Capacity: 24 hours at full load.
 - 3. Spill containment fill box, hinged, lockable design.
 - 4. Low level alarm switch wired to generator control panel.
 - 5. Leak sensor switch installed in interstitial space and wired to generator control panel.
 - 6. Mechanical fill limiter with tight fill connection that shuts off the flow of fuel at a maximum of 95% of the tank name plate capacity.
 - 7. High level alarm station at the tank fill location the alarms at 90% and 95% of tank capacity.
 - 8. Containment Provisions: U.L. Listed double wall.

9. Emergency pressure relief vent.
10. Normal vent extended above roof of enclosure with updraft vent.
11. Low fuel alarm with a spare dry contact.
12. Electrical stub-up, rectangular type, located directly beneath the generator terminal box, beneath the generator control panel and beneath the generator house power panel.

2.07 ENGINE EXHAUST SYSTEM

- A. Muffler: Sized as recommended by engine manufacturer. Silencer(s) shall comply with the package sound attenuation level specified in Outdoor Generator Set Enclosure herein.
- B. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liners.
- C. Generator mufflers shall be mounted inside the enclosure to reduce noise pollution. The manufacturer shall provide isolate vibration for the muffler in the enclosure and shall reduce heat build-up inside the enclosure and provide quality support.

2.08 STARTING SYSTEM

- A. Description: 24-V electric, dual starters, with negative ground and including the following items:
 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" paragraph in "Service Conditions" article above.
 2. Cranking Cycle: As required by NFPA 110 for system level specified.
 3. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above to provide specified cranking cycle at least three times without recharging. Battery size shall be BCI Group No. 8D minimum, and shall be rated not less than 220 amp hours. Necessary cables and clamps shall be provided. Engines equipped with dual starting motors shall have dual battery banks.
 4. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 45-A minimum continuous rating.
 6. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit complies with UL 1236 and includes the following features:

- a. Operation: Equalizing-charging rate of 20 A is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
- b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
- c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10 percent.
- d. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.
- e. Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either condition closes contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
- f. Enclosure and Mounting: NEMA 250, Type 4X 316 Stainless Steel, wall-mounted cabinet.
- g. Charger shall operate on 120V.

2.09 CONTROL AND MONITORING

- A. Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real time digital communications to all engine and regulator controls via SAE J1939.
- B. Environmental: The generator set control shall be tested and certified to the following environmental conditions:
 - 1. -40°C to +70°C Operating Range.
 - 2. 80% humidity non-condensing, 30°C to 60°C.
 - 3. IP22 protection.
 - 4. 5% salt spray, 48 hours, +38°C, 36.8V system voltage.
 - 5. Sinusoidal vibration 4.3G's RMS, 24-1000Hz.
 - 6. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2).
 - 7. Shock: withstand 15G.

C. Functional Requirements: The following functionality shall be integral to the control panel:

1. The control shall include a minimum 64 x 240 pixel, 28mm x 100mm, white backlight graphical display with text based alarm/event descriptions.
2. The control shall include a minimum of 3-line data display.
3. Audible horn for alarm and shutdown with horn silence switch.
4. Standard ISO labeling.
5. Multiple language capability.
6. Remote start/stop control.
7. Local run/off/auto control integral to system microprocessor.
8. Cooldown timer.
9. Speed adjust.
10. Lamp test.
11. Push button emergency stop button.
12. Voltage adjust.
13. Voltage regulator V/Hz slope – adjustable.
14. Password protected system programming.

D. Digital Monitoring Capability: The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units:

1. Engine:
 - a. Engine oil pressure.
 - b. Engine oil temperature.
 - c. Engine coolant temperature.
 - d. Engine RPM.
 - e. Battery volts.
 - f. Engine hours
 - g. Engine crank attempt counter.

- h. Engine successful start counter.
- i. Service maintenance interval.
- j. Real time clock.

2. Generator:

- a. Generator AC volts (Line to Line, Line to Neutral and Average).
- b. Generator AC current (Avg and Per Phase).
- c. Generator AC Frequency.
- d. Generator kW (Total and Per Phase).
- e. Generator kVA (Total and Per Phase).
- f. Generator kVAR (Total and Per Phase).
- g. Power Factor (Avg and Per Phase).
- h. Total kW-hr.
- i. Total kVAR-hr.
- j. % kW.
- k. % kVA.
- l. % kVAR.

