South Valley
WATER RECLAMATION FACILITY

2023 VFD REPLACEMENT PROJECT

CONTRACT DOCUMENTS

BIDDING REQUIREMENTS, CONTRACT FORMS,

CONDITIONS OF THE CONTRACT,

TECHNICAL SPECIFICATIONS AND DRAWINGS

JULY 2023

Digitally signed by Christopher Alan Carvalho
Contact Info: Carollo Engineers, Inc.
Date: 2023.07.17 08:23:47-06'00'

REGISTERED PROFESSIONAL ENGINEER
No. 366286
CHRISTOPHER A. CARVALHO
STATE OF UTAH

Bids will be received at the office of South Valley Water Reclamation Facility located at

7495 South 1300 West, West Jordan, Utah 84084

until 2:00 pm, August 8, 2023

SECTION 00020
CONTRACT DOCUMENTS TABLE OF CONTENTS

SECTION 00030 - NOTICE INVITING BIDS

RECEIPT OF BIDS: Sealed Bids will be received at the office of the South Valley Water Reclamation Facility; OWNER of the WORK located at 7495 South 1300 West, West Jordan, Utah 84084, until 2:00 PM on August 8, 2023, for construction of South Valley Water Reclamation Facility's 2023 VFD REPLACEMENT PROJECT. Any Bids received after the specified time and date will not be considered.

OPENING OF BIDS: The Bids will be publicly opened and read at 2:00 PM, August 8, 2023, at the above-mentioned office of the OWNER.

COMPLETION OF WORK: The WORK shall be completed as described below:

a) Contractor shall procure new materials, demolish and remove existing equipment to be replaced, and install the new equipment. Contractor shall provide all materials required for the Work described. The Work shall be completed by March 29, 2024.

DESCRIPTION OF WORK: The project consists of the following Items:

1. In the Headworks Building demolish and remove the existing VFDs including the existing control sections. Install the new OWNER furnished VFDs in the locations shown on the Drawings. Install the new control sections for the VFDs as shown on the Drawings. The control sections are furnished by a Systems Integrator under contract to the OWNER. Modify existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs.
2. In RAS/WAS Building 1 demolish and remove the existing VFDs. Demolish and modify the motor control centers. Install the new OWNER furnished VFDs in the locations shown on the Drawings. Modify existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs.
3. In RAS/WAS Building 2 demolish and remove the existing VFDs. Install the new OWNER furnished VFDs in the locations shown on the Drawings. Modify existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs. Demolish the existing PCM-1500 and install a new PCM-1500 furnished by the System Integrator.
4. In the Solids Handling Building demolish and remove the existing odor control fan VFDs. Install the new OWNER furnished VFDs. Modify existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs.
5. Demolish existing fiber optic cable and install new fiber optic cable as shown on the Drawings.

SITE OF WORK: The site of the WORK is located at the OWNER's water reclamation facility at 7495 South 1300 West, West Jordan, Utah.

OBTAINING CONTRACT DOCUMENTS: The Contract Documents are entitled "South Valley Water Reclamation Facility - 2023 VFD Replacements Project".

The Contract Documents may be obtained by bidders, subcontractors and equipment suppliers at the office of the South Valley Water Reclamation Facility, 7495 South 1300 West, West Jordan, Utah 84084. Printed bid packages will not be provided. Electronic bid packages will be available from July 17, 2023, through July 21, 2023. Interested parties desiring emailed electronic files should email a request to Matt Hatch with Carollo Engineers, Inc, at mhatch@carollo.com. Electronic bid packages will also be available at www.svwater.com or U3P (fka SciQuest) for registered users. There will be no charge for emailed bid documents.

BID SECURITY: Each Bid shall be accompanied by a certified check or cashier's check or Bid Bond in the amount of 5 percent of the Total Bid Price payable to the OWNER as a guarantee that the Bidder, if its Bid is accepted, will promptly execute the Agreement. A bid shall not be considered unless one of the forms of Bidder's security is enclosed with it.

BIDS TO REMAIN OPEN: The Bidder shall guarantee the Total Bid Price for a period of 45 calendar days from the date of bid opening.

MANDATORY PRE-BID VISIT TO WORK SITE: For a bid to be considered complete, prospective bidders are **required** to attend a pre-bid walk through of the proposed work site which will be conducted by the OWNER on July 25, 2023, at 1:00 pm. The object of the walk through is to acquaint bidders with the site conditions. The pre-bid visit will start at the office of the OWNER located at 7495 South 1300 West, West Jordan City, Utah. Follow-up visits by prospective bidders and subcontractors are available by appointment only. Contact Taigon Worthen, P.E. of the SVWRF for appointments.

PROJECT ADMINISTRATION: Technical communications relative to this WORK shall be directed to the ENGINEER prior to opening of the Bids.

Carollo Engineers, Inc.
7090 S Union Park Ave, Midvale, Utah 84047
Telephone: 801-233-2502
e-mail: mhatch@carollo.com
Attention: Matt Hatch, PE

Communications relative to the purchase of Bid Documents shall be directed to the OWNER.

SOUTH VALLEY WATER RECLAMATION FACILITY
7495 South 1300 West
West Jordan, Utah 84084
Telephone: 801-495-5469
e-mail: tworthen@svwater.com
Attention: Taigon Worthen, P.E.

OWNER'S RIGHTS RESERVED: The OWNER reserves the right to reject any or all bids, to waive any informality in a bid, and to make awards to the lowest responsive, responsible bidder as the OWNER in its sole discretion shall determine may best serve the interest of the OWNER.

- END OF NOTICE INVITING BIDS -

SECTION 00100 - INSTRUCTIONS TO BIDDERS

1. DEFINED TERMS. Terms used in these Instructions to Bidders and the Notice Inviting Bids which are defined in the General Conditions have the meanings assigned to them in the General Conditions. The term "Bidder" means one who submits a Bid directly to OWNER, as distinct from a sub-bidder, who submits a price or quote to a Bidder.

2. INTERPRETATIONS AND ADDENDA.

2.1 All questions about the meaning or intent of the Contract Documents are to be directed to the ENGINEER. Additions, deletions, or revisions to the Contract Documents considered necessary by the ENGINEER in response to such questions will be issued by Addenda, mailed, emailed, or delivered to all parties recorded by the OWNER as having received the Contract Documents. Questions received less than 5 days prior to the date of Bids may not be answered. Only answers to such questions issued by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

2.2 Addenda may also be issued to make other additions, deletions, or revisions to the Contract Documents.

2.3 Bidders shall make no special interpretation or inference of intent from differing formats in the Technical Specifications.

3. BIDDER'S EXAMINATION OF CONTRACT DOCUMENTS AND SITE.

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

A. To examine thoroughly the Contract Documents and other related data identified in the Bidding Documents (including "technical" data referred to below);

B. To visit the site to become familiar with local conditions that may affect cost, progress, or performance, of the WORK;

C. To consider federal, state, and local Laws and Regulations that may affect cost, progress, or performance of the WORK;

D. To study and carefully correlate the Bidder's observations with the Contract Documents; and

E. To notify the OWNER of all conflicts, errors, ambiguities, or discrepancies in or between the Contract Documents and such other related data.

3.2 (Not Used)

3.3 It is also the responsibility of each Bidder before submitting a Bid to examine thoroughly those reports of physical conditions in or relating to existing surface and subsurface conditions (except underground utilities as defined in Article 1 of the General Conditions) which are at or adjacent to the site and which were utilized by the OWNER in the preparation of the Contract Documents. Copies of such reports and drawings are available for information at the office of the OWNER.

3.4 Information and data reflected in the Contract Documents with respect to Underground Utilities at or contiguous to the site are based upon information and data furnished to the OWNER by the owners of such Underground Utilities or others, and the OWNER does not assume responsibility for the accuracy or completeness thereof unless it is expressly

provided otherwise in the Supplementary General Conditions or Section 01530 - Protection of Existing Facilities.

3.5 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, Underground Utilities, and other physical conditions, and possible changes in the Contract Documents due to differing conditions appear in Paragraphs 4.02, 4.03, and 4.04 of the General Conditions.

3.6 Before submitting a Bid, each Bidder will, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests, and studies and obtain any additional information and data which pertain to the physical conditions (surface, subsurface, and Underground Utilities) at or contiguous to the site or otherwise which may affect cost, progress, or performance of the WORK and which the Bidder deems necessary to determine its Bid for performing the WORK in accordance with the time, price, and other terms and conditions of the Contract Documents.

3.7 On reasonable request in advance, the OWNER will provide each Bidder access to the site to conduct such examinations, investigations, explorations, tests, and studies as each Bidder deems necessary for submission of a Bid. Location of any excavation or boring shall be subject to prior approval of OWNER and applicable agencies. Bidder shall fill all holes, restore all pavement to match existing structural section, and shall clean up and restore the site to its former condition upon completion of such explorations. OWNER reserves the right to require Bidder to execute an Access Agreement with the OWNER prior to accessing the site.

3.8 The lands upon which the WORK is to be performed, rights-of-way, and easements for access thereto and other lands designated for use by the CONTRACTOR in performing the WORK are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by the CONTRACTOR. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by the OWNER unless otherwise provided in the Contract Documents.

3.9 The submission of a Bid will constitute an absolute representation by the Bidder that the Bidder has complied with every requirement of this Paragraph 3 and the following:

A. That the Bid is premised upon performing the WORK required by the Contract Documents without exception and such means, methods, techniques, sequences, or procedures of construction (if any) as may be required by the Contract Documents;

B. That Bidder has given the OWNER written notice of all conflicts, errors, ambiguities, and discrepancies in the Contract Documents and the written resolution thereof by the OWNER is acceptable to the Bidder; and

C. That the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the WORK.

4. BID FORMS. The Bid shall be submitted on the Bid Forms bound herein. All blanks on the Bid Forms shall be completed in ink. All names must be printed below the signatures. The Bid shall be submitted in a sealed envelope which shall be plainly marked in the upper left hand corner with the name and address of the Bidder and shall bear the words "BID FORM" followed by the title of the Contract Documents for the WORK, the name of the OWNER, the address where Bids are to be delivered or mailed to, and the date and hour of opening of Bids.

5. CERTIFICATES.

5.1 Bids by corporations must be executed in the corporate name by the president, a vice president, or other corporate officer. Such Bid shall be accompanied by the enclosed Certificate of Authority to sign, attested by the secretary or assistant secretary, and with the corporate seal affixed. The corporate address and state of incorporation must appear below the signature.

5.2 Bids by partnerships must be executed in the partnership name and be signed by a managing partner, accompanied by the enclosed Certificate of Authority to sign, and his/her title must appear under the signature and the official address of the partnership must appear below the signature.

5.3 Bids by joint ventures must be executed in the joint venture name and be signed by a joint venture managing partner, accompanied by the enclosed Certificate of Authority to sign, and his/her title must appear under the signature and the official address of the joint venture must appear below the signature.

6. DISQUALIFICATION OF BIDDERS. More than one Bid from an individual, firm, partnership, corporation, or association under the same or different names will not be considered. If the OWNER believes that any Bidder has financial interest in more than one Bid for the WORK contemplated, all Bids in which such Bidder is interested will be rejected. If the OWNER reasonably believes that collusion exists among the Bidders, all Bids will be rejected. A party who has quoted prices to a Bidder is not hereby disqualified from quoting prices to other Bidders, but is disqualified from submitting a Bid directly for the WORK.

7. QUANTITIES OF WORK. The quantities of work or material stated in unit price items of the Bid are supplied only to give an indication of the general scope of the WORK; the OWNER does not expressly or by implication agree that the actual amount of work or material will correspond therewith, and reserves the right after award to increase or decrease the quantity of any unit price item of the WORK by an amount up to and including 25 percent of any Bid item, without a change in the unit price, and shall include the right to delete any Bid item in its entirety, or to add additional Bid items up to and including an aggregate total amount not to exceed 25 percent of the Bid price.

8. COMPETENCY OF BIDDERS. Only qualified and E100 licensed CONTRACTORS specializing in electrical construction may submit a bid for the performance of the WORK.

9. SUBMISSION OF BIDS. The Bid shall be delivered by the time and to the place stipulated in the Notice Inviting Bids. It is the Bidder's sole responsibility to see that its Bid is received in proper time and at the proper place.

10. BID SECURITY, BONDS, AND INSURANCE. Each Bid shall be accompanied by a certified or cashier's check or approved Bid Bond in the amount stated in the Notice Inviting Bids. Said check or bond shall be made payable to the OWNER and shall be given as a guarantee that the Bidder, if awarded the WORK, will enter into an Agreement with the OWNER, and will furnish the necessary insurance certificates, Payment Bond, and Performance Bond; each of said bonds to be in the amount stated in the Supplementary General Conditions. In case of refusal or failure to enter into said Agreement, the check or Bid Bond, as the case may be, shall be forfeited to the OWNER. If the Bidder elects to furnish a Bid Bond as its Bid security, the Bidder shall use the Bid Bond form bound herein, or one conforming substantially to it in form. Bid Bonds shall

comply with the requirements applicable to payment and performance bonds in the General Conditions.

11. DISCREPANCIES IN BIDS. In the event there is more than one Bid item in a Bid Schedule, the Bidder shall furnish a price for all Bid items in the Schedule, and failure to do so will render the Bid non-responsive and shall cause its rejection. In the event there are unit price Bid items in a Bidding schedule and the amount indicated for a unit price Bid item does not equal the product of the unit price and quantity, the unit price shall govern and the amount will be corrected accordingly, and the BIDDER shall be bound by said correction. In the event there is more than one Bid item in a Bid Schedule and the total indicated for the Schedule does not agree with the sum of the prices Bid on the individual items, the prices Bid on the individual items shall govern and the total for the Schedule will be corrected accordingly, and the BIDDER shall be bound by said correction.

12. MODIFICATIONS AND UNAUTHORIZED ALTERNATIVE BIDS. Unauthorized conditions, limitations, or provisos attached to the Bid shall render it informal and may cause its rejection as being non-responsive. The Bid forms shall be completed without interlineations, alterations, or erasures in the printed text. Alternative Bids will not be considered unless called for. Oral, telegraphic, telephonic or electronic Bids or modifications will not be considered.

13. WITHDRAWAL OF BID. The Bid may be withdrawn by the Bidder by means of a written request, signed by the Bidder or its properly authorized representative. Such written request must be delivered to the place stipulated in the Notice Inviting Bids for receipt of Bids prior to the scheduled closing time for receipt of Bids.

14. AWARD OF CONTRACT. Award of the contract, if awarded, will be made to the lowest responsive, responsible Bidder whose Bid complies with the requirements of the Contract Documents. Unless otherwise specified, any such award will be made within the period stated in the Notice Inviting Bids that the bids are to remain open. Unless otherwise indicated, a single award will be made for all the Bid items in an individual Bid Schedule.

15. RETURN OF BID SECURITY. Within 14 days after award of the contract, the OWNER will, if requested, return the Bid securities accompanying such Bids that are not being considered in making the award. All other Bid securities will be held until the Agreement has been finally executed. They will then be returned, if requested, to the respective Bidders whose Bids they accompany.

16. EXECUTION OF AGREEMENT. The Bidder to whom award is made shall execute a written Agreement with the OWNER on the form of agreement provided, shall secure all insurance, and shall furnish all certificates and bonds required by the Contract Documents within 14 calendar days after receipt of the agreement forms from the OWNER. Failure or refusal to enter into an Agreement as herein provided or to conform to any of the stipulated requirements in connection therewith shall be just cause for annulment of the award and forfeiture of the Bid security. If the lowest responsive, responsible Bidder refuses or fails to execute the Agreement, the OWNER may award the Contract to the second lowest responsive, responsible Bidder. If the second lowest responsive, responsible Bidder refuses or fails to execute the Agreement, the OWNER may award the contract to the third lowest responsive, responsible Bidder. On the failure or refusal of such second or third lowest Bidder to execute the Agreement, each such Bidder's Bid securities shall be likewise forfeited to the OWNER.

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

18. PREFERENCE FOR RESIDENT CONTRACTORS. The OWNER will apply the provisions of Utah Procurement Code 63G-6-405. titled Preference for Resident Contractors (Utah Code -- Title 63G -- Chapter 6) wherein it is stated “(2) (a) When awarding contracts for construction, a public procurement unit shall grant a resident contractor a reciprocal preference as against a nonresident contractor from any state that gives or requires a preference to contractors from that state. (b) The amount of the reciprocal preference shall be equal to the amount of the preference applied by the state of the nonresident contractor.”

- END OF INSTRUCTIONS TO BIDDERS -

SECTION 00300 – BID FORMS

BID

BID TO: South Valley Water Reclamation Facility

1. The undersigned Bidder proposes and agrees, if this Bid is accepted to enter into an Agreement with the OWNER in the form included in the Contract Documents to perform the WORK as specified or indicated in said Contract Documents entitled "South Valley Water Reclamation Facility - 2023 VFD Replacement Project".
2. Bidder accepts all of the terms and conditions of the Contract Documents, including without limitation those in the Notice Inviting Bids and Instructions to Bidders, dealing with the dispositions of the Bid security.
3. This Bid will remain open for the period stated in the "Notice Inviting Bids" unless otherwise required by law. Bidder will enter into an Agreement within the time and in the manner required in the "Notice Inviting Bids" and the "Instructions to Bidders", required by the Contract Documents.
4. Bidder has examined copies of all the Contract Documents including the following Addenda (receipt of all of which is hereby acknowledged):

Number	Date
_____	_____
_____	_____
_____	_____

Failure to acknowledge addenda shall render the bid non-responsive and shall be cause for its rejection.

5. Bidder has familiarized itself with the nature and extent of the Contract Documents, WORK, site, locality where the WORK is to be performed, the legal requirements (federal, state, and local laws, ordinances, rules, and regulations), and the conditions affecting cost, progress or performance of the WORK and has made such independent investigations as Bidder deems necessary.

To all the foregoing, and including all Bid Forms contained in the Bid, said Bidder further agrees to complete the WORK required under the Contract Documents within the Contract Time stipulated in said Contract Documents, and to accept in full payment therefore the Contract Price based on the Total Bid Price(s) named in the aforementioned Bid forms.

Dated: _____ Bidder: _____

By: _____

Title: _____

BID CERTIFICATE

(if Corporation)

STATE OF)

) SS:

COUNTY OF)

I HEREBY CERTIFY that a meeting of the Board of Directors of the _____

_____

_____
a corporation existing under the laws of the State of _____, held on _____, 20 _____, the following resolution was duly passed and adopted:

"RESOLVED, that _____, as _____ of this Corporation, be and is hereby authorized to execute the Bid dated _____, 20___, to the South Valley Water Reclamation Facility by this Corporation and that his/her execution thereof, attested by the Secretary of this Corporation, and with the Corporate Seal affixed, shall be the official act and deed of this Corporation."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the corporation this _____, day of _____, 20___.

_____
Secretary

(SEAL)

BID CERTIFICATE

(if Partnership)

STATE OF)

) SS:

COUNTY OF)

I HEREBY CERTIFY that a meeting of the Partners of the _____

_____

_____
a partnership existing under the laws of the State of _____, held on _____, 20 _____, the following resolution was duly passed and adopted:

"RESOLVED, that _____, as _____ of the Partnership, be and is hereby authorized to execute the Bid dated_____, 20___, to the South Valley Water Reclamation Facility by this Partnership and that his/her execution thereof, attested by the _____ shall be the official act and deed of this Partnership."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this _____, day of _____, 20___.