3. Voltage Regulation:

- a. Excitation voltage.
- b. Excitation current.

E. Alarms and Shutdowns: The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored by the control panel for first and last occurrence:

1. Engine Alarm/Shutdown:

- a. Low oil pressure alarm/shutdown.
- b. High coolant temperature alarm/shutdown.
- c. Loss of coolant shutdown.

- d. Overspeed shutdown.
- e. Overcrank shutdown.
- f. Emergency stop depressed shutdown.
- g. Low coolant temperature alarm.
- h. Low battery voltage alarm.
- i. High battery voltage alarm.
- j. Control switch not in auto position alarm.
- k. Battery charger failure alarm.

2. Generator Alarm/Shutdown:

- a. Generator over voltage.
- b. Generator under voltage.
- c. Generator over frequency.
- d. Generator under frequency.
- e. Generator reverse power.
- f. Generator overcurrent.

3. Voltage Regulator Alarm/Shutdown:

- a. Loss of excitation alarm/shutdown.
- b. Instantaneous over excitation alarm/shutdown.
- c. Time over excitation alarm/shutdown.
- d. Rotating diode failure.
- e. Loss of sensing.
- f. Loss of PMG.

F. Inputs and Outputs:

- 1. Digital Inputs: The Controller shall include the ability to accept six (6) to eighteen (18) programmable digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.

2. Digital Outputs: The control shall include the ability to operate six (6) programmable relay output signals, integral to the controller. The output relays shall be rated for 2A @ 30VDC and consist of six (6) Form A (Normally Open) contacts and two (10) Form C (Normally Open & Normally Closed) contacts.
 3. Discrete Outputs: The control shall include the ability to operate two (2) discrete outputs, integral to the controller, which are capable of sinking up to 300mA.
- G. Maintenance: All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set control:
1. Engine running hours display.
 2. Service maintenance interval (running hours or calendar days).
 3. Engine crank attempt counter.
 4. Engine successful starts counter.
 5. 20 events are stored in control panel memory.
- H. Remote Communications:
1. The control shall include Modbus TCP/IP Ethernet communication. The remote communications shall also be capable of communicating Modbus TCP/IP Ethernet.
 2. Remote Monitoring Software: The control shall provide Monitoring Software with the following functionality:
 - a. Provide access to all data and events on generator set communications network.
 - b. Provide remote control capability for the generator set.
 - c. Ability to natively communicate using Modbus TCP/IP Ethernet.
 3. Remote Indication: Provide a remote indication to SCADA.
 - a. Provide the following individual digital outputs for the following indications for protection and diagnostics:
 - 1). Overcrank.
 - 2). Low coolant temperature.
 - 3). High coolant temperature warning.
 - 4). High coolant temperature shutdown.
 - 5). Low oil pressure warning.

- 6). Low oil pressure shutdown.
 - 7). Overspeed.
 - 8). Low coolant level.
 - 9). EPS supplying load.
 - 10). Control switch not in auto.
 - 11). High battery voltage.
 - 12). Low battery voltage.
 - 13). Battery charger AC failure.
 - 14). Emergency stop.
 - 15). Low Fuel Level.
 - 16). Fuel Leak.
 - 17). Spare.
 - 18). Spare.
- b. The following additional metering shall be provided via Modbus TCP/IP via Ethernet for each Engine:
- 1). Generator kW, kVA, kVAR, PF, Volts, Amps and frequency.
 - 2). Generator AC Amperes – Phase A, Phase B and Phase C.
 - 3). Generator AC Voltage – Phase A-B, Phase B-C, Phase C-A, Phase A, Phase B and Phase C (verify phase rotation).
 - 4). Engine RPM Meter.
 - 5). Engine Battery Voltage Meter.
 - 6). Engine Oil Pressure Gauge.
 - 7). Engine Coolant Temperature Gauge.
 - 8). Engine Running Hour Meter.
 - 9). Engine Start Counter.
 - 10). Atmospheric Pressure.

- 11). Boost Pressure.
- 12). Air Filter Restriction.
- 13). Left Turbo Inlet Pressure.
- 14). Right Turbo Inlet Pressure.
- 15). Engine Hour meter.
- 16). Total Fuel Burned.
- 17). Engine Coolant Level Status.
- 18). Local Engine Control Switch Position.
- 19). Overspeed Switch Status.
- 20). Remote Emergency Stop Actuated.
- 21). Percent Engine Load.
- 22). Oil Filter Pressure Differential.
- 23). Fuel Filter Pressure Differential.
- 24). Aftercoolant Temperature.
- 25). Right Exhaust Temperature.
- 26). Left Exhaust Temperature.
- 27). Crankcase Air Pressure.
- 28). Filtered Fuel Pressure.
- 29). Right Air Filter Restriction.
- 30). Left Air Filter Restriction.
- 31). Fuel Consumption Rate.
- 32). Engine Oil Temperature.

2.10 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker:

1. Molded-case, thermal-magnetic type; 100 percent rated for breakers below 800A; complying with NEMA AB 1 and UL 489.

2. Main devices and feeder devices 800 amps and above shall be individually mounted circuit breakers (100% rated).
 3. Breakers shall have solid-state adjustable trip settings with Long time, Short time, Instantaneous and Ground settings (LSIG).
 4. All circuit protective devices shall have the following minimum symmetrical current interrupting capacity: 65kA.
 5. Series rated feeder devices shall not be acceptable.
 6. Breakers shall have trip indication of Overload, Short Circuit, and Ground Fault trip.
- B. All breakers shall be capable of being locked in the OFF position.
 - C. Tripping Characteristic: Designed specifically for generator protection.
 - D. Trip Rating: Matched to generator rating.
 - E. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - F. Mounting: Adjacent to or integrated with control and monitoring panel.

2.11 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H. Temperature rise of rotor and stator shall be limited to a maximum 125 degree C in 40 degree C ambient.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Drip proof.
- G. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

- H. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.12 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Provide a walk-in type weatherproof sound attenuated (level 2) enclosure. Enclosure shall be constructed of pre-painted white formed aluminum panels. The enclosure shall be sized to adequately house the generator set and all accessories. Enclosure shall be designed for a minimum wind load rating of 100 mph (160 km/h). Provide wind load calculations and certification from an independent licensed professional engineer at time of submittal. Multiple panels are lockable and provide adequate access to components requiring maintenance. Panels are removable by one person without tools. Instruments and control are mounted within enclosure. All hinges, door locks, door handles, etc. shall be stainless steel.
- B. Enclosure: Sound attenuation enclosure rated for 78dB @ 23'.
- C. Description: Vandal-resistant, sound attenuating, weatherproof aluminum housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
- D. Description: Prefabricated or pre-engineered walk-in factory assembled enclosure with the following features:
 - 1. Construction: Aluminum, metal-clad, integral structural-aluminum-framed building erected on concrete foundation.
 - 2. Space Heater: Thermostatically controlled and sized to prevent condensation.
 - 3. Louvers: Equipped with bird screen arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
 - 4. Hinged Doors: With padlocking provisions or keyed latches.
 - 5. Ventilation: Louvers equipped with bird screen arranged to permit air circulation while excluding exterior, birds, and rodents.
 - 6. Muffler Location: Generator mufflers shall be mounted inside the enclosure to reduce noise pollution. The manufacturer shall provide isolate vibration for the muffler in the enclosure and shall reduce heat build-up inside the enclosure and provide quality support.
 - 7. Walls shall be constructed of marine grade 0.080 minimum formed aluminum panels. Roof shall be constructed of marine grade mill finish 0.125 minimum thickness formed aluminum panels using an interlocking standing seam design capable of supporting 75 pounds per square foot. All external attaching hardware shall be stainless steel screw type mechanical fasteners. Enclosure shall be equipped with 4 point lifting means to remove the enclosure from the tank.