_____

BID CERTIFICATE

(if Joint Venture)

STATE OF)

) SS:

COUNTY OF)

I HEREBY CERTIFY that a meeting of the Principals of the _____

_____

_____
a joint venture existing under the laws of the State of _____, held on _____, 20 _____, the following resolution was duly passed and adopted:

"RESOLVED, that _____, as _____of the Joint Venture, be and is hereby authorized to execute the Bid dated_____, 20___, to the "South Valley Water Reclamation Facility by this Joint Venture and that his/her execution thereof, attested by the _____ shall be the official act and deed of this Joint Venture."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the corporation this _____, day of _____, 20___.

_____

LIST OF SUBCONTRACTORS

The Bidder shall list below the name and the location of the place of business of each Subcontractor who will perform work or labor or render service to the prime contractor in or about the construction of the work or improvement, or a Subcontractor who, under subcontract to the prime contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of 1 percent of the prime contractor's total bid or ten thousand dollars ($10,000), whichever is greater. The Bidder shall also list below the portion of the WORK which will be performed by each Subcontractor under its contract. The prime contractor shall list only one Subcontractor for each portion as is defined by the prime contractor in its bid. The prime contractor shall submit information (see next page) required of specialty subcontractors which are proposed to do Sheet Metal (HVAC) Work, Mechanical Work or Electrical Work, if any.

The Bidder's attention is directed to the provisions of Paragraph entitled "Subcontract Limitations," of the Supplementary General Conditions which stipulates the percent of the WORK to be performed with the Bidder's own forces. Failure to comply with this requirement will render the Bid non-responsive and may cause its rejection.

Work to be Performed	Subcontr. License Number	Percent of Total Bid	Subcontractor's Name and Address
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____

Note: Attach additional sheets if required.

INFORMATION REQUIRED OF SPECIALTY SUBCONTRACTORS

The Bidder shall furnish the following information for each specialty subcontractor. Additional sheets shall be attached as required. Failure to complete Item Nos. 1, 2, and 3, will cause the Bid to be non-responsive and may cause its rejection.

(1) SPECIALTY SUBCONTRACTOR's name and address:

_____

_____

_____

(2) SPECIALTY SUBCONTRACTOR's license:

Primary Classification _____

State License No. and Expiration Date _____

Specialty classifications held, if any: _____

Name of Licensee, if different from (1) above:

_____

_____

_____

.

(3) ATTACH TO THIS BID a list of the 5 most recent construction contracts or subcontracts completed by the SPECIALTY SUBCONTRACTOR involving HVAC, Mechanical or Electrical Work of similar type and comparable value at Municipal Water Treatment Plants or Municipal Wastewater Treatment Plants. The list shall include the following information as a minimum:

- Names, address, and telephone number of owner.
- Name of Project.
- Location of Project.
- Brief description of the work involved.
- Contract amount.
- Date of completion of the contract.
- Name, address, and telephone number of architect or engineer.
- Name of owner's project engineer.

INFORMATION REQUIRED OF BIDDER

The Bidder shall furnish the following information. Additional sheets shall be attached as required. Failure to complete Item Nos. 1, 3, and 6, will cause the Bid to be non-responsive and may cause its rejection.

(1) CONTRACTOR's name and address:

_____

_____

_____

(2) CONTRACTOR'S telephone number: _____

(3) CONTRACTOR's fax number: _____

(4) CONTRACTOR's license: Primary Classification _____

State License No. and Expiration Date _____

Specialty classifications held, if any: _____

Name of Licensee, if different from (1) above: _____

_____

_____

(5) Name, address, and telephone number of surety company and agent who will provide the required bonds on this contract:

_____

_____

_____

(6) ATTACH TO THIS BID a financial statement, references, and other information, sufficiently comprehensive to permit an appraisal of CONTRACTOR's current financial condition.

(7) ATTACH TO THIS BID a list of the 5 most recent construction contracts completed by the CONTRACTOR involving HVAC Work of similar type and comparable value at Municipal Water Treatment Plants or Municipal Wastewater Treatment Plants. The list shall include the following information as a minimum:

- Names, address, and telephone number of owner.
- Name of Project.
- Location of Project.
- Brief description of the work involved.
- Contract amount.
- Date of completion of the contract.
- Name, address, and telephone number of architect or engineer.
- Name of owner's project engineer.

NONCOLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER

AND SUBMITTED WITH BID

STATE OF)

) SS:

COUNTY OF)

_____, being first duly sworn, deposes and says that he or she is _____ of_____ the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit or cost element of awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

Signed: _____

Subscribed and sworn to before me

this _____day of _____, 20____

_____

Notary Public in and for the
County of _____
State of _____

(SEAL)

BID BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____as Principal, and _____as Surety, are held and firmly bound unto the South Valley Water Reclamation Facility hereinafter called "OWNER," in the sum of _____dollars, for the payment of which sum, well and truly to be made, we jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns firmly by these presents.

WHEREAS, said Principal has submitted a Bid to said OWNER to perform the WORK required under the bidding schedule(s) of the OWNER's Contract Documents entitled "South Valley Water Reclamation Facility - 2023 VFD Replacement Project".

NOW THEREFORE, if said Principal is awarded a contract by said OWNER and, within the time and in the manner required in the "Notice Inviting Bids" and the "Instruction to Bidder" enters into a written Agreement on the form of agreement bound with said Contract documents, furnishes the required certificates of insurance, and furnishes the required Performance Bond and Payment Bond, and performs in all other respects the agreement created by this bid, then this obligation shall be null and void, otherwise it shall remain in full force and effect. The Surety stipulates and agrees that the obligation of said Surety shall in no way be impaired or affected by an extension of the time within which the OWNER may accept such bid and Surety further waives notice of any such extension. In the event suit is brought upon this bond by said OWNER and OWNER prevails, said Principal and Surety shall pay all costs incurred by said OWNER in such suit, including reasonable attorney's fees and costs to be fixed by the court.

SIGNED AND SEALED, this _____day of _____, 20_____

_____ (SEAL) _____ (SEAL)

(Principal) (Surety)

By: _____ By: _____

(Signature) (Signature)

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

- END OF BID FORMS -

BID SCHEDULES

PART 1 – GENERAL

1.01 CONSTRUCTION CONTRACT

A. Name of Project: South Valley Water Reclamation Facility - 2023 VFD Replacement Project

1.02 SCHEDULES TO BE ADDED TO THE AGREEMENT

A. This Bid Schedule contains the schedules of prices which will be incorporated into the Agreement by reference.

1.03 TAXES

A. The Bidder agrees that all sales, consumer, use, and other similar taxes are included in the stated bid prices for the WORK, unless provision is made herein for the Bidder to separately itemize the estimated amount of tax.

1.04 SCHEDULES OF PRICES

A. Schedule A: Base Lump Sum Bid. This item includes all of the WORK for the project as specified and shown on the Contract Documents. Bidder shall complete Schedule A in its entirety (see next page).

B. PURCHASE ORDER ASSIGNMENT: The successful CONTRACTOR, by submission of a bid agrees to the assignment of the Purchase Order indicated on Page 00510-01. The Base Lump Sum Bid shall not include the value of the assignment of the Purchase Order as the unpaid balance of the Purchase Order by the OWNER as the unpaid balance of the Purchase Order by the OWNER will vary depending upon Vendor's progress.

SCHEDULE A
SVWRF 2023 VFD REPLACEMENT PROJECT

Item No.	Area	Description	Quantity Unit	Equipment Cost[1]	Unit Cost[2]	Total Cost[3]
1	Headworks	Demolition			$	$
2		Installation of new VFDs and Control Sections. MCC updates			$	$
3		Testing and Start-up assistance				
4	RAS/WAS Building No. 1	Demolition			$	$
5		Installation of new VFDs and MCC updates				
6		Testing and Start-up assistance				
7	RAS/WAS Building No. 2	Demolition			$	$
8		Installation of new VFDs and PCM-1500			$	$
9		Testing and Start-up assistance				
10	Solids Handing Building	Demolition			$	$
11		Installation of new VFDs			$	$
12		Testing and Start-up assistance			$	$
13	Fiber Optic Cable	Demolition and Installation			$	$
Bid Schedule Total (Sum of Total Costs of Items 1-13)				$		

Bid Schedule Total In Words: _____

[1]Costs for selected sole-sourced equipment have been predetermined, and pricing is provided where applicable and is for all the units shown and includes submittals, O&M manuals, commissioning and shipping costs. Copies of the respective proposals are provided in the appendix. Where given, use that pricing to determine the total cost. Otherwise obtain and provide pricing from vendors of the Bidder's choosing which conform to the specified requirements. Add sales taxes and other appropriate fees as required.

[2]Where equipment pricing is provided, show the Unit Cost for installation only of each item. Where equipment pricing is not provided, show Unit Cost to furnish and install the items.

[3]The Total Cost is the sum of the equipment costs, if provided, plus the Quantity multiplied by the Unit Cost.
All Unit Costs and Total Costs shall include all labor, equipment, tools, supplies, insurance, taxes, overhead, markups, applicable fees and all other costs associated with performing the Work. These costs shall be distributed fairly among the Bid Items according to their relative amounts and not weighted or unbalanced. The Owner may elect to perform or not perform any of the Bid Item Work according to its best interest, financial limitations or other considerations. The Unit Costs and Total Costs will be used to adjust the Contractor's compensation accordingly. No other compensation will be made for loss of revenue or profit or other expenses associated with these items.

- END OF BID SCHEDULES -

SECTION 00500 – AGREEMENT

THIS AGREEMENT is dated as of the _____day of _____ in the year 20___ by and between South Valley Water Reclamation Facility (hereinafter called OWNER) and _____ _____(Hereinafter called CONTRACTOR).

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1. WORK

CONTRACTOR shall complete the WORK as specified or indicated in the OWNER's Contract Documents entitled South Valley Water Reclamation Facility - 2023 VFD Replacement Project. The WORK is generally described as follows and as listed in Schedule A:

a) In the Headworks Building demolish and remove the existing VFDs including the existing control sections. Install the new OWNER furnished VFDs in the locations shown on the Drawings. Install the new control sections for the VFDs as shown on the Drawings. The control sections are furnished by a Systems Integrator under contract to the OWNER. Modify existing MCCs existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs.
b) In RAS/WAS Building 1 demolish and remove the existing VFDs. Demolish and modify the motor control centers. Install the new OWNER furnished VFDs in the locations shown on the Drawings. Install the new MCC section. Modify existing MCCs, existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs.
c) In RAS/WAS Building 2 demolish and remove the existing VFDs. Install the new OWNER furnished VFDs in the locations shown on the Drawings. Modify existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs. Demolish the existing PCM-1500 and install a new PCM-1500 furnished by the System Integrator.
d) In the Solids Handling Building demolish and remove the existing odor control fan VFDs. Install the new OWNER furnished VFDs. Modify existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs.
e) Demolish existing fiber optic cable and install new fiber optic cable as shown on the Drawings.

ARTICLE 2. CONTRACT TIMES

COMPLETION OF WORK: The WORK shall be completed as follows:

1. Contractor shall begin WORK as soon as the Notice to Proceed is issued following award of WORK. Notice to Proceed is planned as September 7, 2023. Work shall be complete by March 29, 2024.

ARTICLE 3. LIQUIDATED DAMAGES

OWNER and the CONTRACTOR recognize that time is of the essence of this Agreement and that the OWNER will suffer financial loss if the WORK is not completed within the time specified

in Article 2 herein, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense, and difficulties involved in proving in a legal proceeding the actual loss suffered by the OWNER if the WORK is not completed on time. Accordingly, instead of requiring any such proof, the OWNER and the CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) the CONTRACTOR shall pay the OWNER $500.00 for each day that expires after the deadlines specified in Article 2 herein.

ARTICLE 4. CONTRACT PRICE

OWNER shall pay CONTRACTOR for completion of the WORK in accordance with the Contract Documents in current funds the amount set forth in the Bid Schedule(s).

ARTICLE 5. PAYMENT PROCEDURES

CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by OWNER as provided in the General Conditions.

ARTICLE 6. CONTRACT DOCUMENTS

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the WORK consist of this Agreement (pages 00500-1 to 00500-6, inclusive) and the following attachments to this Agreement:

- Notice Inviting Bids (pages 00030-1 to 00030-2, inclusive).
- Instructions to Bidders (pages 00100-1 to 00100-5, inclusive).
- Bid Forms including the Bid, Bid Schedule(s), information required of Bidder, Bid Bond, and all required certificates and affidavits (pages 00300-1 to 00300-9 and 00310-1 to 00310-2, inclusive).
- Performance Bond (pages 00610-1 to 00610-1, inclusive).
- Payment Bond (pages 00620-1 to 00620-1, inclusive).
- General Conditions (pages 00700-1 to 00700-36, inclusive).
- Supplementary General Conditions (pages 00800-1 to 00800-7, inclusive).
- Supplementary General Conditions (Utah) (pages 00810-1 to 00810-4, inclusive).
- Technical Specifications consisting of Divisions and pages, as listed in the Table of Contents.
- Drawings consisting of _116_ sheets, as listed in the Table of Contents/List of Drawings.
- Addenda numbers _ to _, inclusive.
- Notice to Proceed.
- Change Orders which may be delivered or issued after Effective Date of this Agreement and are not attached hereto.

There are no Contract Documents other than those listed in this Article 6. The Contract Documents may only be amended by Change Order as provided in Paragraph 3.03 of the General Conditions.

ARTICLE 7. ASSIGNMENTS

No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation monies that may become due and monies that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

OWNER and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have caused this Agreement to be executed the day and year first above written.

OWNER:
South Valley Water Reclamation Facility
By _____
(Jerry Knight, Board Chairman)

Attest _____

Address for giving notices:
South Valley Water Reclamation Facility
7495 South 1300 West
West Jordan, Utah 84084

Approved as to Form:

_____
(Signature)

_____
(Facility Attorney)

CONTRACTOR:
_____
By_____

[CORPORATE SEAL]

Attest_____

Address for giving notices:
_____
_____
_____

Agent for service of process: _____
_____

Telephone No. for Agent
_____

AGREEMENT CERTIFICATE

(if Corporation)

STATE OF)

) SS:

COUNTY OF)

I HEREBY CERTIFY that a meeting of the Board of Directors of the _____

_____

_____

a corporation existing under the laws of the State of _____, held on _____, 20 _____, the following resolution was duly passed and adopted:

"RESOLVED, that _____, as _____ of this Corporation, be and is hereby authorized to execute the Agreement dated _____, 20___, to the South Valley Water Reclamation Facility by this Corporation and that his/her execution thereof, attested by the Secretary of this Corporation, and with the Corporate Seal affixed, shall be the official act and deed of this Corporation."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the corporation this _____, day of _____, 20___.

_____

Secretary

(SEAL)

AGREEMENT CERTIFICATE

(if Partnership)

STATE OF)

) SS:

COUNTY OF)

I HEREBY CERTIFY that a meeting of the Partners of the _____

_____

_____
a partnership existing under the laws of the State of _____, held on _____, 20 _____, the following resolution was duly passed and adopted:

"RESOLVED, that _____, as _____ of the Partnership, be and is hereby authorized to execute the Agreement dated_____, 20___, by and between this Partnership and South Valley Water Reclamation Facility by this Partnership and that his/her execution thereof, attested by the _____ shall be the official act and deed of this Partnership."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this _____, day of _____, 20___.

_____

AGREEMENT CERTIFICATE

(if Joint Venture)

STATE OF)

) SS:

COUNTY OF)

I HEREBY CERTIFY that a meeting of the Principals of the _____

_____

_____
a joint venture existing under the laws of the State of _____, held on _____, 20 _____, the following resolution was duly passed and adopted:

"RESOLVED, that _____, as _____of the Joint Venture, be and is hereby authorized to execute the Agreement dated_____, 20___, by and between this Joint Venture and South Valley Water Reclamation Facility and that his/her execution thereof, attested by the _____ shall be the official act and deed of this Joint Venture."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this _____, day of _____, 20___.

_____

PURCHASE ORDERS ASSIGNMENT

FOR VALUE RECEIVED, SOUTH VALLEY WATER RECLAMATION FACILITY, Assignor, hereby assigns, transfers and sets over to _____(Contractor)_____ _____,

of _____(Address)_____, Assignee, all of Assignor's right, title and interest in and to the following described Purchase Orders (copies of which are attached hereto and incorporated by reference as though fully set forth herein), subject to the terms and conditions thereof, to wit:

Purchase Order No.	Amount	Company
21894	$745,500.00	Intermountain Fuse Supply

THIS ASSIGNMENT IS MADE pursuant to and in accordance with terms of the Contract Documents and Specifications entered into by and between Assignor and Assignee for the construction of South Valley Water Reclamation Facility's **2023 VFD REPLACEMENT PROJECT** dated

the____ day of _____, 2023.

ASSIGNOR HEREBY DELEGATES to Assignee and Assignee, upon execution hereof, hereby expressly assumes all of the obligations and duties to be performed by Assignor under the aforesaid Purchase Orders in accordance with the terms thereof and as provided in said Contract Documents and Specifications.

IN WITNESS WHEREOF, Assignor has executed this Assignment this _____ day of _____, 2023.

ASSIGNOR: SOUTH VALLEY WATER RECLAMATION FACILITY

By:_____

Title:_____

Attest:

_____

Title:_____

_____(Contractor)_____, Assignee, on this _____ day of _____, 2023, hereby accepts the assignment of the above-described Purchase Orders, subject to the terms and conditions thereof and in accordance with the terms of this Assignment.

ASSIGNEE:

By:_____

Title:_____

SECTION 00610 - PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____ as CONTRACTOR,

and _____ as Surety,

are held and firmly bound unto South Valley Water Reclamation Facility hereinafter called "OWNER," in the sum of _____ dollars,

for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH that said CONTRACTOR has been awarded and is about to enter into the annexed Agreement with said OWNER to perform the WORK as specified or indicated in the Contract Documents entitled “South Valley Water Reclamation Facility - 2023 VFD Replacement Project”.

NOW THEREFORE, if said CONTRACTOR shall perform all the requirements of said Contract Documents required to be performed on its part, at the times and in the manner specified therein, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

PROVIDED, that any alterations in the WORK to be done or the materials to be furnished, or changes in the time of completion, which may be made pursuant to the terms of said Contract Documents, shall not in any way release said CONTRACTOR or said Surety hereunder, nor shall any extensions of time granted under the provisions of said Contract Documents, release either said CONTRACTOR or said Surety, and notice of such alterations or extensions of the Agreement is hereby waived by said Surety.

IN WITNESS WHEREOF, we have hereunder set our hands this_____day of_____, 20___.

(SEAL)	(SEAL)
_____	_____
(CONTRACTOR)	(Surety)
By: _____	By:_____
(Signature and SEAL)	(Signature and SEAL)

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

SECTON 00620 – PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____ as CONTRACTOR,

and _____ as Surety,

are held and firmly bound unto South Valley Water Reclamation Facility hereinafter called "OWNER," in the sum of _____ dollars, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH that said CONTRACTOR has been awarded and is about to enter into the annexed Agreement with said OWNER to perform the WORK as specified or indicated in the Contract Documents entitled "South Valley Water Reclamation Facility - 2023 VFD Replacement Project".

NOW THEREFORE, if said CONTRACTOR, or subcontractor, fails to pay for any materials, equipment, or other supplies, or for rental of same, used in connection with the performance of work contracted to be done, or for amounts due under applicable State law for any work or labor thereon, said Surety will pay for the same in an amount not exceeding the sum specified above, and, in the event suit is brought upon this bond, reasonable attorney's fees to be fixed by the court. This bond shall inure to the benefit of any persons, companies, or corporations entitled to file claims under applicable State law so as to give a right of action to them or their assigns in any suit brought upon this bond.

PROVIDED, that any alterations in the WORK to be done or the materials to be furnished, or changes in the time of completion, which may be made pursuant to the terms of said Contract Documents, shall not in any way release said CONTRACTOR or said Surety thereunder, nor shall any extensions of time granted under the provisions of said Contract Documents release either said CONTRACTOR or said Surety, and notice of such alterations or extensions of the Agreement is hereby waived by said Surety.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this_____ day of _____, 20____.

_____(SEAL) _____(SEAL)
(CONTRACTOR) (Surety)

By: _____ By: _____
(Signature) (Signature and SEAL)

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

- END OF BID FORMS -

SECTION 00700
GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents and printed with initial or all capital letters, the following terms have the meanings indicated:

Addenda - Written or graphic instruments issued prior to the opening of Bids which make additions, deletions, or revisions to the Contract Documents.

Agreement - The written contract between the OWNER and the CONTRACTOR for the performance of the WORK pursuant to the Contract Documents. Documents incorporated into the contract by reference become part of the contract and of the Agreement.

Application for Payment - The form furnished by the ENGINEER and completed by the CONTRACTOR to request progress or final payment including supporting documentation to substantiate the amounts for which payment is requested.

Bid - The offer or proposal of a Bidder, submitted on the prescribed form, setting forth the price or prices for the WORK to be performed.

Bidder - Any person, firm or corporation submitting a Bid for the WORK.

Bonds - Bid, Performance and Payment Bonds and other instruments which protect the OWNER against loss due to inability or refusal of the CONTRACTOR to perform pursuant to the Contract Documents.

Change Order - A document recommended by the OWNER'S REPRESENTATIVE, which is signed by the CONTRACTOR and the OWNER and authorizes an addition, deletion, or revision in the WORK, or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.

Contract Documents - The documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the WORK, consisting of the Drawings, Technical Specifications, General Conditions, Supplementary General Conditions, Notice Inviting Bids, Instructions to Bidders, Addenda, CONTRACTOR's Bid, Information Required of Bidder, Agreement, Performance Bond, Payment Bond, Notice To Proceed and Change Orders. Only printed or hard copies of the documents listed above are Contract Documents.

Contract Price - The total monies payable by the OWNER to the CONTRACTOR for completion of the WORK under the terms and conditions of the Contract Documents.

Contract Time - The number of successive Days or the date stated in the Contract Documents for Substantial Completion of the WORK. The Contract Time begins to run on the date specified in the Notice to Proceed.

CONTRACTOR - The person, firm, or corporation with whom the OWNER has executed the Agreement.

Day - A calendar day of 24 hours measured from midnight to the next midnight.

Defective Work - Work that: is unsatisfactory, faulty, or deficient; does not conform to the Contract Documents; does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents; has been damaged prior to the ENGINEER's recommendation of final payment.

Drawings - The drawings, plans, maps, profiles, diagrams, and other graphic representations which show the character, location, nature, extent, and scope of the WORK.

Effective Date of the Agreement - The date indicated in the Agreement on which it was executed.

ENGINEER - The person, firm or corporation named as such in the Contract Documents.

Field Order - A written order issued by the OWNER which requires minor changes in the WORK, but which does not involve a change in the Contract Price or Contract Time.

General Requirements - Division 1 of the Technical Specifications.

Laws and Regulations; Laws or Regulations - Includes any and all applicable state, federal and local statutes, common law, rules, regulations, ordinances, codes, and/or orders.

Notice of Award - The OWNER's written notice to the apparent successful Bidder stating that upon compliance with the conditions precedent enumerated therein by the apparent successful Bidder within the time specified, the OWNER will enter into the Agreement.

Notice to Proceed - The OWNER's written notice to the CONTRACTOR authorizing the CONTRACTOR to proceed with the work and establishing the date of commencement of the Contract Time.

OWNER - SOUTH VALLEY WATER RECLAMATION FACILITY.

OWNER'S REPRESENTATIVE - The authorized representative of the OWNER who is assigned to the site or any part thereof.

Partial Utilization - Placing a portion of the WORK in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion of the WORK.

Project - A unit of total construction of which the WORK to be provided under the Contract Documents, may be the whole, or a part thereof.

Shop Drawings - All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for the CONTRACTOR to illustrate some portion of WORK and all illustrations, brochures, standard schedules, performance charts, instruction, and diagrams to illustrate material or equipment for some portion of the WORK.

Specifications - (Same definition as for Technical Specifications hereinafter).

Subcontractor - An individual, firm, or corporation having a direct contract with the CONTRACTOR or with any other Subcontractor for the performance of a part of the WORK.

Substantial Completion - That state of construction when the WORK has progressed to the point where, in the opinion of the OWNER as evidenced by the Notice of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the WORK can be

utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to any work refer to substantial completion thereof.

Supplementary General Conditions - The part of the Contract Documents which makes additions, deletions, or revisions to these General Conditions.

Supplier - A manufacturer, fabricator, supplier, distributor, materialman, or vendor.

Technical Data - The factual information contained in reports describing physical conditions, including: exploration method, plans, logs, laboratory test methods and factual data. Technical Data does not include conclusions, interpretations, interpolations, extrapolations or opinions contained in reports or reached by the CONTRACTOR.

Technical Specifications - Those portions of the Contact Documents consisting of the General Requirements and written technical descriptions of products and execution of the WORK.

Underground Utilities - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments and any encasements containing such facilities which have been installed under ground to furnish any of the following services or materials: water, sewage and drainage removal, electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, traffic, or other control systems.

WORK - The entire construction required to be furnished under the Contract Documents. WORK is the result of performing services, furnishing labor and supervision, and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

ARTICLE 2 - PRELIMINARY MATTERS

2.01 DELIVERY OF BONDS/INSURANCE CERTIFICATES

A. The CONTRACTOR shall deliver to the OWNER the Bonds and insurance certificates required by the Contract Documents within ten (10) days after receiving the Notice of Award from the OWNER.

2.02 COPIES OF DOCUMENTS

A. The OWNER shall furnish the CONTRACTOR five copies of the Contract Documents (Specifications and reduced Drawings), together with two sets of full-scale Drawings. Additional quantities of the Contract Documents will be furnished at reproduction cost.

2.03 STARTING THE PROJECT

A. The CONTRACTOR shall begin construction of the WORK within 10 days after the commencement date stated in the Notice to Proceed, but shall not commence construction prior to the commencement date.

2.04 BEFORE STARTING CONSTRUCTION

A. Before undertaking each part of the WORK, the CONTRACTOR shall carefully study and compare the Contract Documents to check and verify pertinent figures and dimensions shown thereon with all applicable field measurements. The CONTRACTOR shall promptly report in writing to the OWNER any conflict, error, or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from the OWNER before proceeding with any work affected thereby.

B. The CONTRACTOR shall submit to the OWNER for review those documents called for under the Section entitled “Contractor Submittals” in the General Requirements.

2.05 PRECONSTRUCTION CONFERENCE

A. The CONTRACTOR shall attend a preconstruction conference with the OWNER, the ENGINEER and others as appropriate to discuss the construction of the WORK in accordance with the Contract Documents.

2.06 FINALIZING SCHEDULES

A. At least 7 days before the CONTRACTOR's submittal of its first Application for Payment, the CONTRACTOR, the OWNER, and others as appropriate will meet to finalize the schedules submitted in accordance with the General Requirements.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 INTENT

A. The Contract Documents comprise the entire agreement between OWNER and CONTRACTOR concerning the WORK. The Contract Documents are complementary, what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.

B. It is the intent of the Contract Documents to describe the WORK, as completely as possible and in a functional manner. The WORK is intended to be constructed in accordance with the Contract Documents. All work, materials, or equipment that may be reasonably inferred from the Contract Documents as being required to produce the completed work shall be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe work, materials, or equipment such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals, or codes or any technical society, organization, or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual, or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of the OWNER, the CONTRACTOR, or the ENGINEER or any of their consultants, agents, or employees from those set forth in the Contract Documents.

C. If, during the performance of the WORK, the CONTRACTOR finds a conflict, error or discrepancy in the Contract Documents, the CONTRACTOR shall immediately report it to the OWNER in writing and before proceeding with the work affected thereby. The OWNER shall then make a written interpretation, clarification, or correction.

3.02 ORDER OF PRECEDENCE OF CONTRACT DOCUMENTS

A. In resolving issues resulting from conflicts, errors, or discrepancies in any of the Contract Documents, or the order of precedence shall be as follows:

1. Change Orders
2. Agreement
3. Addenda
4. Supplementary General Conditions
5. General Conditions
6. Technical Specifications
7. Referenced Standard Specifications
8. Drawings
9. Contractor's Bid (Bid Form).

B. With reference to the Drawings the order of precedence is as follows:

1. Figures govern over scaled dimensions
2. Detail drawings govern over general drawings
3. Addenda/change order drawings govern over general drawings

4. Contract Drawings govern over standard drawings.

3.03 AMENDING AND SUPPLEMENTING CONTRACT DOCUMENTS

A. The Contract Documents may be amended by a Change Order (pursuant to Article 10) to provide for additions, deletions or revisions in the WORK or to modify terms and conditions.

3.04 REUSE OF DOCUMENTS

A. Neither the CONTRACTOR, Subcontractor, Supplier, nor any other person or organization performing any of the WORK under a contract with the OWNER shall have or acquire any title to or ownership rights in any of the Drawings, Technical Specifications, or other documents used on the WORK, and they shall not reuse any of them on the extensions of the Project or any other project without the written consent of the OWNER and the ENGINEER.

ARTICLE 4 - AVAILABILITY OF LANDS: PHYSICAL CONDITIONS, REFERENCE POINTS

4.01 AVAILABILITY OF LANDS

A. The OWNER shall furnish the lands, rights-of-way and easements upon which the WORK is to be performed and for access thereto, together with other lands designated for the use of the CONTRACTOR in the Contract Documents. Easements for permanent structures or permanent changes in existing major facilities will be obtained and paid for by the OWNER, unless otherwise provided in the Contract Documents. Nothing contained in the Contract Documents shall be interpreted as giving the CONTRACTOR exclusive occupancy of the lands or rights-of-way provided. The CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment. The CONTRACTOR shall not enter upon nor use any property not under the control of the OWNER until a written temporary construction easement agreement has been executed by the CONTRACTOR and the property owner, and a copy of the easement furnished to the ENGINEER prior to its use. Neither the OWNER nor the ENGINEER shall be liable for any claims or damages resulting from the CONTRACTOR's unauthorized trespass or use of any properties.

4.02 PHYSICAL CONDITIONS - SUBSURFACE AND EXISTING STRUCTURES

A. Explorations and Reports: The Supplementary General Conditions may identify exploration reports and subsurface conditions tests at the site that have been utilized by the OWNER in the preparation of the Contract Documents. The CONTRACTOR may rely upon the accuracy of the Technical Data contained in these reports. The CONTRACTOR is responsible for the interpretation, extrapolation or interpolation of all technical as well as nontechnical data and its reliance on the completeness, opinions and interpretation of the reports.

B. Existing Structures: The Supplementary General Conditions identify the drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Utilities referred to in Paragraph 4.04 herein) which are at or contiguous to the site that have been utilized by the OWNER in the preparation of the Contract Documents. The CONTRACTOR is responsible for the interpretation, extrapolation or

interpolation of all technical as well as nontechnical data and its reliance on the completeness, opinions and interpretation of the reports.

4.03 DIFFERING SITE CONDITIONS

A. The CONTRACTOR shall notify the OWNER upon encountering any of the following unforeseen conditions, hereinafter called "differing site conditions," during the prosecution of the WORK. The CONTRACTOR's notice to the OWNER shall be in writing and delivered before the differing site conditions are disturbed, but in no event later than 14 days after their discovery.

1. Subsurface or latent physical conditions at the site of the WORK which could not reasonably have been discovered through diligent inspection by CONTRACTOR before his Bid was submitted which differs materially from those indicated, described, or delineated in the Contract Documents including those reports and documents discussed in Paragraph 4.02; and

2. Physical conditions at the site of the WORK of an unusual nature which could not reasonably have been discovered through diligent inspection by CONTRACTOR before his Bid was submitted and which differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents including those reports and documents discussed in Paragraph 4.02.

B. The OWNER will review the alleged differing site conditions; determine the necessity of obtaining additional explorations or tests with respect to verifying their existence and extent.

C. If the OWNER concludes that because of newly discovered conditions a change in the Contract Documents is required, a Change Order will be issued as provided in Article 10 to reflect and document the consequences of the differing site conditions.

D. In each such case, an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, or any combination thereof, will be allowable to the extent that they are attributable to the differing site conditions. If the OWNER and the CONTRACTOR are unable to agree as to the amount or length of the Change Order, a claim may be made as provided in Articles 11 and 12.

E. The CONTRACTOR's failure to give written notice of differing site conditions within 14 days of their discovery and before they are disturbed shall constitute a waiver of all claims in connection therewith, whether direct or consequential in nature.

4.04 PHYSICAL CONDITIONS - UNDERGROUND UTILITIES

A. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Utilities at or contiguous to the site are based on information and data furnished to the OWNER by the owners of Underground Utilities or by others. Unless it is expressly provided in the Supplementary General Conditions, the OWNER and the ENGINEER shall not be responsible for the accuracy or completeness of any Underground Utilities information or data. The CONTRACTOR's responsibility relating to underground utilities are: review and check all information and

data, locate all Underground Utilities shown or indicated in the Contract Documents, coordinate the WORK with the owners of Underground Utilities during construction, safeguard and protect the Underground Utilities, and repair any damage to Underground Utilities resulting from the WORK. The cost of all these activities will be considered as having been included in the Contract Price.

B. Not Shown or Indicated: If an Underground Utility not shown or indicated in the Contract Documents is uncovered or revealed at or contiguous to the site and which the CONTRACTOR could not reasonably have been expected to be aware of, the CONTRACTOR shall identify the owner of the Underground Utility, give written notice of the location to that owner and notify the OWNER.

4.05 REFERENCE POINTS

A. The OWNER will provide one benchmark, near or on the site of the WORK, and will provide two points near or on the site to establish a base line for use by the CONTRACTOR in laying out the WORK. Unless otherwise specified in the General Requirements, the CONTRACTOR shall furnish all other lines, grades, and benchmarks required for proper execution of the WORK.

B. The CONTRACTOR shall preserve all benchmarks, stakes, and other survey marks. In case of their removal or destruction by its own employees or by its subcontractor's employees, the CONTRACTOR shall be responsible for the accurate replacement of reference points by professionally qualified personnel at no additional cost to the OWNER.

ARTICLE 5 - BONDS AND INSURANCE

5.01 PERFORMANCE, PAYMENT AND OTHER BONDS

A. The CONTRACTOR shall furnish Performance and Payment Bonds, each in the amount of 100% of the Contract Price as security for the faithful performance and payment of all the CONTRACTOR's obligations under the Contract Documents. The Performance Bond shall remain in effect at least until one year after the date of Notice of Completion, except as otherwise provided by Law or Regulation or by the Contract Documents. After the OWNER issues the Notice of Completion, the amount of the Performance Bond may be reduced to 10 percent of the Contract Price, or $1,000, whichever is greater. The CONTRACTOR shall also furnish such other Bonds as are required by the Supplementary General Conditions. The OWNER, at its sole discretion, may waive bond requirements for work not exceeding $50,000.

B. If the surety on any Bond furnished by the CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the WORK is located, the CONTRACTOR shall within 7 days after written approval by the OWNER of a substitute Bond and Surety substitute the approved Bond and Surety.

5.02 INSURANCE

A. The CONTRACTOR shall purchase and maintain the insurance required under this paragraph. This insurance shall include the specific coverages set out herein and be written for not less than the limits of liability and coverages provided in the Supplementary General Conditions, or required by law, whichever is greater. The CONTRACTOR's

liabilities under the Agreement shall not be deemed limited in any way to the insurance coverage required.

B. The CONTRACTOR shall furnish the OWNER with certificates indicating the type, amount, class of operations covered, effective dates and expiration dates of all policies. All insurance policies purchased and maintained (or the certificates or other evidence thereof) shall contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 30 days' prior written notice has been given to the OWNER by certified mail. Contract or certificate terms which state that reasonable efforts will be made to notify the OWNER prior to cancellation, change or renewal of the policy are not acceptable. All insurance shall remain in effect until the OWNER issues the Notice of Final Completion and at all times thereafter when the CONTRACTOR may be correcting, removing, or replacing defective work in accordance with Paragraph 13.01B or completing punch list items required by the Notice of Substantial Completion. In addition, the insurance required herein (except for Worker's Compensation and Employer's Liability) shall name the OWNER, the ENGINEER, and their officers, agents, and employees as "additional insured" under the policies. All liability insurance policies shall be occurrence and not claims made policies.

1. Workers' Compensation and Employer's Liability: This insurance shall protect the CONTRACTOR against all claims under applicable state workers' compensation laws. The CONTRACTOR shall also be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of a workers' compensation law. This policy shall include an "all states" endorsement. The CONTRACTOR shall require each subcontractor similarly to provide Workers' Compensation Insurance for all of the latter's employees to be engaged in the WORK unless its employees are covered by the protection afforded by the CONTRACTOR's Workers' Compensation Insurance. In the event a class of employees is not protected under the Workers' Compensation Statute, the CONTRACTOR or Subcontractor, as the case may be, shall provide adequate employer's liability insurance for the protection of its employees not protected under the statute.

2. Comprehensive General Liability: This insurance shall be written in comprehensive form and shall protect the CONTRACTOR against all claims arising from injuries to persons other than its employees and damage to property of the OWNER or others arising out of any act or omission of the CONTRACTOR or its agents, employees or subcontractors. The policy shall include the following endorsements: (1) Protective Liability endorsement to insure the contractual liability assumed by the CONTRACTOR under the indemnification provisions in these General Conditions; (2) Broad Form Property Damage endorsement; (3) Personal Injury endorsement to cover personal injury liability for intangible harm. The Comprehensive General Liability coverage shall contain no exclusion relative to blasting, explosion, collapse of building, or damage to underground structures.

3. Comprehensive Automobile Liability: This insurance shall be written in comprehensive form. The policy shall protect the CONTRACTOR against all claims for injuries to employees, members of the public and damage to property of others arising from the use of CONTRACTOR's motor vehicles, whether they are owned, non-owned, or hired, and whether used or operated on or off the site. The motor vehicle insurance required under this paragraph shall include: (a) motor

vehicle liability coverage; (b) personal injury protection coverage and benefits; (c) uninsured motor vehicle coverage; and (d) underinsured motor vehicle coverage.

4. Subcontractor's Insurance: The CONTRACTOR shall require each of its subcontractors to procure and to maintain Comprehensive General Liability Insurance and Comprehensive Automobile Liability Insurance of the type and in the amounts specified in the Supplementary General Conditions or insure the activities of its subcontractors in the CONTRACTOR's own policy, in like amount.

5. Builder's Risk: This insurance shall be of the "all risk" type, shall be written in completed value form, and shall protect the CONTRACTOR, the OWNER, and the ENGINEER against damage to buildings, structures, materials and equipment. The amount of this insurance shall not be less than the insurable value of the WORK at completion. Builder's risk insurance shall provide for losses to be payable to the CONTRACTOR, the OWNER, and the ENGINEER as their interests may appear. The policy shall contain a provision that in the event of payment for any loss under the coverage provided, the insurance company shall have no rights of recovery against the CONTRACTOR, the OWNER, or the ENGINEER. The Builder's Risk policy shall insure against all risks of direct physical loss or damage to property from any external cause including flood and earthquake. Allowable exclusions, if any, shall be as specified in the Supplementary General Conditions.

ARTICLE 6 - CONTRACTOR RESPONSIBILITIES

6.01 SUPERVISION AND SUPERINTENDENCE

A. The CONTRACTOR shall supervise and direct the WORK competently and efficiently, devoting the attention and applying the skills and expertise necessary to perform the WORK in accordance with the Contract Documents. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incidental thereto. The CONTRACTOR shall be responsible to see that the finished WORK complies accurately with the Contract Documents.