8. Provide a minimum of two entrance doors on each side. Doors shall be strategically located to provide easy access and serviceability. One door shall be located directly in front of the generator terminal box. Another door shall be located directly in front of the generator control panel. Door handles shall be two-point pad lockable type. Provide drip rails above each door opening.
 9. Intake air shall enter the enclosure through an acoustic baffle section or hood located in the rear wall of the enclosure and shall include aluminum birdscreen. Air intake shall be 1250 feet per minute or less to minimize water intrusion. The radiator discharge air shall pass through a horizontal discharge plenum section, which incorporates a motorized damper and aluminum birdscreen. The air handling system shall be engineered and constructed so as not to exceed a total of 0.50 inches of water gauge static pressure drop with minimal water intrusion.
 10. Engine Cooling Airflow through Enclosure: Adequate to maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for two hours with ambient temperature at top of range specified in system service conditions.
 11. The manufacturer shall provide a minimum of two (2) duplex receptacles in the enclosure.
 12. The manufacturer shall provide a minimum of four (4) LED light fixtures that shall be switched. The switch for the light fixture shall be located near each main door for the generator unit. The light fixtures shall be equal to Metalux Model No. 4NLW4040C (4' linear LED). The manufacturer shall be responsible for all controls and wiring as required for a complete and operational system.
 13. The manufacturer shall provide a minimum of two (2) LED light fixtures, one exterior light mounted in the center of the main exit door on each side of the generator enclosure. The exterior lights shall be controlled via a photocell and the controls shall be equipped with an On/Off/Auto selector switch to allow for manual or automatic operation of the exterior lights. The light fixture shall be equal Lumark "Crosstour" LED model No. XTOR1B-4000K. The manufacturer shall be responsible for all controls and wiring as required for a complete and operational system.
 14. Turn duct: Supply discharge air turn duct to direct sound and air upward. Provide sound dampening material on the turn duct to reduce noise.
 15. GROUNDING MEANS: Provide two NEMA 2-hole ground pads located near the base of the generator mounted 180° apart. Ground pads shall be stainless steel and suitable for terminating #4/0 ground conductor.
- E. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at with ambient temperature at top of range specified in system service conditions.

- F. Provide a work platform fabricated from aluminum with aluminum hand/guard railing and stairs, to enable maintenance personnel to safely access enclosure and personnel doors. Depth shall be minimum 36 inches or as required to permit all enclosure doors to fully open without being obstructed by railing. Platforms shall be installed on either side of the enclosure. Finish height shall be roughly the same as the bottom of the enclosure. Modular deck shall be perforated aluminum. Stair width shall be 36 inches; stair depth shall be 12 inches. Entire assembly shall be ADA compliant.

2.13 VIBRATION ISOLATION DEVICES

- 1. Supply vibration isolators as recommended by the manufacturer.

2.14 FINISHES

- A. Indoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.
- B. Outdoor Enclosure: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer. Color: Coordinate with the Owner.

2.15 FUEL MAINTENANCE SYSTEM

- A. Each fuel storage tank shall include two stage fuel maintenance system that will remove dirt and water. The maintenance system shall be plumbed into the tank per the manufacturer's recommendations.
- B. The separator shall remove 99.9% of the water in the fuel line and 95% of the solids.
- C. The stabilizer shall decontaminate and stabilize the fuel without the use of chemical additives.
- D. The system shall operate on 120V, 1 phase, 60Hz, 20A circuit breaker.
- E. Programmable controller:
 - 1. The controller shall be a UL 508 listed assembly.
 - 2. Provide dry contact for general alarms.
- F. The system shall be capable of treating the maximum amount of fuel that the entire sub-base tank fuel system is capable of being filled with. Acceptable manufacturer is Fuel Technologies International LLC product number FTI-2.8.
- G. The fuel tank shall be provided with all the necessary and required pipe and fittings for installation and proper operation of the system.

2.16 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 - 2. 4 Hour full load.
 - 3. Maximum power.
 - 4. Voltage regulation.
 - 5. Transient and steady-state governing.
 - 6. Single-step load pickup.
 - 7. Safety shutdown.
 - 8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
 - 9. Report factory test results within 10 days of completion of test.

2.17 DISTRIBUTION

- A. Provide and install a 120/240V single phase, 3 wire panelboard inside enclosure for distributing power to generator block heater, battery charger, lights, receptacles and any other devices requiring 120/240V power. Panelboard shall be minimum 30 pole with 100 amp main breaker, in a NEMA 3R 304 stainless steel enclosure, have bolt-on breakers with a minimum 14,000 AIC rating and tin-plated copper bus. Panelboard and transformer shall be manufactured by Square D, Eaton, GE/ABB or Siemens.
- B. Generator manufacturer shall be responsible for providing panelboard, Surge Protection Device (SPD), circuit breakers and all associated cabling and conduits to devices requiring power in the generator and the generator enclosure. Cabling shall be per Specification 26 05 19 "Low Voltage Electrical Power Conductors and Cables", 26 05 23 "Control Voltage Electrical Power Cables" and conduit shall be per Specification 26 05 33 "Raceways and Boxes for Electrical Systems".
- C. The Manufacturer shall provide the minimum number and ampacity of circuit breakers as follows:

1. One 20A/1P Circuit Breaker for Interior Lights.
2. One 20A/1P Circuit Breaker for Exterior Lights.
3. One 20A/1P Circuit Breaker for Receptacles.
4. One 20A/1P Circuit Breaker for Battery Charger.
5. One 20A/1P Circuit Breaker for Generator Control Panel.
6. One 20A/1P Circuit Breaker for Fuel Maintenance System.
7. One Circuit Breaker sized as required for each block heater.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 CONCRETE BASES

- A. Coordinate sizes and locations of concrete bases. Verify structural requirements with structural engineer.
- B. Install concrete bases of dimensions indicated for packaged engine generators

3.03 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch on 4-inch high concrete base. Secure sets to anchor bolts installed in concrete bases.

- D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
 - 1. Verify that electrical wiring is installed according to manufacturers' submittal and installation requirements in Division 26 Sections. Proceed with equipment startup only after wiring installation is satisfactory.
- E. The contractor shall provide all fuel for testing of the generator. The contractor shall be responsible for providing a full tank of fuel upon completion of this project.

3.04 CONNECTIONS

- A. Ground Equipment
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's representative shall be available to advise and assist the installation of the generators by the Construction Contractor.
- B. Furnish the services of a competent manufacturer's service representative who shall be experienced in the assembly and wiring of the generator units of similar size and character. He shall direct the installation of the equipment and shall assist and advise with the electricians or other workmen who are performing the actual work of installing the generator units. He also shall assist in the adjustment and testing of the equipment.
- C. Startup procedures, testing and troubleshooting of the generator shall be performed under the supervision of the manufacturer's representative. Energization of the generators shall not be permitted without the manufacturer's representative permission.
- D. Time spent on the job by the service representative shall be adequate for performing all functions described herein.
- E. All costs (travel expenses, testing equipment, etc.) required for testing start-up, and training shall be the responsibility of the equipment manufacturer/Contractor.
- F. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to assist in testing. Report results in writing. Provide on site field service for start-up.
- G. Testing: Perform field quality-control testing under the supervision of the manufacturer's factory-authorized service representative.
- H. Tests: Include the following:

1. Tests recommended by manufacturer, including under load tests. The engine distributor shall furnish all equipment and personnel required for testing, including load banks, transformer and cable.
 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, the following:
 - a. Single-step full-load pickup test.
 - b. 4-hour reactive load bank test.
 3. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.
 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 6. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 7. Perform a reactive load bank test of each generator set at full load and 0.80 power factor for 4 hours at full load. Record system data at 15 minute intervals as recommended by the engine manufacturer.
 8. Perform a system load bank test with the generator connected to the 480V main-tie-main MCC and operating at full load for 4 hours at 0.80 power factor.
 9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within
 10. Perform a load test with actual designed connected loads at the site with the generator connected to the 480V main-tie-main MCC and operating at designed load for 4 hours at 0.80 power factor.
 11. The Contractor shall provide fuel for the testing and any subsequent re-testing of the generator and shall top off the fuel tank upon final completion.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- K. All Generator Testing Report(s) shall be submitted to Engineer for approval no later than two weeks after testing has been conducted.
- L. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- M. Contractor shall fill fuel tank with manufacturers recommended fuel when all tests have been completed.

3.06 COMMISSIONING

- A. Battery Equalization: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

3.07 CLEANING

- A. On completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.08 TRAINING

- A. All costs (travel expenses, testing equipment, etc.) required for testing start-up, and training shall be the responsibility of the equipment manufacturer/Contractor.
- B. Training shall include theory of operation, application and trouble shooting. A training outline and manual of training course material shall be provided to the Owner two weeks in advance of the course. The eight hour training session shall be broken up into two segments each of 4-hours with a 15 minute break every two hours. Lunch break will be one hour. Training session shall be conducted by Generator manufacturer personnel. Training session shall be scheduled and coordinated with the Owner.
- C. Instruct the operating and maintenance personnel in principle of operating of all major devices and the care and maintenance of components included in the generator units, for a period of not less than one (1) eight (8) hour day. The one day training shall take place at the Owner's facilities at Pearson Pump Station in Keller, Texas. Coordinate with Owner for exact requirements and dates for training.
- D. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
2. Review data in maintenance manuals. Review data in maintenance manuals.
3. Schedule training with Owner, with at least seven days advance notice.
4. Minimum Instruction Period: Eight hours.
5. Training shall not take place until construction is complete and generator online and fully operational.