B. The CONTRACTOR shall employ the superintendent named in "Information Required of Bidder" on the work site at all times during the progress of the WORK. The superintendent shall not be replaced without the OWNER's written consent. The superintendent will be the CONTRACTOR's representative at the site and shall have authority to act on behalf of the CONTRACTOR. All communications given to the superintendent shall be as binding as if given to the CONTRACTOR. The CONTRACTOR shall issue all its communications to the OWNER.

C. The CONTRACTOR's superintendent, or OWNER approved representative shall be present at the site of the WORK at all times while work is in progress. Failure to observe this requirement shall be considered suspension of the WORK by the CONTRACTOR until the superintendent is again present at the site.

6.02 LABOR, MATERIALS, AND EQUIPMENT

A. The CONTRACTOR shall provide skilled, competent and suitably qualified personnel to survey and lay out the WORK and perform construction as required by the Contract Documents. The CONTRACTOR shall at all times maintain good discipline and order at the site.

B. Except in connection with the safety or protection of persons at the WORK, or property at the site or adjacent thereto, all work at the site shall be performed during regular working hours (7:00 a.m. - 6:00 p.m., Monday through Friday), and the CONTRACTOR will not permit overtime work or the performance of work on Saturday, Sunday or any legal holiday observed by the OWNER without the OWNER's written consent given after prior written notice to the OWNER. Except as otherwise provided in this Paragraph, the CONTRACTOR shall receive no additional compensation for overtime work, i.e., work in excess of 8 hours in any one calendar day or 40 hours in any one calendar week, even though such overtime work may be required under emergency conditions and may be ordered by the OWNER in writing. Additional compensation will be paid the CONTRACTOR for overtime work in the event extra work is ordered by the OWNER and the Change Order specifically authorizes the use of overtime work, but only to the extent that the CONTRACTOR pays overtime wages on a regular basis being paid (>40 hours per week) for overtime work of a similar nature in the same locality.

C. All costs of inspection and testing performed during overtime work approved solely for the convenience of the CONTRACTOR shall be borne by the CONTRACTOR. The OWNER shall have the authority to deduct the costs of all inspection and testing from any partial payments otherwise due to the CONTRACTOR.

D. Unless otherwise specified in the Contract Documents, the CONTRACTOR shall furnish, erect, maintain and remove the construction plant, and temporary works and assume full responsibility for all materials, equipment, labor, transportation, construction equipment, machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities and all other facilities and incidentals necessary for the furnishing, performance testing, start-up and completion of the WORK.

E. All materials and equipment incorporated into the WORK shall be of new and good quality, except as otherwise provided in the Contract Documents. If required by the OWNER, the CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. The CONTRACTOR shall apply, install, connect, erect, use, clean, and condition all material and equipment in accordance with the instructions of the manufacturer and Supplier except as otherwise provided in the Contract Documents.

6.03 ADJUSTING PROGRESS SCHEDULE

A. The CONTRACTOR shall submit any adjustments in the progress schedule to the OWNER for acceptance in accordance with the provisions for "Contractor Submittals" in the General Requirements.

6.04 SUBSTITUTES AND "OR-EQUAL" ITEMS

A. The CONTRACTOR shall submit proposed substitutes and "or-equal" items in accordance with the provisions for "Contractor Submittals" in the General Requirements.

6.05 SUBCONTRACTORS, SUPPLIERS, AND OTHERS

A. The CONTRACTOR shall be responsible to the OWNER and the ENGINEER for the acts and omissions of its subcontractors and their employees to the same extent as the CONTRACTOR is responsible for the acts and omissions of its own employees. Nothing contained in this paragraph shall create any contractual relationship between any subcontractor and the OWNER or the ENGINEER nor relieve the CONTRACTOR of any liability or obligation under the Agreement.

6.06 PERMITS

A. Unless otherwise provided in the Supplementary General Conditions, the CONTRACTOR shall obtain and pay for all construction permits and licenses from the agencies having jurisdiction, including furnishing the insurance and bonds required by such agencies. The costs incurred by the CONTRACTOR in compliance with this paragraph shall not be made the basis for claims for additional compensation. The OWNER shall assist the CONTRACTOR, when necessary, in obtaining such permits and licenses. The CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the WORK, which are applicable at the time of opening of Bids, including all utility connection charges for utilities required by the WORK.

B. The CONTRACTOR shall pay all license fees and royalties and assume all costs when any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others when issued in the construction of the WORK or incorporated into the WORK. If a particular invention, design, process, product, or device is specified in the Contract Documents for incorporation into or use in the construction of the WORK and if to the actual knowledge of the OWNER or the ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of these rights shall be disclosed by the OWNER in the Contract Documents. The CONTRACTOR shall indemnify, defend and hold harmless the OWNER and the ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, damages, losses, and expenses (including attorneys' fees and court costs) arising out of any infringement of patent rights or copyrights incident to the use in the performance of the WORK or resulting from the incorporation in the WORK of any invention, design, process, product, or device not specified in the Contract Documents.

6.07 LAWS AND REGULATIONS

A. The CONTRACTOR shall observe and comply with all Laws and Regulations which in any manner affect those engaged or employed on the WORK, the materials used in the WORK, or the conduct of the WORK. If any discrepancy or inconsistency should be discovered in the Contract Documents in relation to any Laws or Regulations, the CONTRACTOR shall report the same in writing to the OWNER. Notwithstanding any immunity otherwise provided by applicable workers' compensation statutes, the CONTRACTOR shall indemnify, defend and hold harmless the OWNER, the ENGINEER and their officers, agents, and employees against all claims arising from violation of any

Laws or Regulations, by CONTRACTOR or by its employees or subcontractors. This indemnity provision is intended to provide the greatest protection of the OWNER and ENGINEER allowed by law. Any particular law or regulation specified or referred to elsewhere in the Contract Documents shall not in any way limit the obligation of the CONTRACTOR to comply with all other provisions of federal, state, and local laws and regulations.

6.08 EQUAL OPPORTUNITY

A. The CONTRACTOR agrees not to discriminate against anyone because of race, national origin, ancestry, color, religion, sex, age, or disability. The CONTRACTOR agrees to abide by all applicable civil rights Laws and Regulations.

6.09 TAXES

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

6.10 USE OF PREMISES

A. The CONTRACTOR shall confine construction equipment, stored materials and equipment, and other operations of workers to (1) the Project site, (2) the land and areas identified for the CONTRACTOR's use in the Contract Documents, and (3) other lands whose use is acquired by Laws and Regulations, rights-of-way, permits, and easements. The CONTRACTOR shall be fully responsible to the owner and occupant of such lands for any damage to the lands or areas contiguous thereto, resulting from the performance of the WORK or otherwise. Should any claim be made against the OWNER or the ENGINEER by owner or occupant of lands because of the performance of the WORK, the CONTRACTOR shall promptly settle the claim by agreement, or resolve the claim through litigation. The CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify, defend, and hold the OWNER and the ENGINEER harmless from and against all claims, damages, losses, and expenses (including, but not limited to, fees of engineers, architects, attorneys, and other professionals and court costs) arising directly, indirectly, or consequentially out of any action, legal or equitable, brought by any owner or occupant of land against the OWNER or the ENGINEER to the extent the claim is based or arises out of the CONTRACTOR's performance of the WORK.

6.11 SAFETY AND PROTECTION

A. The CONTRACTOR shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the WORK. The CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. All persons on or near the work site and other persons and organizations who may be affected by activities on or near the work site.

2. All the WORK and materials and equipment to be incorporated therein, whether in storage on or off the site; and

3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

B. The CONTRACTOR shall comply with all applicable Laws and Regulations (whether referred to herein or not) of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss and shall erect and maintain all necessary safeguards for such safety and protection. The CONTRACTOR shall notify owners of adjacent property and utilities when prosecution of the WORK may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Unless the CONTRACTOR otherwise designates in writing a different individual as the responsible individual, the CONTRACTOR's superintendent shall be CONTRACTOR's representative at the site whose duties shall include providing all persons on the work site with a reasonably safe environment and the prevention of accidents.

6.12 SHOP DRAWINGS AND SAMPLES

A. After checking and verifying all field measurements and after complying with the applicable procedures specified in the General Requirements, the CONTRACTOR shall submit all shop drawings to the OWNER for review and approval in accordance with the approved schedule for shop drawing submittals specified in the General Requirements.

B. The CONTRACTOR shall also submit to the OWNER for review and approval all samples in accordance with the approved schedule of sample submittals specified in the General Requirements.

C. Before submitting shop drawings or samples, the CONTRACTOR shall determine and verify all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar data with respect thereto and review or coordinate each shop drawing or sample with other shop drawings and samples and with the requirements of the WORK and the Contract Documents. The CONTRACTOR shall stamp each shop drawing, certifying his review. If the same shop drawings require re-submittal more than two times, the CONTRACTOR shall pay for the costs of ENGINEER’s and OWNER’s subsequent review(s).

6.13 CONTINUING THE WORK

A. The CONTRACTOR shall carry on the WORK and adhere to the progress schedule during all disputes or disagreements with the OWNER. No work shall be delayed or postponed pending resolution of any dispute or disagreement, except as the CONTRACTOR and the OWNER may otherwise mutually agree in writing.

6.14 INDEMNIFICATION

A. To the fullest extent permitted by Laws and Regulations, and notwithstanding any immunity the CONTRACTOR might otherwise have under applicable workers’ compensation statutes, the CONTRACTOR shall indemnify, defend, and hold harmless the OWNER, the ENGINEER, and their officers, agents, and employees, against and from all claims and liability arising under or by reason of, or claimed by others to arise under or

by reason of, the Agreement or any performance of the WORK, but not from the sole negligence or willful misconduct of the OWNER and/or the ENGINEER. Such indemnification by the CONTRACTOR shall include but not be limited to the following:

1. Liability or claims resulting in whole or in part, directly or indirectly from, or claimed by others to result in whole or in part, directly or indirectly from, the negligence, carelessness or other fault of the CONTRACTOR or its employees, Subcontractors, Suppliers or agents in the performance of the WORK, or in guarding or maintaining the same, or from any improper materials, implements, or appliances used in its construction;

2. Liability or claims arising in whole or in part, directly or indirectly, from or based on, or claimed by others to arise in whole or in part, directly or indirectly, from or based on, the violation of any Laws or Regulations by the CONTRACTOR or its employees, Subcontractors, Suppliers or agents;

3. Liability or claims arising in whole or in part, directly or indirectly, from, or claimed by others to arise in whole or in part, directly or indirectly from, the use or manufacture by the CONTRACTOR, or its Subcontractors, Suppliers or agents in the performance of this Agreement of any copyrighted or uncopyrighted composition, secret process, patented or unpatented invention, article, or appliance, unless otherwise specifically stipulated in this Agreement.

4. Liability or claims arising in whole or in part, directly or indirectly, from, or claimed by others to arise in whole or in part, directly or indirectly from, the breach of any warranties, whether express or implied, made by the CONTRACTOR or its Subcontractors, Suppliers or agents;

5. Liabilities or claims arising in whole or in part, directly or indirectly, from, or claimed by others to arise in whole or in part, directly or indirectly from, the willful misconduct of the CONTRACTOR or its Subcontractors, Suppliers or agents; and,

6. Liabilities or claims arising in whole or in part, directly or indirectly, from, or claimed by others to arise in whole or in part, directly or indirectly from, any breach of the obligations assumed herein by the CONTRACTOR or its Subcontractors, Suppliers or agents.

7. If for any reason the OWNER is required to pay damages in proportion to the fault of the OWNER notwithstanding the above indemnity provisions, CONTRACTOR shall, notwithstanding any workers' compensation immunity, indemnify and hold OWNER harmless from the payment of any increased damages OWNER is required to pay which result from a reapportionment of the fault of the CONTRACTOR, or any of its employees, Subcontractors or Suppliers pursuant to Utah Code Annotated section 78b-5-818, Comparative negligence.

B. The CONTRACTOR shall reimburse the OWNER, and the ENGINEER for all costs and expense, (including but not limited to fees and charges of engineers, architects, attorneys, and other professional and court costs) incurred by the OWNER, and the ENGINEER in enforcing the provisions of this Paragraph.

C. The indemnification obligation under this Paragraph shall not be limited in any way by any limitation of the amount or type of damages, compensation, or benefits payable by or for the CONTRACTOR or any such subcontractor or other person or organization under workers' compensation acts, disability benefit acts, or other employee benefit acts.

6.15 CONTRACTOR'S DAILY REPORTS

A. The CONTRACTOR shall complete a daily report indicating manpower, major equipment, subcontractors, weather conditions, etc., involved in the performance of the WORK. The daily report shall be completed on forms prepared by the CONTRACTOR and acceptable to the OWNER, and shall be submitted to the OWNER at the conclusion of each workday.

6.16 ASSIGNMENT OF CONTRACT

A. The CONTRACTOR shall not assign, sublet, sell, transfer, or otherwise dispose of the Agreement or any portion thereof, or its right, title, or interested therein, or obligations thereunder, without the written consent of the OWNER except as imposed by law. If the CONTRACTOR violates this provision, the Agreement may be terminated at the option of the OWNER. In such event, the OWNER shall be relieved of all liability and obligations to the CONTRACTOR and to its assignee or transferee, growing out of such termination.

ARTICLE 7 - OTHER WORK

7.01 RELATED WORK

A. The OWNER may perform other work related to the Project at the site by the OWNER's own forces, have other work performed by utility owners, or let other direct contracts for the performance of the other work which may contain General Conditions similar to these. If the fact that such other work is to be performed was not noted in the Contract Documents written notice thereof will be given to the CONTRACTOR prior to commencing any other work.

B. The CONTRACTOR shall afford each utility owner and other contractor who is a party to a direct contract (or the OWNER, if the OWNER is performing the additional work with the OWNER's employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of the other work. The CONTRACTOR shall properly connect and coordinate the WORK with the other work. The CONTRACTOR shall do all cutting, fitting, and patching of the WORK that may be required to make its several parts come together properly and integrate with the other work. The CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and shall only cut or alter their work with the written consent of the OWNER and the others whose work will be affected.

C. If the proper execution or results of any part of the CONTRACTOR's work depends upon the integration of work with the completion of other work by any other contractor or utility owner (or the OWNER), the CONTRACTOR shall inspect and report to the OWNER in writing all delays, defects, or deficiencies in the other work that renders it unavailable or unsuitable for proper integration with the CONTRACTOR's work. Except for the results or effects of material latent defects and deficiencies in the other work which could not reasonably have been discovered by the CONTRACTOR, the CONTRACTOR's failure to report will constitute an acceptance of the other work as fit and proper for integration

with the CONTRACTOR's work and as a waiver of any claim for additional time or compensation associated with the integration of the CONTRACTOR's work with the other work.

7.02 COORDINATION

A. If the OWNER contracts with others for the performance of other work on the Project at the site, a coordinator will be identified to the extent that the coordinator can be identified at this time, in the Supplementary General Conditions and delegated the authority and responsibility for coordination of the activities among the various contractors. The specific matters over which the coordinator has authority and the extent of the coordinator's authority and responsibility will be itemized in the Supplementary General Conditions or in a notice to the CONTRACTOR at such time as the identity of the coordinator is determined.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 COMMUNICATIONS

A. The OWNER shall issue all its communications directly to the CONTRACTOR.

8.02 PAYMENTS

A. The OWNER shall make payments to the CONTRACTOR as provided in Article 14.

8.03 LANDS, EASEMENTS, AND SURVEYS

A. The OWNER's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. The OWNER shall identify and make available to the CONTRACTOR copies of exploration reports and subsurface conditions tests at the site and in existing structures which have been utilized in preparing the Drawings and Technical Specifications as set forth in Paragraph 4.02

8.04 CHANGE ORDERS

A. The OWNER shall execute approved Change Orders for the conditions described in Paragraph 10.01D.

B. When funds are not budgeted to support continuation of performance in a subsequent fiscal period, the contract shall be canceled and the contractor shall be reimbursed for the reasonable value of any non-recurring costs incurred but not amortized in the price of the supplies or services delivered under the contract.

8.05 INSPECTIONS AND TESTS

A. The OWNER's responsibility with respect to inspection, tests, and approvals is set forth in Paragraph 13.03B.

8.06 SUSPENSION OF WORK

A. In connection with the OWNER's right to stop work or suspend work, see Paragraphs 13.04 and 15.01, Paragraphs 15.02 and 15.03 deal with the OWNER's right to terminate services of the CONTRACTOR under certain circumstances.

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 OWNER'S REPRESENTATIVE

A. The OWNER will designate a representative during the construction period. The duties, responsibilities and the limitations of authority of the OWNER's representative during construction are summarized hereafter.

9.02 VISITS TO SITE

A. The ENGINEER will make visits to the site during construction to observe and inspect the progress and quality of the WORK and to determine, in general if the WORK is proceeding in accordance with the Contract Documents.

9.03 PROJECT REPRESENTATIVE

A. The OWNER'S Representative will observe and inspect the performance of the WORK. The Owner's Representative and/or other authorized agents of the OWNER shall serve as the primary contact(s) with the Contractor during the construction phase. All submittals shall be delivered to, and communications between the OWNER and the CONTRACTOR shall be handled by, the Owner's Representative and/or other authorized agents. The Owner's Representative shall be the primary authorized representative of the OWNER in all on-site relations with the CONTRACTOR.

9.04 CLARIFICATIONS AND INTERPRETATIONS

A. The OWNER will issue, with reasonable promptness written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as the OWNER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents.

9.05 AUTHORIZED VARIATIONS IN WORK

A. The OWNER may authorize minor variations in the WORK as described in the Contract Documents when such variations do not involve an adjustment in the Contract Price or the Contract Time and are consistent with the overall intent of the Contract Documents. These variations shall be accomplished by issuing a Field Order. The issuance of a Field Order requires the CONTRACTOR to perform the work described in the order promptly. If the CONTRACTOR believes that a Field Order justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree as to the amount or extent thereof, the CONTRACTOR may make a claim therefor as provided in Article 11 and 12.

9.06 REJECTION OF DEFECTIVE WORK

A. The OWNER is authorized to reject work which the OWNER believes to be defective and require special inspection or testing of the WORK as provided in Paragraph 13.03G, whether or not the WORK is fabricated, installed, or completed.

9.07 CONTRACTOR SUBMITTALS, CHANGE ORDERS, AND PAYMENTS

A. The OWNER will review for approval all CONTRACTOR submittals, including shop drawings, samples, substitutes, and "or equal" items, etc., in accordance with the procedures set forth in the General Requirements.

B. In connection with the OWNER's REPRESENTATIVE responsibilities as to Change Orders, see Articles 10, 11, and 12.

C. In connection with the OWNER responsibilities as to Applications for Payment, see Article 14.

9.08 DISPUTES, CLAIMS AND OTHER MATTERS

A. All claims, disputes, and other matters concerning the acceptability of the WORK, the interpretation of the requirements of the Contract Documents pertaining to the performance of the WORK, and claims for changes in the Contract Price or Contract Time under Articles 11 and 12 will be referred to the OWNER in writing with a request for formal decision in accordance with this paragraph. The OWNER will render a decision in writing within 30 days of receipt of the request. Written notice of each claim, dispute, or other matter will be delivered by the CONTRACTOR to the OWNER promptly (but in no event later than 30 days) after the occurrence of the event. Written supporting data will be submitted to the OWNER with the written claim unless the OWNER allows an additional period of time to ascertain more accurate data in support of the claim.