3.09 WARRANTY

- A. Manufacturer shall warrant equipment to be free of defects in materials and workmanship for twenty-four (24) months from date of shipment. The warranty shall including all parts, and labor.

3.10 SERVICE CONTRACT

- A. The Manufacturer shall provide an extended service agreement for two (2) years including all parts, labor, maintenance, testing, etc.

END OF SECTION

DIVISION 31
EARTHWORK

31 05 13 SOILS FOR EARTHWORK

1.00 GENERAL

1.01 WORK INCLUDED

- A. This Section of the specifications describes the various classes of Earth Fill. All of the classes of Earth Fill contained in this specification may not be used on this project. The classes of Earth Fill used on this project are shown on the drawings or specified in other sections of the specifications. This Section does not include specifications for placement and compaction of Earth Fill. Specifications for placement and compaction of Earth Fill are included in other sections of the specifications and/or shown on the drawings.

1.02 STANDARDS

- A. Soil materials shall be classified into the appropriate class of Earth Fill shown below according to ASTM D2487 "Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)" or other appropriate methods as designated by the Engineer.

2.00 PRODUCTS

2.01 MATERIALS; CLASSIFICATIONS

- A. Class 1 Earth Fill: Limited to clays and sandy clays classified as CH material with a liquid limit greater than or equal to 50, a plasticity index greater than or equal to 25, and a minimum of 60 percent passing the No. 200 sieve, which are free of organic materials.
- B. Class 2 Earth Fill: Limited to clays and sandy clays classified as CH and CL materials with a coefficient of permeability less than or equal to 1.0×10^{-7} cm/sec, a liquid limit greater than or equal to 30, a plasticity index greater than or equal to 15, and more than 50 percent passing the No. 200 sieve, which are free of organic materials.
- C. Class 3 Earth Fill: Consist of any materials classified as CH, CL, SM, SP, SP-SM, SC, and GC, which have a minimum plasticity index of 4, which are free of organic materials.
- D. Class 4 Earth Fill: Consist of materials which are classified as SP, SM, SC, CL, or dual classifications thereof, which have a liquid limit less than or equal to 35 and a plasticity index of a minimum of 4 and a maximum of 15, which are free of organic materials.
- E. Class 5 Earth Fill: Consist of materials classified as SP or SP-SM which have a plasticity index less than or equal to 4 and a maximum of 12 percent passing the No. 200 sieve, which are free of organic materials.
- F. Class 12 Earth Fill: Consist of soils suitable for topsoil which are relatively free of stones or other objectionable debris, which have sufficient humus content to readily support vegetative growth. The suitability of soils for topsoil shall be subject to the approval of the Engineer.

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

31 23 10 STRUCTURAL EXCAVATION AND BACKFILL

1.00 GENERAL

1.01 SUMMARY

- A. This Section specifies excavation, backfill materials, backfill placement and compaction procedures, and other construction activities incidental to project structures.

1.02 QUALIFICATION ASSURANCE

- A. Testing Agency: An independent testing agency that is AASHTO accredited.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
1. Qualification Data: For testing agency.
 2. Provide list of compaction equipment to be used.
 3. Backfill material classifications: For each soil or aggregate backfill material provide a certification by the testing agency.
 4. Compaction Test Results: Submit test results within 24 hours of successful testing.

1.04 STANDARDS

- A. Material classification, placing, and testing shall be in compliance with the latest revisions of the following standards, unless otherwise noted in the Contract Documents.

1. ASTM International (ASTM) Standards:

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³ (600 kN-m/m ³))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

- B. Any other testing required by these specifications and not specifically referenced to a standard shall be performed under ASTM or other appropriate standards as designated by the Engineer.

1.05 DELIVERY AND STORAGE

- A. Deposit material to be used for backfill in storage piles at points convenient for handling of the material during the backfilling operations and as required to prevent contamination with other materials.

1.06 JOB CONDITIONS

- A. Review subsurface investigations. A limited subsurface investigation has been performed by Rone Engineers. A geotechnical report from that investigation is available at the Engineer's office for information purposes only. The precise profile of soil and rock strata beneath this Site is not known.
- B. Review the Site and determine the conditions which may affect the structural excavation, prior to the commencement of the excavation.

2.00 PRODUCTS

2.01 BACKFILL MATERIALS

- A. Select Fill: Select fill shall be Class 4 Earth Fill as specified in Section 31 05 13 "Soils for Earthwork."
- B. Topsoil: Topsoil shall be Class 12 Earth Fill as specified in Section 31 05 13 "Soils for Earthwork."

2.02 COMPACTION EQUIPMENT

- A. Compaction equipment shall conform to the following requirements.
 - 1. Heavy Compaction Equipment:
 - a. Tamping Compactor: Steel wheels with rectangular face, tapered pads that prevent fluffing the soil. Compactor shall be equipped with cleaning fingers to remove soil accumulation from between pads.
 - 1). Operating Weight, Minimum: 30,000 pounds.
 - 2). Wheels or Drum Size, Minimum: 4 feet diameter.
 - 3). Travel Speed, Maximum: 10 mph.
 - b. Pneumatic Rollers: Minimum eight-tire, pneumatic roller with a modular ballast system and flexible operating weight, and which will equally distribute load between tires to provide compaction uniformity.
 - 1). Operating Weight Range: As required for specified compaction, 36,000 to 50,000 pounds.
 - 2). Tire Pressure Range: 80 psi to 100 psi.
 - 3). Travel Speed, Maximum: 10 mph.
 - 4). Distance Between Edges of Adjacent Tires: Less than 50 percent of tire width.
 - c. Vibratory Rollers: Smooth drum roller with 90 percent of the static weight transmitted through a single drum.
 - 1). Static Weight, Minimum: 20,000 pounds
 - 2). Centrifugal Force Per Drum, Minimum: 40,000 pounds
 - 3). Frequency: 1400 v/min

- 4). Drum Size: Diameter 5 feet, +/- 1 foot; width between 6 and 9 feet.
 - 5). Travel Speed: 5 mph for self-propelled; 2 mph for towed.
 - 6). No backing up of the vibratory roller will be allowed on an embankment unless the vibrating mechanism is capable of being reversed.
2. Hand-Directed Compaction Equipment: Use power tampers and vibratory plate compactors in areas where it is impracticable or unacceptable to use heavy compaction equipment.

3.00 EXECUTION

3.01 PREPARATION

- A. Clear and grub the area to be excavated prior to the start of excavation. Remove the surficial vegetation, waste and soils to a minimum depth of 12 inches. Depth of removal shall not be less than that required to remove trees, shrubs, stumps, roots, and other organic material above and below ground from within the area to be excavated. Ensure below grade organic material is removed to a minimum depth of 18 inches below bottom of footing/structure.

3.02 EXCAVATION FOR FOUNDATIONS

- A. General: Excavate subgrade to the depth indicated on Drawings, +/- 0.1 feet tolerance. Extend limits of the excavation beyond the perimeter of the foundations as indicated on the Drawings.
 1. Exposed subgrade surfaces shall be level and of sound, stable material; free of mud, frost, snow, or ice. Testing agency or Owner's representative shall confirm exposed subgrade is a suitable bearing material based on the Construction Documents.
 2. Proof roll the exposed subgrade in accordance with TxDOT Item 216. Do not proof roll wet or saturated subgrades.
 3. Where unsound or unstable material is uncovered, notify Owner's representative. Remove objectionable material and replace after approval is received from Owner's representative. Replacement material shall be as indicated here unless otherwise indicated on Drawings:
 - a. Soil subgrade replacement material: Compacted structural fill.
- B. Excavation Safety: All excavations shall be in accordance with OSHA requirements.

3.03 WATER IN FOUNDATION EXCAVATIONS

- A. General:
 1. Prevent water infiltration into foundation excavations. Remove standing water from excavation prior to placing concrete. If removal of standing water is not possible due to continuous water infiltration, then contact Owner's representative for additional direction regarding placing concrete underwater.
 2. Do not dewater a foundation excavation while placing concrete or for a period of at least 24 hours after concrete placement.