B. When reviewing the claim or dispute, the OWNER'S REPRESENTATIVE will not show partiality to the OWNER or the CONTRACTOR and will incur no liability in connection with any interpretation or decision rendered in good faith. The OWNER'S REPRESENTATIVE rendering of a decision with respect to any claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in Paragraph 14.12) shall be a condition precedent to the OWNER's or the CONTRACTOR's exercise of their rights or remedies under the Contract Documents or by Law or Regulations with respect to the claim, dispute, or other matter.

9.09 LIMITATION ON ENGINEER'S RESPONSIBILITIES

A. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," as allowed," "as reviewed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review, or judgment of the OWNER as to the WORK, it is intended that such requirement, direction, review, or judgment will be solely to evaluate the WORK for compliance with the Contract Documents, unless there is a specific statement indicating otherwise. The use of any such term or adjective shall not be effective to assign to the OWNER any duty or authority to supervise or direct the performance of the WORK.

B. Neither the OWNER nor the ENGINEER will be responsible for the CONTRACTOR's means, methods, techniques, sequences, or procedures of construction not specified in the Contract Documents. Neither the OWNER nor the ENGINEER shall have any responsibility for safety precautions or programs on site or for the safety of CONTRACTOR'S employees, Subcontractors, employees of Subcontractors, Suppliers, employees of Suppliers or others on site.

C. Neither the OWNER nor the ENGINEER will be responsible for the acts or omissions of the CONTRACTOR nor of any Subcontractor, Supplier, or any other person or organization performing any of the WORK to the extent that such acts or omissions are not reasonably discoverable considering the level of observation and inspection required by the ENGINEER's agreement with the OWNER.

ARTICLE 10 - CHANGES IN THE WORK

10.01 GENERAL

A. Without invalidating the Agreement and without notice to any surety, the OWNER may at any time or from time to time, order additions, deletions, or revisions in the WORK; these will be authorized by a written Field Order and/or a Change Order issued by the OWNER. Upon receipt of any of these documents, the CONTRACTOR shall promptly proceed with the work involved pursuant to the applicable conditions of the Contract Documents.

B. If the OWNER and the CONTRACTOR are unable to agree upon the increase or decrease in the Contract Price or an extension or shortening of the Contract Time, if any, that should be allowed as a result of a Field Order, a claim may be made therefor as provided in Articles 11 and 12.

C. The CONTRACTOR shall not be entitled to an increase in the Contract Price nor an extension of the Contract Time with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented by Change Order, except in the case of an emergency and except in the case of uncovering work provided in the Paragraph 13.03G.

D. The OWNER and the CONTRACTOR shall execute appropriate Change Orders covering:

1. Changes in the WORK which are ordered by the OWNER pursuant to Paragraph 10.01A;

2. Changes required because of acceptance of defective work under Paragraph 13.06;

3. Changes in the Contract Price or Contract Time which are agreed to by the parties; or

4. Any other changes agreed to by the parties.

5. Any construction contract change order which increases the contract amount shall have the prior written certification of the District's controller that the expenditure of the change order amount is properly authorized by the Districts board of trustees

consistent with the District's budget and financial management policies and the instructions of the board of trustees.

E. If the provisions of any Bond require notice of any change to be given to a surety, the giving of these notices will be the CONTRACTOR's responsibility. The CONTRACTOR shall provide for the amount of each applicable Bond to be adjusted accordingly.

10.02 ALLOWABLE QUANTITY VARIATIONS

A. Whenever a unit price and quantity have been established for a bid item in the Contract Documents, the quantity stated may be increased or decreased to a maximum of 25 percent with no change in the unit price. An adjustment in the quantity in excess of 25 percent will be sufficient to justify a change in the unit price. All changes in the quantities of bid items shall be documented by Change Order.

B. In the event a part of the WORK is to be entirely eliminated and no lump sum or unit price is named in the Contract Documents to cover the eliminated work, the price of the eliminated work shall be agreed upon in writing by the OWNER and the CONTRACTOR. If the OWNER and the CONTRACTOR fail to agree upon the price of the eliminated work, the price shall be determined in accordance with the provisions of Article 11.

ARTICLE 11 - CHANGE OF CONTRACT PRICE

11.01 GENERAL

A. The Contract Price constitutes the total compensation payable to the CONTRACTOR for performing the WORK. Except as directed by Change Orders, all duties, responsibilities, and obligations assigned to or undertaken by the CONTRACTOR shall be at its expense without change in the Contract Price.

B. The Contract Price may only be changed by a Change Order. Any claim for an increase in the Contract Price shall be based on written notice delivered by the CONTRACTOR to the OWNER promptly (but in no event later than 30 days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered with the claim, unless the OWNER allows an additional period of time to ascertain more accurate data in support of the claim, and shall be accompanied by the CONTRACTOR's written statement that the amount claimed covers all known amounts (direct, indirect, and consequential) to which the CONTRACTOR is entitled as a result of the occurrence of the event. If the OWNER and the CONTRACTOR cannot otherwise agree on the amount involved, all claims for adjustment in the Contract Price shall be determined by the OWNER in accordance with Paragraph 9.08A. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph.

C. The value of any work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

1. Where the work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved.

2. Mutual acceptance of a lump sum, which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.

3. On the basis of the cost of work (determined as provided in Paragraphs 11.02 and 11.03) plus a CONTRACTOR's fee for overhead and profit (determined as provided in Paragraph 11.04).

11.02 COST OF WORK (BASED ON TIME AND MATERIALS)

A. General: The term "cost of work" means the sum of all costs necessarily incurred and paid by the CONTRACTOR for labor, materials, and equipment in the proper performance of work. Except as otherwise may be agreed to in writing by the OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project.

B. Labor: The cost of labor used in performing work by the CONTRACTOR, a Subcontractor, or other forces will be the sum of the following:

1. The actual wages paid plus any employer payments to, or on behalf of workers for fringe benefits including health and welfare, pension, vacation, and similar purposes. The cost of labor may include the rates paid to foremen when determined by the OWNER that the services of foremen do not constitute a part of the overhead allowance.

2. All payments imposed by state and federal laws including, but not limited to, compensation insurance, and social security payments.

3. The amount paid for subsistence and travel required by collective bargaining agreements, or in accordance with the regular practice of the employer.

4. At the beginning of the extra work and as later requested by the OWNER, the CONTRACTOR shall furnish the OWNER proof of labor compensation rates being paid.

C. Materials: The cost of materials used in performing work will be the cost to the purchaser, whether CONTRACTOR or Subcontractor, from the Supplier thereof, except as the following are applicable:

1. Trade discounts available to the purchase shall be credited to the OWNER notwithstanding the fact that such discounts may not have been taken by the CONTRACTOR.

2. For materials secured by other than a direct purchase and direct billing to the purchaser, the cost shall be deemed to be the price paid to the actual Supplier as determined by the OWNER. Markup except for actual costs incurred in the handling of such materials will not be allowed.

3. Payment for materials from sources owned wholly or in part by the purchaser shall not exceed the price paid by the purchaser for similar materials from these sources on extra work items or current wholesale price for the materials delivered to the work site, whichever is lower.

4. If, in the opinion of the OWNER, the cost of material is excessive, or the CONTRACTOR does not furnish satisfactory evidence of the cost of the material, then the cost shall be deemed to be the lowest current wholesale price for the quantity concerned, delivered to the work site less trade discount. The OWNER reserves the right to furnish materials for the extra work and no claim shall be made by the CONTRACTOR for costs and profit on such materials.

D. Equipment: The CONTRACTOR will be paid for the use of equipment at the rental rate listed for the equipment specified in the Rental Rate Blue Book published by Dataquest, Inc. The rental rate will be used to compute payments for equipment whether the equipment is under the CONTRACTOR's control through direct ownership, leasing, renting, or another method of acquisition. The rental rate to be applied for use of each item of equipment shall be the rate resulting in the least total cost to the Owner for the total period of use.

1. All equipment shall, in the opinion of the OWNER, be in good working condition and suitable for the purpose for which the equipment is to be used.

2. Before construction equipment is used on the extra work, the CONTRACTOR shall plainly stencil or stamp an identifying number thereon at a conspicuous location, and shall furnish to the OWNER, in duplicate, a description of the equipment and its identifying number.

3. Unless otherwise specified, manufacturers' ratings and manufacturer-approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be powered by a unit of at least the minimum rating recommended by the manufacturer.

4. Individual pieces of equipment or tools having a replacement value of $100 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefore.

5. Rental time will not be allowed while equipment is inoperative due to breakdowns.

E. Equipment on the Work: The rental time to be paid for equipment used on the WORK shall be the time the equipment is in productive operation on the extra work being performed and, in addition, shall include the time required to move the equipment to the location of the extra work and return it to the original location or to another location that requires no more moving time than that required to return it to its original location. Moving time will not be paid if the equipment is used on other than the extra work, even though located at the site of the extra work. Loading and transporting costs will be allowed, in lieu of moving time, when the equipment is moved by means other than its own power. However, no payment will be made for loading and transporting costs when the equipment is used on other than the extra work even though located at the site of the extra work. The following shall be used in computing the rental time of equipment on the WORK.

1. When hourly rates are listed, any part of an hour less than 30 minutes of operation shall be considered to be 1/2-hour of operation, and any part of an hour in excess of 30 minutes will be considered one hour of operation.

2. When daily rates are listed, any part of a day less than 4 hours operation shall be considered to be 1/2-day of operation. When owner-operated equipment is used to perform extra work to be paid for on a time and materials basis, the CONTRACTOR will be paid for the equipment and operator, as set forth in Paragraph (3), (4), and (5), following.

3. Payment for the equipment will be made in accordance with the provisions in Paragraph 11.02D, herein.

4. Payment for the cost of labor and subsistence or travel allowance will be made at the rates paid by the CONTRACTOR to other workers operating similar equipment already on the WORK, or in the absence of such labor, established by collective bargaining agreements for the type of workmen and location of the extra work, whether or not the operator is actually covered by such an agreement. A labor surcharge will be added to the cost of labor described herein in accordance with the provisions of Paragraph 11.02B, herein, which surcharge shall constitute full compensation for payments imposed by state and federal laws and all payments made to on behalf of workers other than actual wages.

5. To the direct cost of equipment rental and labor, computed as provided herein, will be added the allowances for equipment rental and labor as provided in Paragraph 11.04, herein.

11.03 SPECIAL SERVICES

A. Special work or services are defined as that work characterized by extraordinary complexity, sophistication, or innovation or a combination of the foregoing attributes which are unique to the construction industry. The following may be considered by the OWNER in making estimates for payment for special services:

1. When the OWNER and the CONTRACTOR, by agreement, determine that a special service or work is required which cannot be performed by the forces of the CONTRACTOR or those of any of its Subcontractors, the special service or work may be performed by an entity especially skilled in the work to be performed. After validation of invoices and determination of market values by the OWNER, invoices for special services or work based upon the current fair market value thereof may be accepted without complete itemization of labor, material, and equipment rental cost.

2. When the CONTRACTOR is required to perform work necessitating special fabrication or machining process in a fabrication or a machine shop facility away from the job site, the charges for that portion of the work performed at the off-site facility may by agreement, be accepted as a special service and accordingly, the invoices from the work may be accepted without detailed itemization.

3. All invoices for special services will be adjusted by deducting all trade discounts offered or available, whether the discounts were taken or not. In lieu of the allowances for overhead and profit specified in Paragraph 11.04, herein, an allowance of 5 percent will be added to invoices for special services.

B. All work performed hereunder shall be subject to all of the provisions of the Contract Documents and the CONTRACTOR's sureties shall be bound with reference hereto as under the original Agreement. Copies of all amendments to surety bonds or supplemental surety bonds shall be submitted to the OWNER for review prior to the performance of any work hereunder.

11.04 CONTRACTOR'S FEE

A. Work ordered on the basis of time and materials will be paid for at the actual necessary cost as determined by the OWNER, plus allowances for overhead and profit. For extra work involving a combination of increases and decreases in the WORK, the actual necessary cost will be the arithmetic sum of the additive and deductive costs. The allowance for overhead and profit shall include full compensation for superintendence, bond and insurance premiums, taxes, office expenses, and all other items of expense or cost not included in the cost of labor, materials, or equipment provided for under Paragraphs 11.02B, C, and D herein, including extended overhead and home office overhead. The allowance for overhead and profit will be made in accordance with the following schedule:

OVERHEAD AND PROFIT ALLOWANCE

Labor ……	10 percent
Materials ……..	10 percent
Equipment ……...	10 percent

B. It is understood that labor, materials, and equipment may be furnished by the CONTRACTOR or by a Subcontractor, and that the allowance specified herein shall be applied to the labor, materials, and equipment costs of the Subcontractor, to which the CONTRACTOR may add five percent of the Subcontractor's total cost of work. Regardless of the number of hierarchical tiers of Subcontractors, the five-percent markup may be applied one time only for each separate work transaction.

ARTICLE 12 - CHANGE OF CONTRACT TIME

12.01 GENERAL

A. The Contract Time may only be changed by a Change Order. Any claim for an extension of the Contract time shall be based on written notice delivered by the CONTRACTOR to the OWNER promptly (but in no event later than 30 days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within 30 days after such occurrence (unless the OWNER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the CONTRACTOR's written statement that the adjustment claimed is the entire adjustment to which the CONTRACTOR has reason to believe it is entitled as a result of the occurrence of said event. Claims for adjustment in the Contract Time shall be determined by the OWNER in accordance with Paragraph 9.08 if the OWNER’s representative and the CONTRACTOR cannot otherwise agree. No claim for an adjustment in the Contract Time will be valid if not submitted in accordance with the requirements of this paragraph.

B. The Contract Time will be extended in an amount equal to time lost if the CONTRACTOR makes a claim as provided in Paragraph 12.01A and the OWNER determines that the delay was caused by events beyond the control of the CONTRACTOR. Examples of events beyond the control of the CONTRACTOR include acts or neglect by the OWNER or others performing additional work as contemplated by Article 7, or by acts of God or of the public enemy, fire, floods, epidemics, quarantine restrictions, strikes, labor disputes, sabotage, or freight embargoes.

C. All time limits stated in the Contract Documents are of the essence.

D. None of the aforesaid time extensions shall entitle the CONTRACTOR to any adjustment in the Contract Price or any damages for delay. Furthermore, the CONTRACTOR hereby indemnifies and holds harmless the OWNER and ENGINEER, their officers, agents and employees from and against all claims, damages, losses and expenses (including lost property and attorney's fees) arising out of or resulting from the temporary suspension of work whether for the OWNER's convenience as defined in Article 15.01A or for whatever other reasons including the stoppage of work by the OWNER for the CONTRACTOR's failure to comply with any order issued by the OWNER.

12.02 EXTENSIONS OF THE TIME FOR DELAY DUE TO INCLEMENT WEATHER

A. "Inclement weather" is any weather condition or conditions resulting immediately therefrom, causing the CONTRACTOR to suspend construction operations or preventing the CONTRACTOR from proceeding with at least 75 percent of the normal labor and equipment force engaged on the WORK.

B. Should the CONTRACTOR prepare to begin work at the regular starting time at the beginning of any regular work shift on any day on which inclement weather, or its effects on the condition of the WORK prevents work from beginning at the usual starting time and the crew is dismissed as a result thereof, the CONTRACTOR will not be charged for a working day whether or not conditions change thereafter during the day and the major portion of the day could be considered to be suitable for construction operations.

C. The CONTRACTOR shall base its construction schedule upon the inclusion of the number of days of inclement weather specified in the Supplementary General Conditions. No extension of the Contract Time due to inclement weather will be considered until after the stated number of days of inclement weather has been reached. However, no reduction in Contract Time will be made if the number of inclement weather days is not reached.

12.03 EXTENSIONS OF TIME FOR OTHER DELAYS

A. If the CONTRACTOR is delayed in completion of the WORK beyond the Contract Time, by acts of God or of the public enemy, fire, floods, epidemics, quarantine restrictions, strikes, labor disputes, industry-wide shortage of raw materials, sabotage or freight embargoes, the CONTRACTOR shall be entitled to an adjustment in the Contract Time. No such adjustment will be made unless the CONTRACTOR shall notify the OWNER in writing of the causes of delay within 15 calendar days from the beginning of any such delay. The OWNER shall ascertain the facts and the extent of the delay. No adjustment in time shall be made for delays resulting from noncompliance with the Contract Documents, accidents, failure on the part of the CONTRACTOR to carry out the provisions of the Contract Documents including failure to provide materials, equipment or

workmanship meeting the requirements of the Contract Documents; the occurrence of such events shall not relieve the CONTRACTOR from the necessity of maintaining the required progress.

B. If the CONTRACTOR is delayed in completing the WORK beyond the Contract Time by reason of shortages of raw materials required for CONTRACTOR-furnished items, the CONTRACTOR shall be entitled to an adjustment in the Contract Time in like manner as if the WORK had been suspended for the convenience and benefit of the OWNER; provided, however, that the CONTRACTOR shall furnish documentation acceptable to the OWNER that he placed or attempted to place firm orders with Suppliers at a reasonable time in advance of the required date of delivery of the items in question, that such shortages shall have developed following the date such orders were placed or attempts made to place same, that said shortages are general throughout the affected industry, that said shortages are shortages of raw materials required to manufacture CONTRACTOR furnished items and not simply failure of CONTRACTOR's Suppliers to manufacture, assemble or ship items on time, and that the CONTRACTOR shall, to the degree possible, have made revisions in the sequence of his operations, within the terms of the Contract Documents, to offset the expected delay. The CONTRACTOR shall notify the OWNER, in writing, concerning the cause of delay, within 15 calendar days of the beginning of such delay. The validity of any claim by the CONTRACTOR to an adjustment in the Contract Time shall be determined by the OWNER, and his findings thereon shall be based on the OWNER's knowledge and observations of the events involved and documentation submitted by the CONTRACTOR, showing all applicable facts relative to the foregoing provisions. Only the physical shortage of raw materials will be considered under these provisions as a cause for adjustment of time and no consideration will be given to any claim that items could not be obtained at a reasonable, practical, or economical cost or price, unless it is shown to the satisfaction of the OWNER that such items could have been obtained only at exorbitant prices entirely out of line with current rates taking into account the quantities involved and the usual practices in obtaining such quantities.

C. If the CONTRACTOR is delayed in completion of the WORK by any act of the OWNER not authorized by the Contract Documents, an adjustment in the Contract Time will be made by the OWNER in like manner as if the WORK had been suspended for the convenience and benefit of the OWNER. In the event of such delay, the CONTRACTOR shall notify the OWNER in writing of the causes of delay within 15 calendar days from the beginning of any such delay.

ARTICLE 13 - WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

13.01 WARRANTY, GUARANTEE AND CORRECTION PERIOD

A. The CONTRACTOR warrants and guarantees to the OWNER and the ENGINEER that all work, equipment, materials and workmanship are in accordance with the Contract Documents and are not defective. Reasonably prompt notice of defects discovered by the OWNER or ENGINEER shall be given to the CONTRACTOR. All defective work, whether or not in place, may be rejected, corrected, or accepted as provided in this Article 13.

B. If within one (1) year after the date of final completion, as set by the Contractor's Certificate of Final Completion, or a longer period of time prescribed by Laws or Regulations or by the terms of any applicable special guarantee or specific provisions of the Contract

Documents, any part of the WORK is found to be defective, the OWNER shall notify the CONTRACTOR in writing and the CONTRACTOR shall promptly, without cost to the OWNER and in accordance with the OWNER's written notification, either correct the defective work, or, if it has been rejected by the OWNER, remove it from the site and replace it with non-defective work. In the event the CONTRACTOR does not promptly comply with the notification, or in an emergency where delay would cause serious risk of loss or damage, the OWNER may have the defective work corrected or rejected work removed and replaced. All direct, indirect, and consequential costs of the removal and replacement including but not limited to fees and charges of engineers, architects, attorneys and other professionals will be paid by the CONTRACTOR. This paragraph shall not be construed to limit nor diminish the CONTRACTOR's absolute guarantee to complete the WORK in accordance with the Contract Documents.