- B. Rock Foundation Subgrade: If rock material becomes weathered due to water infiltration, then remove weathered material and provide rock replacement material to restore foundation subgrade elevation.
- C. Soil Foundation Subgrade: If foundation subgrade becomes saturated do not disturb the subgrade. Wait for water to evacuate the subgrade and subgrade surface to adequately stiffen prior to placing concrete. If subgrade is disturbed, then wait until subgrade has dried out, excavate disturbed subgrade and provide replacement material as indicated above.

3.04 COMPACTED BACKFILL

- A. General: Backfill excavated spaces and areas not occupied by the permanent structure.
 - 1. Backfill behind a retaining wall or basement-type wall shall not be placed until the concrete has reached its 28-day compressive strength or 7 days, whichever is longer.
 - 2. Unless otherwise indicated on Drawings, structures with a top slab shall not backfilled until the top slab has been in place at least 4 days.
 - 3. Structures with soil on opposing (opposite) sides shall be backfilled to prevent uneven loading of the structure – evenly raise backfill on opposing sides of the structure. The maximum differential backfill height between opposing sides is 1 foot.
 - 4. Do not permit rollers to operate within 3 feet of structures.
 - 5. Maximum Loose Lift Height:
 - a. Heavy Compaction Equipment: 8 inches.
 - b. Hand-Directed Compaction Equipment: 4 inches.
 - 6. Previous Compacted Layer: If backfill placement occurs over a period of time greater than 24 hours, then scarify and recompact the previous day's final compacted layer.
 - a. Scarify and Recompact: 6-inch depth; adjust the moisture content; recompact.
 - b. Saturated subgrades shall not be worked on until sufficiently dry and harden so as not to be rutted with compaction equipment. Scarify and recompact layers damaged by weather or construction equipment.
- B. Moisture: Prior to compacting backfill, mix and aerate or water the loose lift backfill material as necessary to adjust the moisture content and evenly distribute throughout. The material shall contain moisture within the limits specified below.
 - 1. In accordance with ASTM D6938, determine the optimum moisture content for the maximum dry density.
 - 2. Backfill moisture content shall be as indicated in Table 1, "Compacted Fill."
 - 3. Aggregate fill: Completely cohesionless materials, shall be at a moisture content which will allow use of the specified compaction equipment and consistent achievement of the specified density.
- C. Compaction: As required to achieve the specified density, increase the number of passes above the minimum specified and/or modify the weight of the equipment.
 - 1. Determine the maximum dry density in accordance with ASTM D698 for cohesive soils and ASTM D4253 for cohesionless soils.

2. Minimum number of passes for all compacted fill types: 8.
3. Cohesive Soils: A tamping compactor or tamping compactor followed by a pneumatic roller shall be used.
4. Cohesionless or low cohesive soils: A vibratory roller or vibratory plate compactors shall be required if the material is cohesionless or with less than 15 percent passing the No. 200 sieve. Confirm applicability of vibratory compaction equipment in the field.
5. Overlap passes a minimum of 1 feet for heavy compaction equipment and 50 percent of the baseplate width for hand-directed equipment.
6. Backfill density shall be as indicated in Table 1, "Compacted Fill."

Table 1: Compacted Fill			
Backfill Type	Density	Moisture Content^{2, 3}	Comments
Select Fill	95%-100%	-2% to +2%	N/A
On-Site Clay, Sandy Clay and Shaley Clay	95%-100%	0% to +4%	N/A
On-Site Clayey Sand	95%-100%	-2% to +2%	N/A

¹ The percentage indicated is the minimum required percentage of the maximum dry density as determined by the applicable ASTM.

² Range indicated is the acceptable tolerance with respect to the optimum moisture content.

³ Completely cohesionless materials, shall be at a moisture content which will allow use of the specified compaction equipment and result in consistent achievement of the specified density.

3.05 FIELD QUALITY CONTROL

- A. Owner is responsible for the costs involved in providing an approved testing agency to perform quality control testing of backfill operations and verification of subgrade bearing material. The testing laboratory shall make tests of in-place density and moisture in accordance with ASTM Standards previously mentioned in this Section. The testing agency shall monitor backfill operations continuously or at intervals acceptable to the Owner's representative. It shall be the responsibility of the Contractor to notify the testing agency a minimum of 2 business days before backfill operations begin.
 1. Unless noted otherwise, in-place density tests shall be conducted at a rate of one test per 1500 square feet for every lift.

END OF SECTION