13.02 ACCESS TO WORK

A. The ENGINEER, other representatives of the OWNER, testing agencies, and governmental agencies with jurisdictional interests shall have access to the work at reasonable times for their observation, inspections, and testing. The CONTRACTOR shall provide proper and safe conditions for their access.

13.03 TESTS AND INSPECTIONS

A. The CONTRACTOR shall give the OWNER timely notice of readiness of the WORK for all required inspections, tests, or approvals.

B. If Laws or Regulations of any public body other than the OWNER, with jurisdiction over the WORK require any work to be specifically inspected, tested, or approved, the CONTRACTOR shall pay all costs in connection therewith. The CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with the OWNER's acceptance of a Supplier of materials or equipment proposed as a substitution or "or-equal" to be incorporated in the WORK and of materials or equipment submitted for review prior to the CONTRACTOR's purchase for incorporation in the WORK. The cost of all inspections, tests, and approvals, with the exception of the above which are required by the Contract Documents, shall be paid by the OWNER (unless otherwise specified).

C. The OWNER will make, or have made, such inspections and tests as the OWNER deems necessary to see that the WORK is being accomplished in accordance with the Contract Documents. The CONTRACTOR, without additional cost to the OWNER, shall provide the labor and equipment necessary to make the WORK available for inspections. Unless otherwise specified in the Supplementary General Conditions, all other costs of inspection and testing will be borne by the OWNER. In the event the inspections or tests reveal non-compliance with the requirements of the Contract Documents, the CONTRACTOR shall bear the cost of corrective measures deemed necessary by the OWNER, as well as the cost of subsequent re-inspection and retesting. Neither observations by the OWNER nor inspections, tests, or approvals by others shall relieve the CONTRACTOR from the CONTRACTOR's obligation to perform the WORK in accordance with the Contract Documents.

D. All inspections, tests, or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by properly licensed organizations selected by the OWNER.

E. If any work (including the work of others) that is to be inspected, tested, or approved is covered without the OWNER's written authorization, it must, if requested by the OWNER, be uncovered for testing, inspection, and observation. The uncovering shall be at the CONTRACTOR's expense unless the CONTRACTOR timely notified the OWNER of the CONTRACTOR's intention to cover the same and the OWNER failed to act with reasonable promptness in response to the notice.

F. If any work is covered contrary to the written request of the OWNER, it must, if requested by the OWNER, be uncovered for the OWNER's observation at the CONTRACTOR's expense.

G. If the OWNER considers it necessary or advisable that covered work be observed, inspected or tested by the OWNER or others, the OWNER shall direct the CONTRACTOR to uncover, expose, or otherwise make available for observation, inspection, or testing that portion of the work in question. The CONTRACTOR shall comply with the OWNER's direction and furnish all necessary labor, material, and equipment. If the work is defective, the CONTRACTOR shall bear all direct, indirect and consequential costs of uncovering, exposure, observation, inspection, and testing and of satisfactory reconstruction of the work, including, but not limited to, fees and charges for engineers, architects, attorneys, and other professionals. However, if the work is not defective, the CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both. The increase in Contract Time and Contract Price shall be the CONTRACTOR's actual time and costs directly attributable to uncovering and exposing the work. If the parties are unable to agree as to the amount or extent of the changes, the CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.

13.04 OWNER MAY STOP THE WORK

A. If the WORK is defective, or the CONTRACTOR fails to perform work in such a way that the completed WORK will conform to the Contract Documents, the OWNER may order the CONTRACTOR to stop the WORK, or any portion thereof, until the cause for the order has been eliminated. This right of the OWNER to stop the WORK shall not give rise to any duty on the part of the OWNER to exercise this right for the benefit of the CONTRACTOR or any other party.

13.05 CORRECTION OR REMOVAL OF DEFECTIVE WORK

A. When directed by the OWNER, the CONTRACTOR shall promptly correct all defective work, whether or not fabricated, installed, or completed, or, if the work has been rejected by the OWNER, remove it from the site and replace it with non-defective work. The CONTRACTOR shall bear all direct, indirect and consequential costs of correction or removal, including but not limited to fees and charges of engineers, architects, attorneys, and other professionals made necessary thereby. If the CONTRACTOR does not correct the defective work within 30 days, the OWNER may correct the WORK and charge the CONTRACTOR for the cost of correcting the defective WORK.

13.06 ACCEPTANCE OF DEFECTIVE WORK

A. If, instead of requiring correction or removal and replacement of defective work, the OWNER prefers to accept the work, the OWNER may do so. The CONTRACTOR shall bear all direct, indirect, and consequential costs attributable to the OWNER's evaluation of and determination to accept the defective work. If any acceptance of defective work occurs prior to final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the WORK, and the OWNER shall be entitled to an appropriate decrease in the Contract Price.

ARTICLE 14 - PAYMENTS TO CONTRACTOR, LIQUIDATED DAMAGES AND COMPLETION

14.01 LUMP SUM BID

A. A schedule of values or lump sum price breakdown will serve as the basis for progress payments for a lump sum Bid and will be incorporated into the form of Application for Payment included in the Contract Documents.

14.02 UNIT PRICE BID

A. Progress payments for a unit price Bid will be based on the number of units completed.

14.03 APPLICATION FOR PROGRESS PAYMENT

A. Unless otherwise prescribed by the OWNER, on the 25th of each month, the CONTRACTOR shall submit to the OWNER for review and approval, an Application for Payment completed and signed by the CONTRACTOR covering the WORK completed as of the date of the Application and accompanied by such supporting documentation as required by the Contract Documents.

B. The Application for Payment shall identify, as a sub-total, the amount of the CONTRACTOR's Total Earnings to Date, plus the Net Value of Materials On-site which have not yet been incorporated in the WORK.

C. The Net Payment Due to the CONTRACTOR shall be the above-mentioned sub-total, from which shall be deducted the retainage amount and the total amount of all previous payments made to the CONTRACTOR.

D. The OWNER may retain five percent of the amount otherwise due to the Contractor as retainage. Monies retained shall be placed in an interest-bearing account for the benefit of the CONTRACTOR.

E. Except as otherwise provided in the Supplementary General Conditions, the value of materials stored at the site shall be valued at 95 percent of the value of the materials. This amount shall be based upon the value of all acceptable materials and equipment stored at the site or at another location agreed to in writing by the OWNER; provided, each individual item has a value of more than $5000 and will become a permanent part of the WORK. The Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that the CONTRACTOR has received the materials and equipment free and clear of all liens, charges, security

interests, and encumbrances (which are hereinafter referred to as "Liens") and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect the OWNER's interest therein, all of which will be satisfactory to the OWNER.

14.04 CONTRACTOR'S WARRANTY OF TITLE

A. The CONTRACTOR warrants and guarantees that title to all work, materials, and equipment covered by an Application for Payment, whether incorporated in the WORK or not, will pass to the OWNER no later than the time of final payment, free and clear of all liens.

14.05 REVIEW OF APPLICATIONS FOR PROGRESS PAYMENT

A. The OWNER will, within 7 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to the OWNER, or return the Application to the CONTRACTOR indicating in writing the OWNER's reasons for refusing to recommend payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the Application. Thirty days after presentation of the Application for Payment with the OWNER's REPRESENTATIVE recommendation, the amount recommended will (subject to the provisions of Paragraph 14.05B) become due and when due will be paid by the OWNER to the CONTRACTOR.

B. The OWNER may refuse to make payment of the full amount recommended by the OWNER's REPRESENTATIVE to compensate for claims made by the OWNER on account of the CONTRACTOR's performance of the WORK or other items entitling the OWNER to a credit against the amount recommended, but the OWNER must give the CONTRACTOR written notice within 7 days stating the reasons for such action.

14.06 PARTIAL UTILIZATION

A. The OWNER may utilize or place into service any item of equipment or other usable portion of the WORK at any time prior to completion of the WORK. The OWNER shall notify the CONTRACTOR in writing of its intent to exercise this right. The notice will identify the equipment or specific portion or portions of the WORK to be utilized or otherwise placed into service.

B. It shall be understood by the CONTRACTOR that until such written notification is issued, all responsibility for care and maintenance of all items or portions of the WORK to be partially utilized shall be borne by the CONTRACTOR. Upon the issuance of a notice of partial utilization, the OWNER's REPRESENTATIVE will deliver to the OWNER and the CONTRACTOR a written recommendation as to division of responsibilities between the OWNER and the CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities and insurance.

C. The CONTRACTOR shall retain full responsibility for satisfactory completion of the WORK, regardless of whether a portion thereof has been partially utilized by the OWNER, and the CONTRACTOR's one-year correction period shall commence only after the date of Final Completion for the WORK.

14.07 DAMAGES

A. The CONTRACTOR shall pay to the OWNER the amount specified in the Supplementary General Conditions, not as a penalty but as liquidated damages, if he fails to complete the WORK or specified parts of the WORK within the Contract Time. The periods for which these damages shall be paid shall be the number of Days from the Contract Time as contained in the Agreement, or from the date of termination of any extension of time approved by the OWNER, to the date or dates on which the OWNER issues the Notice of Substantial Completion as provided in Article 14.08, herein. The OWNER may deduct the amount of said damages from any monies due or to become due the CONTRACTOR. After Substantial Completion, if the CONTRACTOR fails to complete the remaining WORK within 45 days or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER the amount stated in the Supplementary General Conditions as liquidated damages for each day that expires after the 45 days, until readiness for final payment.

B. The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would sustain; and said amount is agreed to be the amount of damages which the OWNER would sustain.

C. If actual damages are assessed, they will include all costs incurred by the OWNER as a result of a delay in the completion time of the work beyond the contract time.

D. All times specified in the Contract Documents are hereby declared to be of the essence.

14.08 SUBSTANTIAL COMPLETION

A. When the CONTRACTOR considers the WORK ready for its intended use, the CONTRACTOR will notify the OWNER in writing that the WORK is Substantially Complete. Within a reasonable time thereafter, the OWNER and the CONTRACTOR, shall make an inspection of the WORK to determine the status of completion. If the OWNER does not consider the WORK Substantially Complete, the OWNER will notify the CONTRACTOR in writing giving the reasons therefor. If the OWNER considers the WORK Substantially Complete, the OWNER will execute the Notice of Substantial Completion signed by the CONTRACTOR, which shall fix the date of Substantial Completion.

B. The Notice of Substantial Completion shall be a release by the CONTRACTOR of the OWNER and its agents from all claims and liability to the CONTRACTOR for anything done or furnished for, or relating to, the WORK or for any act or neglect of the OWNER or of any person relating to or affecting the WORK, to the date of Substantial Completion, except demands against the OWNER for the remainder of the amounts kept or retained from progress payments and excepting pending, unresolved claims filed in writing prior to the date of Substantial Completion. At the time of delivery of the Notice of Substantial Completion, the OWNER's REPRESENTATIVE will deliver to the OWNER and the CONTRACTOR, if applicable, a written recommendation as to division of responsibilities between the OWNER and the CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities and insurance. Upon the OWNER's acceptance of these recommendations, the recommendation will be binding on the OWNER and the CONTRACTOR until final payment.

C. The OWNER, upon written notice to the CONTRACTOR, shall have the right to exclude the CONTRACTOR from the WORK after the date of Substantial Completion, and complete all or portions of the WORK at the CONTRACTOR's expense.

14.09 COMPLETION AND FINAL PAYMENT

A. Upon written certification from the CONTRACTOR that the WORK is complete (if a Notice of Substantial Completion has been issued this certification must occur within 45 days of that date), the OWNER will make a final inspection with the CONTRACTOR. If the OWNER does not consider the WORK complete, the OWNER will notify the CONTRACTOR in writing of all particulars in which this inspection reveals that the WORK is incomplete or defective. The CONTRACTOR shall immediately take the measures necessary to remedy these deficiencies. If the OWNER considers the WORK complete, the CONTRACTOR may proceed to file its application for final payment pursuant to this Article. At the request of the CONTRACTOR, the OWNER's REPRESENTATIVE may recommend to the OWNER that certain minor deficiencies in the WORK that do not prevent the entire WORK from being used by the OWNER for its intended use, and the completion of which will be unavoidably delayed due to no fault of the CONTRACTOR, be exempted from being completed prerequisite to final payment. These outstanding items of pickup work, or "punch list items", shall be listed on the Notice of Substantial Completion, together with the recommended time limits for their completion, and extended warranty requirements for those items and the value of such items.

B. After the issuance of the Notice of Completion and after the CONTRACTOR has completed corrections that have not been exempted to the satisfaction of the OWNER and delivered to the OWNER all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, marked-up record documents and other documents, all as required by the Contract Documents; and after the OWNER has indicated that the WORK is acceptable, the CONTRACTOR may make application for final payment following the procedure for progress payments. The final application for payment shall be accompanied by all documentation called for in the Contract Documents and other data and schedules as the OWNER may reasonably require, including an affidavit of the CONTRACTOR that all labor, services, material, equipment and other indebtedness connected with the WORK for which the OWNER or his property might in any way be responsible, have been paid or otherwise satisfied, and a consent of the payment bond surety to final payment, all in forms approved by the OWNER.

14.10 FINAL APPLICATION FOR PAYMENT

A. If, on the basis of the OWNER's observation of the WORK during construction and final inspection, and the OWNER's review of the final application for payment and accompanying documentation, all as required by the Contract Documents, the OWNER is satisfied that the WORK has been completed and the CONTRACTOR has fulfilled all of his obligations under the Contract Documents, the OWNER's REPRESENTATIVE will, within ten days after receipt of the final application for payment, indicate in writing his recommendation of payment and present the application to the OWNER for payment. Thereupon, the OWNER's REPRESENTATIVE will give written notice to the OWNER and the CONTRACTOR that the WORK is acceptable by executing the Notice of Completion. Otherwise, the OWNER will return the application to the CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case the CONTRACTOR shall make the necessary corrections and resubmit the application.

B. Within 45 calendar days after the Notice of Completion, the OWNER will make final payment including all deducted retainage and interest to the CONTRACTOR. The OWNER's remittance of final payment shall be the OWNER's acceptance of the WORK if formal acceptance of the WORK is not indicated otherwise. The final payment shall be that amount remaining after deducting all prior payments and all amounts to be kept or retained under the provisions of the Contract, including the following items:

1. Liquidated or actual damages, as applicable.

2. Two times the value of any outstanding items of pickup work or "punch list items", indicated on the OWNER's Notice of Completion as being yet uncompleted.

14.11 CONTRACTOR'S CONTINUING OBLIGATIONS

A. The CONTRACTOR's obligation to perform and complete the WORK in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by the OWNER, nor the issuance of a Notice of Substantial Completion or Notice of Completion, nor payment by the OWNER to the CONTRACTOR under the Contract Documents, nor any use or occupancy of the WORK or any part thereof by the OWNER, nor any act of acceptance by the OWNER nor any failure to do so, nor any review of a shop drawing or sample submittal, will constitute an acceptance of work or materials not in accordance with the Contract Documents or a release of the CONTRACTOR's obligation to perform the WORK in accordance with the Contract Documents.

14.12 FINAL PAYMENT TERMINATES LIABILITY OF OWNER

A. Final payment is defined as the last progress payment made to the CONTRACTOR for earned funds, less deductions listed in Paragraph 14.10B herein. The acceptance by the CONTRACTOR of the final payment referred to in Paragraph 14.10 herein, shall be a release of the OWNER and its agents from all claims of liability to the CONTRACTOR for anything done or furnished for, or relating to, the work or for any act or neglect of the OWNER or of any person relating to or affecting the work, except demands against the OWNER for the remainder, if any, of the amounts kept or retained under the provisions of Paragraph 14.10 herein; and excepting pending, unresolved claims filed prior to the date of the Notice of Substantial Completion.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 SUSPENSION OF WORK BY OWNER

A. The OWNER may, by written notice to the Contractor, temporarily suspend the WORK, in whole or in part, for a period or periods of time, but not to exceed 90 days, for the convenience and benefit of the OWNER upon the occurrence of any one or more of the following: (1) unsuitable weather; (2) delay in delivery of OWNER- furnished equipment or materials, or such other conditions as are considered unfavorable for prosecution of the work; (3) Shortfall in construction funds; (4) Constraints imposed by public entities, public utilities, property owners or legal proceedings; (5) Failure or delay in acquisition of easements or right-of-way by the OWNER; or (6) Other conditions which, in the opinion of the OWNER, warrant a delay in the WORK. Suspended WORK shall be resumed by the CONTRACTOR within 10 calendar days of receipt from the OWNER of written notice to

resume work. Whenever the OWNER temporarily suspends work for any conditions enumerated in this Article, the CONTRACTOR shall be entitled to an adjustment in the Contract Time as specified in Article 12.03 C.

B. The suspension of work shall be effective upon receipt by the CONTRACTOR of a written order suspending the work and shall be terminated upon receipt by the Contractor of a written order terminating the suspension.

C. The CONTRACTOR hereby indemnifies and holds harmless the OWNER, their officers, agents and employees, from and against all claims, damages, losses and expenses, including lost profits and attorney's fees, arising out of or resulting from the temporary suspension of the WORK, whether for the OWNER's convenience described in this Article or for whatever other reasons, including the stoppage of work by the OWNER for the CONTRACTOR's failure to comply with any order issued by the OWNER.

15.02 TERMINATION OF AGREEMENT BY OWNER (CONTRACTOR DEFAULT)

A. In the event of default by the CONTRACTOR, the OWNER may give written notice to the CONTRACTOR of OWNER's intent to terminate the Agreement. The notice shall state the event of default and the time allowed to remedy the default. It shall be considered a default by the CONTRACTOR whenever the CONTRACTOR shall: (1) declare bankruptcy, become insolvent, or assign its assets for the benefit of its creditors; (2) fail to provide materials or workmanship meeting the requirements of the Contract Documents; (3) disregard or violate provisions of the Contract Documents or OWNER's instructions, (4) fail to prosecute the WORK according to the approved progress schedule; or, (5) fail to provide a qualified superintendent, competent workmen, or materials or equipment meeting the requirements of the Contract Documents. If the CONTRACTOR fails to remedy the conditions constituting default within the time allowed, the OWNER may then issue a Notice of Termination.

B. In the event the Agreement is terminated in accordance with Paragraph 15.02A, the OWNER may take possession of the WORK and may complete the WORK by whatever method or means the OWNER may select. The cost of completing the WORK shall be deducted from the balance which would have been due the CONTRACTOR had the Agreement not been terminated and the WORK completed in accordance with the Contract Documents. If such cost exceeds the balance which would have been due, the CONTRACTOR shall pay the excess amount to the OWNER. If such cost is less than the balance which would have been due, the CONTRACTOR shall have no claim to the difference.

15.03 TERMINATION OF AGREEMENT BY OWNER (FOR CONVENIENCE)

A. The OWNER may terminate the Agreement at any time if it is found that reasons beyond the control of either the OWNER or CONTRACTOR make it impossible or against the OWNER's interests to complete the WORK. In such a case, the CONTRACTOR shall have no claims against the OWNER except: (1) for the value of the work, as determined by the OWNER, performed by the Contractor up to the date the Agreement is terminated; and, (2) for the cost of materials and equipment on hand, in transit, or on definite commitment, as of the date the Agreement is terminated, which would be needed in the WORK and which meet the requirements of the Contract Documents. The value of work performed and the cost of materials and equipment delivered to the site, as mentioned

above, shall be determined by the OWNER in accordance with the procedure prescribed from making the final application for payment and final payment under Paragraphs 14.09 and 14.10.

15.04 TERMINATION OF AGREEMENT BY CONTRACTOR

A. The CONTRACTOR may terminate the Agreement upon 10 days written notice to the OWNER, whenever: (1) the WORK has been suspended under the provisions of Paragraph 15.01, for more than 90 consecutive days through no fault or negligence of the CONTRACTOR, and notice to resume work or to terminate the agreement has not been received from the OWNER within this time period; or, (2) the OWNER should fail to pay the CONTRACTOR any monies due him in accordance with the terms of the Contract Documents and within 60 days after presentation to the OWNER by the CONTRACTOR of a request therefore, unless within said 10-day period the OWNER shall have remedied the condition upon which the payment delay was based. In the event of such termination, the CONTRACTOR shall have no claims against the OWNER except for those claims specifically enumerated in Paragraph 15.03, and as determined in accordance with the requirements of that paragraph.

ARTICLE 16 - NOTICE

16.01 GIVING NOTICE

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

16.02 TITLE TO MATERIALS FOUND ON THE WORK

A. The OWNER reserves the right to retain title to all soils, stone, sand, gravel, and other materials developed and obtained from excavations and other operations connected with the WORK. Unless otherwise specified in the Contract Documents, neither the CONTRACTOR nor any Subcontractor shall have any right, title, or interest in or to any such materials. The CONTRACTOR will be permitted to use in the WORK, without charge, any such materials which meet the requirements of the Contract Documents.

16.03 RIGHT TO AUDIT

A. If the CONTRACTOR submits a claim to the OWNER for additional compensation, the OWNER shall have the right, as a condition to considering the claim, and as a basis for evaluation of the claim, and until the claim has been settled, to audit the CONTRACTOR's books. This right shall include the right to examine books, records, documents, and other evidence and accounting procedures and practices, sufficient to discover and verify all direct and indirect costs of whatever nature claimed to have been incurred or anticipated to be incurred and for which the claim has been submitted. The right to audit shall include the right to inspect the CONTRACTOR's plants, or such parts thereof, as may be or have been engaged in the performance of the WORK. The CONTRACTOR further agrees that the right to audit encompasses all subcontracts and is binding upon subcontractors. The right to examine and inspect herein provided for shall be exercisable through such

representatives as the OWNER deems desirable during the CONTRACTOR's normal business hours at the office of the CONTRACTOR. The CONTRACTOR shall make available to the OWNER for auditing, all relevant accounting records and documents, and other financial data, and upon request, shall submit true copies of requested records to the OWNER.

16.04 HAZARDOUS MATERIALS

A. If the CONTRACTOR during the course of work observes the existence of hazardous material, the CONTRACTOR shall promptly notify the OWNER. The OWNER shall consult with others regarding removal or encapsulation of the hazardous material and the CONTRACTOR shall not perform any work pertinent to the hazardous material prior to receipt or special instruction from the OWNER.

ARTICLE 17 - SUBCONTRACT LIMITATIONS

17.01 SUBCONTRACT LIMITATIONS

A. In addition to the provisions of Paragraph 6.05 of the General Conditions, the CONTRACTOR shall perform not less than 30 percent of the WORK with its own forces (i.e., without subcontracting). The 30 percent requirement shall be understood to refer to the WORK, the value of which totals not less than 30 percent of the Contract Price.

ARTICLE 18 - PATENTS AND COPYRIGHTS

18.01 PATENTS AND COPYRIGHTS

A. The CONTRACTOR shall indemnify and save harmless the OWNER, the ENGINEER, and their officers, agents, and employees, against all claims or liability arising from the use of any patented or copyrighted design, device, material, or process by the CONTRACTOR or any of his subcontractors in the performance of the WORK.

-END OF SECTION-

SECTION 00800
SUPPLEMENTARY GENERAL CONDITIONS

PART 1 - GENERAL

These Supplementary General Conditions make additions, deletions, or revisions to the General Conditions as indicated herein. All provisions which are not so added, deleted, or revised remain in full force and effect. Terms used in these Supplementary General Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions.

SGC-1 DEFINITIONS

Add the following definitions to Article 1:

OWNER - The OWNER is further defined as South Valley Water Reclamation Facility, 7495 South 1300 West, West Jordan, Utah 84084. Telephone No.: (801) 566-7711.

OWNER'S REPRESENTATIVE - The OWNER'S REPRESENTATIVE is defined in SGC - 9.03 on page 00800-5. The OWNER'S REPRESENTATIVE for this project shall be Taigon Worthen.

BIDDER - The person, firm, or corporation, partnership or joint venture or LLC submitting a Bid for the Work.

CONTRACTOR - The person, firm, or corporation, partnership or joint venture or LLC with whom the OWNER has executed the Agreement.

ENGINEER - Defined as Carollo Engineers, Inc. 7090 South Union Park Avenue, Suite 600, Midvale, Utah 84047.

SYSTEM INTEGRATOR - See CONTRACTOR.

SGC-2.02 COPIES OF DOCUMENTS

The OWNER shall furnish to the CONTRACTOR 5 copies of the Contract Documents which may include bound reduced drawings, if any, together with 2 sets of full-scale Drawings if requested. Additional quantities of the Contract Documents will be furnished at reproduction cost plus mailing costs if copies are mailed.

SGC-4.02 REPORTS OF PHYSICAL CONDITIONS

In the preparation of the Contract Documents, the OWNER has relied upon:

A. The following drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground utilities) which are at or contiguous to the site of the WORK.

4. Drawings dated November 2011 prepared by Carollo Engineers, Inc., entitled "2011 Headworks VFD Replacement."

5. Drawings dated January 2006 prepared by, MWH Inc., entitled “SVWRF - Project 4C.”
6. Drawings dated January 2008 prepared by Bowen Collins & Associates, Inc., entitled “SVWRF - Project 4D.”

B. Copies of these drawings may be examined at the office of the OWNER, during regular business hours. As provided in Paragraph 4.02 of the General Conditions and as identified and established above, the CONTRACTOR may rely upon the accuracy of the technical data contained in such reports and drawings, except for such physical dimensions that can be field verified; however, the interpretation of such technical data, including any interpolation or extrapolation thereof, and opinions contained in such reports and drawings are not to be relied on by the CONTRACTOR.

SGC-5.01 BONDS

Delete the first sentence of Paragraph 5.1A and add the following:

The CONTRACTOR shall furnish a satisfactory Performance Bond in the amount of 100 percent of the Contract Price and a satisfactory Payment Bond in the amount of 100 percent of the Contract Price as security for the faithful performance and payment of all the CONTRACTOR’s obligations under the Contract Documents.

SGC-5.02 INSURANCE

A. Substitute for Paragraph 5.02.B. the following:

All insurance required by the Contract Documents to be purchased and maintained by the CONTRACTOR shall be obtained from insurance companies that are duly licensed, admitted, and authorized to issue insurance policies for the limits and coverage so required in the State in which the Project is located. Such insurance companies shall have a current Best’s Rating of at least an “A” (Excellent) general policy holder’s rating and a Class VIII financial size category and shall also meet such additional requirements and qualifications as may be provided in the Supplementary General Conditions.

B. Add the following to Paragraph 5.02.B.5:

If the OWNER finds it necessary to occupy or use a portion or portions of the project prior to Substantial Completion, the OWNER shall provide notice of occupancy without the need for mutual agreement between the OWNER and the CONTRACTOR and to which the insurance company providing the Builder’s Risk Insurance has consented by endorsement to the policy or policies.

C. The limits of liability for the insurance required by Paragraph 5.2 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations. Limits may be provided by a combination of primary and excess liability policies or through a single policy. If the limits are provided by a combination of primary and excess liability policies, then the excess or umbrella liability coverages shall include commercial general, comprehensive automobile, and employer’s liability and shall provide coverage at least as broad as the underlying policies.

1. Workers' Compensation:

a.	State:	Statutory
b.	Applicable Federal (e.g. USHL&H):	Statutory
c.	Employer's Liability:	$1,000,000

2. Comprehensive or Commercial General Liability:

Combined Single Limit:

a. Premises/operations

$ 1,000,000	Each Occurrence
$ 2,000,000	Annual Aggregate

b. Products/completed operations

$ 1,000,000	Each Occurrence
$ 2,000,000	Annual Aggregate

c. Personal Injury

$ 1,000,000	Each Occurrence
$ 2,000,000	Annual Aggregate

d. Policies shall include premises/operations, products, completed operations, independent contractors, owners' and contractors' protective, explosion, collapse, underground hazards, broad form contractual, personal injury with employment contractual exclusions deleted, and broad form property damage.

e. If policies are written on a Commercial General Liability form, the General Aggregate shall be at least two times the each occurrence limit or be written on a "per project" basis.

f. All policies shall be written on an occurrence basis. If the CONTRACTOR would like to substitute any "claims made" liability policies, then these must be pre-approved in writing according to the terms and conditions they may impose.

g. If policies are written for split limits, limits shall be equal for bodily injury and property damage liability.

3. Comprehensive Automobile Liability (including owned, hired, and non-owned vehicles):

Combined Single Limit:

a. Bodily Injury and Property Damage: $2,000,000 each accident

b. If policies are written for split limits, limits shall be equal for bodily injury

per person, bodily injury per accident and property damage.

4. Excess Liability Insurance:

   a. $4,000,000 over all underlying coverage lines

5. Builder's Risk Insurance:

   a. In an amount equal to the replacement cost of the completed value of the project or $4,000,000 whichever is greater.

   b. Any deductibles of self-insured retentions shall be as agreed to by the OWNER and CONTRACTOR.

   c. The CONTRACTOR shall include flood and earthquake coverage in the Builder's Risk Insurance requirements under Paragraph 5.02.B.5 of the General Conditions, with a minimum limit of $4,000,000 per event or occurrence.

D. All policies shall provide that the CONTRACTOR agrees to waive all rights of subrogation against the OWNER, the ENGINEER, and their subconsultants, employees, officers and directors, for WORK performed under the Agreement. Endorsements shall be provided with certificates of insurance.

E. All policies shall also specify that the insurance provided by the CONTRACTOR will be considered primary and not contributory to another insurance available to the OWNER or ENGINEER.

F. All policies except Workers' Compensation and Builders Risk shall name the OWNER, including their officers, directors or board members, employees agents or any others associated with the management or operations of South Valley Water Reclamation Facility; Engineer, their consultants, subconsultants, shall be additional insureds on the Auto Liability and Commercial General Liability policies. The Builders Risk insurance shall name the CONTRACTOR, OWNER, and ENGINEER as named insureds and subcontractors and additional insureds. The Workers' Compensation policy shall name the OWNER as additional insured by means of an alternative employer endorsement, with respect to the employer's liability coverage only.

G. All policies shall provide for 60 days notice prior to any cancellation, reduction in coverage or nonrenewal.

H. The deductible or self-insured retention on Comprehensive or Commercial General Liability shall not be greater than $25,000. All deductibles are the responsibility of the CONTRACTOR.

SGC-6.05 SUBCONTRACT LIMITATIONS

Add the following as paragraph 6.05.B of the General Conditions

B. The CONTRACTOR shall perform not less than 30 percent of the WORK with its own forces (i.e., without subcontracting). The 30 percent requirement shall be understood to

refer to the WORK, the value of which totals not less than 30 percent of the Contract Price.

SGC-6.06 PERMITS

A. The CONTRACTOR shall acquire and comply with the following permits if applicable:

1. State permits to construct and/or operate sources of air pollution.

2. Certificates and permits are required for sources such as, but not limited to, the following:

a. Fuel burning equipment.
b. Gasoline and petroleum distillate storage containers.
c. Land disturbing activities.
d. Processing equipment (sand, gravel, concrete batch plant, etc.).
e. Odors.

3. Permit-Required Confined Space: The workspace in which the WORK is to be performed may contain permit-required confined spaces (permit spaces) as defined in 29 CFR 1910.146. Permit space entry is allowed in such spaces only through compliance with a confined space entry program meeting the requirements of 29 CFR 1910.146.

4. Encroachment Permit

B. The CONTRACTOR shall comply with OWNER requirements for a “Hot Work Permit” as described in Section 01520 - Security/Process Safety Management.

SGC-9.03 PROJECT REPRESENTATION

A. The OWNER’s Representative, will act as directed by and under the supervision of the OWNER and will confer with the OWNER regarding its actions. The OWNER’s REPRESENTATIVE dealings in matters pertaining to the WORK shall, in general, be only with the OWNER and the CONTRACTOR, and dealings with Subcontractors shall only be through or with the full knowledge of the CONTRACTOR.

B. The OWNER’s REPRESENTATIVE shall have the duties and responsibilities set forth in this paragraph.

1. Review the progress schedule of Shop Drawing submittals and schedule of values prepared by the CONTRACTOR and consult with the ENGINEER concerning their acceptability, as applicable.

2. Attend preconstruction conferences. Arrange a schedule of progress meetings and other job conferences as required and notify in advance those expected to attend.
Attend meetings and maintain and circulate copies of minutes thereof.

3. Serve as the OWNER's liaison with the CONTRACTOR, working principally through the CONTRACTOR's superintendent and assist said superintendent in understanding the intent of the Contract Documents.

4. Receive Shop Drawings and samples furnished by the CONTRACTOR.

5. Conduct on-site observations of the WORK in progress to assist the OWNER in determining if the WORK is proceeding in accordance with the Contract Documents.

6. Transmit to the CONTRACTOR the OWNER's or ENGINEER's clarifications and interpretations of the Contract Documents.

7. Consider and evaluate the CONTRACTOR's suggestions for modifications in the Contract Documents and report them with recommendations to the OWNER.

8. Review applications for payment with the CONTRACTOR for compliance with the established procedure for their submittal and forward them with recommendations to the OWNER, noting particularly their relation to the schedule of values, work completed, and materials and equipment delivered at the Site but not incorporated in the WORK.

9. During the course of the WORK, verify that certificates, maintenance and operation manuals, and other data required to be assembled and furnished by the CONTRACTOR are applicable to the items actually installed.

10. Before the OWNER prepares a Notice of Completion, as applicable, submit to the CONTRACTOR a list of observed items requiring completion or correction.

11. Conduct final inspection in the company of the ENGINEER, the OWNER, and the CONTRACTOR, and prepare a punch list of items to be completed or corrected.

12. Verify that all items on the punch list have been completed or corrected and make recommendations concerning acceptance.

SGC-11.03D EQUIPMENT

The CONTRACTOR will be paid for the use of equipment at the rental rate listed for such equipment specified in the current edition of the following reference publication:

A. "Rental Rate Blue Book for Construction Machinery" as published by the Machinery Information Division of the K-III Directory Corporation, telephone number (800) 669-3282.

SGC-12.02 WEATHER DELAYS

The CONTRACTOR's construction schedule shall anticipate 30 days of delay due to unusually severe weather.

SGC-14.03C AMOUNT OF RETENTION

Add the following to Paragraph 14.03C of the General Conditions:

Unless otherwise prescribed by law, the OWNER may retain a portion of the amount otherwise due to the CONTRACTOR, as follows:

1. Retention of 5 percent of each approved progress payment until the WORK is certified as having reached substantial completion.

SGC-14.03D VALUE OF MATERIALS STORED AT THE SITE

Unless otherwise prescribed by law or prescribed in Assigned Purchase Order Agreements, the value of materials stored at the SVWRF shall be 95 percent of the value of such materials.

SGC-14.05.A REVIEW OF APPLICATIONS FOR PROGRESS PAYMENT

Replace the last sentence with the following: “Forty-Five days after presentation of the Application for Payment with the ENGINEER’S recommendation, the amount recommended will (subject to the provisions of Paragraph 14.05B) become due and when due will be paid by the OWNER to the CONTRACTOR.”

SGC-14.07.A DAMAGES

Add the following sentence: “The amount of liquidated damages shall be $500 per calendar day.”

-END OF SECTION-

SECTION 00810
SUPPLEMENTARY GENERAL CONDITIONS (UTAH)

SGC-18 UTAH STATE REQUIREMENTS

A. Retainage of Compensation to CONTRACTOR: Pursuant to Utah Code Ann. 13-8-5, any retainage of CONTRACTOR's compensation hereunder shall be placed in an interest-bearing escrow account and the interest which accrues thereon shall do so for the benefit of CONTRACTOR and Subcontractors. Release of the retainage shall be as contemplated by the General Conditions and Supplementary General Conditions, Article 14 – Payments to Contractor, Liquidated Damages and Completion. Any interest which has accrued on the retainage, and which is released to the CONTRACTOR shall be promptly disbursed by CONTRACTOR to itself and/or to Subcontractors on a pro rata basis.

B. Certification of Change Orders: Pursuant to Utah Code Ann. Section 63G-6-602, no change order shall be authorized without a written certification, signed by an official representative of the OWNER responsible for monitoring and reporting the status of the costs of the total Project or the contract budget, stating that funds are available for the subject change order.

C. Adjustments in Price: Pursuant to Utah Code Ann. Section 63G-6-601, any adjustment in compensation due CONTRACTOR under this agreement shall be computed in one or more of the following ways:

1. By agreement on a fixed-price adjustment before commencement of the pertinent performance or as soon as practicable;

2. By unit prices specified in the contract or subsequently agreed upon;

3. By the costs attributable to the events or situations with adjustment of profit or fee, all as specified in the contract or subsequently agreed upon;

4. In any other manner as OWNER and CONTRACTOR may mutually agree;

5. In the absence of agreement between CONTRACTOR and OWNER, by a unilateral determination by OWNER of the costs attributable to the events or situations with adjustment of profit or fee, all as computed by the OWNER in accordance with Utah Code Ann. Section 63G-6-415 and/or the rules and regulations promulgated thereunder.

D. Cost Principles: CONTRACTOR shall comply in all respects with applicable provisions of Utah Code Ann. Section 63G-6-415, and the rules and regulations promulgated thereunder. To the extent that such provisions are inconsistent with the other terms and conditions of this agreement, the former shall prevail. OWNER may, at reasonable times and places, audit the books and records of CONTRACTOR, any Subcontractor, or any other person who has submitted cost or pricing data pursuant to said section. The books and records of CONTRACTOR shall be maintained for 3 years following the end of the fiscal year in which final payment is made under the Contract. The books and records of the Subcontractor and all other persons shall be maintained for 3 years following the end of the fiscal year in which final payment is made under the subcontract and/or to the person, unless a shorter period is otherwise authorized in writing.

E. Project Safety: CONTRACTOR shall comply in all respects with the Utah Occupational Safety and Health Act, Utah Code Ann. Sections 34A-6-101 et seq., and the rules, regulations and standards promulgated thereunder by the Utah State Industrial Commission, as such act, rules, regulations or standards now exist or may be amended during the term of this agreement. Specifically, but not in limitation, CONTRACTOR shall comply with Construction Standards, Rules and Regulations, promulgated by the Utah Occupation and Safety and Health Division, Utah State Industrial Commission.

F. Protection of Underground Utility Facilities: CONTRACTOR shall comply in all respects with Utah Code Ann. Section 54 Chapter 8a et seq. and the rules and regulations promulgated thereunder, as it now exists or may be amended during the term of this agreement, with regard to the protection of underground utility facilities. Specifically, but not in limitation, CONTRACTOR shall notify the appropriate public utility(s) when making an excavation with power equipment. CONTRACTOR shall further refrain from proceeding with excavation until such time as the appropriate public utility(s) have advised CONTRACTOR of the location of any underground facilities in the area proposed for excavation by marking such facilities with stakes, paint, or other customary way, indicating horizontal location within 24 inches of the outside dimensions of both sides of the underground facility.

G. Review of Construction by OWNER: OWNER may, at its option, assign a field representative to review the construction of the Project in progress. Said representative will cooperate with the ENGINEER/OWNER in attempting to note deviations from, or necessary adjustments to, the Contract Documents or deficiencies or defects in the construction. Said representative's presence on the Project, however, shall in no way relieve CONTRACTOR of its primary responsibility for construction of the Project in accordance with the Contract Documents.

H. OWNER Inspection: Pursuant to Utah Code Ann. Section 63G-6-418, OWNER may, at reasonable times, inspect the plant or place of business of the CONTRACTOR or any Subcontractor which is related to the performance of this contract or any subcontract entered into hereunder.

I. Code Requirements: The provisions of the latest editions of the International Building Code, National Electric Code, and Utah Plumbing Code, as adopted or followed in Utah, including standards adopted in relation thereto, as supplemented or amended, shall apply to the Project except as specific variances may be expressly authorized by the OWNER. If the Contract Documents fail to meet the minimum standards of the referenced codes, CONTRACTOR shall be responsible to bring such information to the attention of the architect/OWNER associated with the Project. Subcontractors shall also inform CONTRACTOR of any infractions of the above-referenced codes regarding their own particular trades. In the event that workmanship or incidental materials are not specified or indicated, they shall at least conform to the above-referenced codes and shall be incorporated into the Work without any additional cost to the OWNER. If the Contract Documents call for items or workmanship which exceed code requirements, the Contract Documents shall take precedence over such requirements.

J. Workers Compensation: CONTRACTOR shall comply in all respects with Utah Code Ann. Section 34A-2-101, et seq. and the rules and regulations promulgated thereunder by the Utah State Industrial Commission, as such law, rules or regulations now exist or may be amended during the term of this agreement.

K. Archaeological, Anthropological, or Paleontological Findings: CONTRACTOR shall comply with Utah Code Ann. Section 9-8-301 et seq., with respect to the discovery of archaeological, anthropological, or paleontological findings at or on the Project site. Specifically, but not in limitation, CONTRACTOR shall promptly notify the Utah Division of State History of any such findings.

L. Nondiscrimination Equal Employment Opportunity: CONTRACTOR shall comply in all respects with the Utah Anti-Discrimination Act of 1965, Utah Code Ann. Section 34A-5-101 et seq., and the rules and regulations promulgated thereunder by the Utah State Industrial Commission and/or its Anti-Discrimination Division, as such act, rules or regulations now exist or may be amended during the term of this agreement, specifically:

1. CONTRACTOR shall not discriminate against any employee or applicant for employment because of race, color, sex, religion, ancestry or national origin.

2. In all solicitations or advertisements for employees, CONTRACTOR shall state that all qualified applicants shall receive consideration without regard to race, color, sex, religion, ancestry or national origin.

3. CONTRACTOR shall send to each labor union or worker's representative notices to be provided, stating the CONTRACTOR's responsibilities under the statute.

4. CONTRACTOR shall furnish such information or reports as are requested by the Utah State Industrial Commission and/or its Anti-Discrimination Division, for the purpose of determining compliance with the statute.

5. CONTRACTOR shall include the provisions of paragraphs 1 through 4 above in all subcontracts for this Project.

6. Failure of the CONTRACTOR to comply with the statute, the rules and regulations promulgated thereunder, and this provision, shall be deemed a breach of contract entitling OWNER, in its discretion, to cancel, terminate, or suspend this agreement in whole or in part.

M. Affirmative Action: CONTRACTOR shall take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, sex or national origin. Such action shall include, but shall not be limited to: employment; upgrading; demotion or transfer; recruitment or recruitment advertising; layout or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

At its discretion, OWNER may perform a compliance review at CONTRACTOR's place of business and/or the Project site to verify CONTRACTOR's compliance with this provision. Such compliance verifications may be conducted with such frequency as is needed to assure CONTRACTOR's compliance with this provision.

N. Citizens Preferred: Pursuant to Utah Code Ann. Section 34-30-1, CONTRACTOR shall give preference in hiring to citizens of the United States or those having declared their intention to become citizens; failure to comply may render this contract null and void at the discretion of OWNER.

O. Veterans' Preference: Pursuant to Utah Code Ann. Section 71-10-2, CONTRACTOR shall give preference in hiring to honorable discharged veterans who have served in the Armed Forces of the United States during a period of conflict, war, or other national emergencies as defined by Congress, and to any un-remarried surviving spouse of an honorably discharged veteran, if they possess qualifications for that employment and if the honorably discharged veteran is or, if deceased, was a resident of the State of Utah.

P. Specific OWNER Requirements: CONTRACTOR shall comply with the specific rules and regulations promulgated by OWNER pursuant to authority granted or retained under the Utah Procurement Code, Utah Code Ann. Section 63G-6-101, et seq.

-END OF SECTION-

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.1 THE REQUIREMENT

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of the construction of the “South Valley Water Reclamation Facility - 2023 VFD Replacements,” complete and operational including:

1. In the Headworks Building demolish and remove the existing VFDs including the existing control sections. Install the new OWNER furnished VFDs in the locations shown on the Drawings. Provide new control sections for each VFD. Modify existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs.
2. In RAS/WAS Building 1 demolish and remove the existing VFDs. Demolish and modify the motor control centers. Install the new OWNER furnished VFDs in the locations shown on the Drawings. Modify existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs.
3. In RAS/WAS Building 2 demolish and remove the existing VFDs. Install the new OWNER furnished VFDs in the locations shown on the Drawings. Modify existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs. Demolish the existing PCM-1500 and provide a new PCM-1500.
4. In Solids Building demolish and remove the existing VFDs. Install the new OWNER furnished VFDs in the locations shown on the Drawings. Modify existing raceway, cables supports as necessary. Startup, test, and commission the new VFDs.
5. Demolish existing fiber optic cable and install new fiber optic cable as shown on the Drawings.

1.3 CONTRACT METHOD

A. The WORK hereunder will be constructed under a single lump sum contract.

1.4 WORK BY OTHERS (Not Used)

1.5 WORK SEQUENCE AND SCHEDULING CONSTRAINTS

A. WORK sequence and scheduling constraints are described in Section 01030 - Special Project Constraints.

1. The Work shall be complete by March 29, 2024.

1.6 CONTRACTOR USE OF PROJECT SITE

A. The CONTRACTOR's use of the project Site shall be limited to its construction operations, including onsite storage of materials and onsite fabrication facilities. Temporary daytime staging, Monday through Friday, may be allowed in the asphalt parking area between the Emergency Generator Building and the South Headworks Building, CONTRACTOR shall maintain OWNER vehicle access thru this staging area to Blower Building 1 at all times, and may be allowed in the asphalt and concrete areas adjacent to the RAS 1 and RAS 2 pump stations, CONTRACTOR shall maintain OWNER vehicle access thru this staging area to RAS 1 and RAS 2 man doors and equipment rollup doors at all times. All equipment, material, toolboxes, etc. shall be removed after 5:00 P.M. on all days in which this area is used for temporary staging.

New equipment must be stored inside temporary enclosures protected from the weather and elements. Temporary enclosures may be staged in location approved by the Owner during construction. Temporary enclosures shall be locked up at the end of each workday by 5 pm.

1.7 OWNER USE OF THE PROJECT SITE

A. The OWNER may utilize all or part of the existing facilities during the entire period of construction for the conduct of the OWNER’s normal operations. The CONTRACTOR shall cooperate and coordinate with the OWNER to facilitate the OWNER's operations and to minimize interference with the CONTRACTOR's operations at the same time. In any event, the OWNER shall be allowed safe access to the Site during the period of construction.

1.8 PARTIAL UTILIZATION OF THE WORK BY OWNER

A. After each Headworks VFD is installed, tested and commissioned, the OWNER will utilize the VFD as part of normal plant operations.

1.9 OUTAGE PLAN AND REQUESTS

A. Outage Plans are discussed in Section 1030 - Special Project Constraints

1.10 PROJECT MEETINGS

A. Preconstruction Conference

1. Prior to the commencement of WORK at the Site, a preconstruction conference will be held at a mutually agreed time and place. The CONTRACTOR'S Project Manager, its Superintendent, its Safety Representative, and its Subcontractors shall attend the conference as the CONTRACTOR deems appropriate. Other attendees will be:

a. ENGINEER;

b. Representatives of OWNER;
c. Others as requested by CONTRACTOR, OWNER, or ENGINEER.

2. The CONTRACTOR shall bring the preconstruction conference submittals in accordance with Section 01300 - Contractor Submittals.

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

a. Status of CONTRACTOR's insurance and bonds.
b. CONTRACTOR's tentative schedules.
c. Transmittal, review, and distribution of CONTRACTOR's submittals.
d. Processing applications for payment.
e. Maintaining record documents.
f. Critical WORK sequencing.
g. Field decisions and Change Orders.
h. Use of project site, office and storage areas, security, housekeeping, and OWNER's needs.
i. Major equipment deliveries and priorities.
j. CONTRACTOR’s assignments for safety and first aid.
k. Contract authority and channels of communication.
l. Utilities required for construction.
m. CONTRACTOR’s preliminary schedule.
n. Establishment of emergency contacts.

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

5. The CONTRACTOR and its Subcontractors should plan on the conference taking no less than one half working day.

B. Progress Meetings

1. The CONTRACTOR shall schedule and hold regular onsite progress meetings at times requested by OWNER or as required by progress of the WORK. The CONTRACTOR, OWNER and all Subcontractors active on the Site must attend each meeting. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers, and other subcontractors.

2. The OWNER will preside at the progress meetings and will arrange for keeping and distributing the minutes. The purpose of the meetings will be to review the progress of the WORK, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop. During each meeting, the CONTRACTOR shall present any issues which may impact its progress with a view to resolving these issues expeditiously.

1.11 SURVEY CONTROL AND REQUIREMENTS (not applicable)

1.12 BUILDING PERMIT (not applicable)

1.13 DEFINITIONS APPLICABLE TO TECHNICAL SPECIFICATIONS

A. The following words shall have the defined meaning in the Technical Portions of the WORK:

Indicated	is a word used to direct the CONTRACTOR to information contained on the Drawings or in the Specifications. Terms such as “shown,” “noted,” “scheduled,” and “specified” also may be used to assist in locating information, but no limitation of location is implied or intended.
Furnish	means to supply and deliver to the site, to unload and unpack ready for assembly, installation, testing, and startup.
Install	defines operations at the site including assembly, erection, placing, anchoring, applying, shaping to dimension, finishing, curing, protecting, and cleaning, ready for the OWNER’s use.
Provide	is defined as furnish and install, test, adjust, program, and demonstrate proper operation if required by the specification, ready for the intended use.
Installer	a person or firm engaged by the CONTRACTOR or its subcontract or any subcontractor for the performance of installation, erection, or application work at the site. Installers must be expert in the operations they are engaged to perform.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

-END OF SECTION-

SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.1 SCOPE

A. Payment for the various items of the Bid Schedule, as further specified herein, shall include all compensation to be received by the CONTRACTOR for furnishing all tools, equipment, supplies and manufactured articles, and for all labor, operations and incidentals appurtenant to the items of work being described, as necessary to complete the various items of the WORK, all in accordance with the requirements of the Contract Documents, including appurtenances thereto, and including all costs of permits and cost of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration of the U. S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bid Schedule(s), and all costs therefore shall be included in the prices named in the Bid Schedule(s) for the various appurtenant items of work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION–

SECTION 01030
SPECIAL PROJECT CONSTRAINTS

PART 1 - WORK INVOLVED WITH EXISTING PLANT

1.1 GENERAL

A. The WORK shall be executed while the existing wastewater treatment plant is in operation. Operation of the existing plant shall not be jeopardized, nor shall the efficiency of wastewater treatment be reduced as a result of the execution of the WORK.

B. Critical events in the sequence of construction are described in this Section and shall be utilized by the CONTRACTOR as a guideline. The construction constraints presented are intended to describe the sequence of critical events necessary to minimize disruption to the ongoing treatment plant processes. It shall be understood and agreed by the CONTRACTOR that the critical events described are not all inclusive and that additional items of work not described may be required to minimize disruption and ensure compliance.

1.2 The construction constraints described herein shall be incorporated into the CONTRACTOR's schedule as described in Section 01311 - Scheduling and Reporting.

A. Operational functions or shutdown of portions of the existing plant required to facilitate CONTRACTOR's operation will be done by the plant personnel only.

B. The plant operation and maintenance personnel will cooperate in every way that is practical in order to facilitate CONTRACTOR's operation.

C. If it is necessary for the proper operation or maintenance of portions of the plant, the OWNER may require the CONTRACTOR to reschedule an approved shutdown. The CONTRACTOR shall then reschedule his operations so there shall be no conflict with necessary operations or maintenance of the plant.

1.3 COMPLIANCE WITH UPDES PERMIT

A. Operations by the CONTRACTOR shall not impair in any way the OWNER's responsibility to comply with the facility's UPDES permit requirements.

1.4 OUTAGE PLANS

A. It is the CONTRACTOR's responsibility to coordinate and plan their construction activities in detail and provide such to the OWNER on an as needed or as requested basis by the OWNER or the ENGINEER. Outage plans shall be complete, concise, and provided two week in advance to the OWNER for review.

1.5 SCHEDULE CONSTRAINTS

A. It is the CONTRACTOR's responsibility to coordinate and plan the construction activities to integrate each schedule constraint into performance of the overall WORK.

1.6 CONSTRUCTION SEQUENCING

A. The order of construction in the different facilities can be adjusted based on the availability of the control equipment and fiber optic cable. Work in one facility shall be completed before work begins in the next facility except as explicitly allowed by the OWNER.

B. Replacement of Headworks Influent Pump Variable Frequency Drives:

1. A minimum of four pumps must be always kept in operation including automatic control except when HW-MCC-B is being modified for pumps P-2 and P-3. Complete operability of the pumps at each stage of construction shall be demonstrated to the Owner before beginning work on the next stage of construction. CONTRACTOR shall keep power supplied to HW-MCC-C at all times except for the minimum time required to temporarily hook-up and remove a temporary generator as outlined below.

2. The following is a proposed sequence of construction. It does not include all steps. Refer to the Demolition Drawings for additional information.
   a. Demolish VFD-HW-7 and the associated control section.
   b. Pumps in service HW-P-2, HW-P-3, HW-P-4, HW-P-5, HW-P-6.
   c. Install the new HW-VFD-7 and control section.
   d. Make all power and control connections and return HW-P-7 to service.
   e. Demolish VFD-HW-6.
   f. Pumps in service HW-P-2, HW-P-3, HW-P-4, HW-P-5, HW-P-7.
   g. Install the new HW-VFD-6 and control section.
   h. Make all power and control connections and return HW-P-6 to service.
   i. Demolish VFD-HW-5.
   j. Pumps in service HW-P-2, HW-P-3, HW-P-4, HW-P-6, HW-P-7.
   k. Install the new HW-VFD-5 and control section.
   l. Make all power and control connections and return HW-P-5 to service.
   m. Demolish VFD-HW-4.
   n. Pumps in service HW-P-2, HW-P-3, HW-P-5, HW-P-6, HW-P-7.
   o. Install the new HW-VFD-4 and control section.
   p. Make all power and control connections and return HW-P-4 to service.
   q. Provide a temporary generator to power HW-MCC-C while HW-MCC-B is being modified. The work on HW-MCC-B shall not start until the temporary generator is installed and in operation.
   r. Make the modifications to HW-MCC-B. Separate P-2 and P-3 from common bussing and install the new feeder breakers.
   s. Pumps in service HW-P-4, HW-P-6, HW-P-7.
   t. Perform acceptance testing on HW-MCC-B and return to service.
   u. Remove the temporary generator powering HW-MCC-C and remake the feed from HW-MCC-C.
   v. Pump in service HW-P-4, HW-P-5, HW-P-6, HW-P-7.
   w. Demolish HW-VFD-2 and HW-VFD-3.
   x. Install the new HW-VFD-3 and control section 2/3.
   y. Make all power and control connections and return HW-P-3 to service.
   z. Install the new HW-VFD-2.
   aa. Make all power and control connections and return HW-P-2 to service.
   bb. All pumps in service.

C. RAS/WAS Pump Station No. 1 replacement of variable frequency drives.
   1. All valve changes to isolate pumps from the process will be done by the Owner. The Contractor may choose either the north side or south side to begin the work.
   2. Complete operability of the pumps at each stage of construction shall be demonstrated to the Owner before beginning work on the next stage of construction.
   3. North side RAS pumps, PMP-1401, PMP-1402, PMP-1403 and WAS pumps.
      a. General:
         1) At least one WAS pump shall be in service at any time unless otherwise noted.
         2) RAS Pumps PMP-1401, PMP-1402 and PMP-1403 can removed from service.
      b. Demolition:
         1) Demolish the existing VFDs for PMP-1401 and PMP-1402.
         2) Demolish MCC sections RW-MCC-A-D and RW-MCC-A-E
         3) WAS pump PMP-1603 is in service.
      c. Install new MCC section RW-MCC-A-F.
      d. Install the new VFDs for:
         1) PMP-1401.
         2) PMP-1402.
         3) PMP-1403.
         4) PMP-1601.
         5) PMP-1602.
         6) PMP-1603.
      e. Make all power and control connections for pumps:
         1) PMP-1401.
         2) PMP-1402.
         3) PMP-1601.
         4) PMP-1602.
      f. Furnish a temporary generator and connect it to MCC section RW-MCC-A-F and power the following:
         1) PMP-1601.
         2) PMP-1602.
         3) WAS pumps PMP-1601 and PMP-1602 shall be tested and available for use by the OWNER before PMP-1403 is taken out of service.
      g. Demolish the existing RAS pump starter in section RW-MCC-A-C
      h. Install the new feeder breaker in section RW-MCC-A-C
      i. Make all power and control connections for PMP-1403
      j. Disconnect the temporary generator and make the power connection to section RW-MCC-A-F.
      k. Make final power and control connections for the VFD for PMP-1603 and PMP-1603.
      l. Test RAS pumps PMP-1401, PMP-1402, PMP-1403 and WAS pump PMP-1603 before beginning work on the south side RAS pumps.
   4. South side RAS pumps PMP-1404, PMP-1405, PMP-1406
      a. General
      b. 1. RAS pumps PMP-1404, PMP-1405 and PMP-1406 can be removed from service.
      c. Demolish the existing VFDs for PMP-1404 and PMP-1406.
      d. Demolish the starter in RW-MCC-B for RAS pump PMP-1405
      e. Install the three new VFDs for RAS pumps PMP-1404, PMP-1405 and PMP-1406.

f. Install the new feeder breaker in RW-MCC_B.
g. Make all power and control connections for RAS pumps PMP-1404, PMP-1405 and PMP-1406.

D. RAS/WAS Pump Station No. 2 replacement of variable frequency drives, PCM-1500 and section RW-MCC-A-C:

1. All valve changes to isolate pumps from the process will be done by the Owner.

a. Complete operability of the pumps at each stage of construction shall be demonstrated to the Owner before beginning work on the next stage of construction.

2. Scenario 1: Select the first RAS VFD to be demolished and coordinate with the Owner to isolate the pump.

a. The Contractor may select either VFD as the starting point.

1) Demolish the existing VFD and install the new VFD.

2) Make all power and control connections and return the RAS pump to service.

3) Install the new VFD for PMP-1502.

4) Disconnect PMP-1502 from the full voltage starter in RW-MCC-C.

i. Make all power and control connections and return the RAS pump to service.

ii. Demolish the remaining VFD.

iii. Install the new VFD for the third RAS pump.

iv. Make all power and control connections and return the RAS pump to service.

v. Demolish and replace the existing WAS pump VFDs one at a time.

vi. Demolish and replace PCM-1500. Coordinate with the Owner who will operate the RAS 2 Pump Station manually.

vii. Perform testing and commissioning on PCM-1500.

3. Scenario 2: The OWNER may elect to shutdown all of RAS 2 and Bioreactor 5 to allow the work to be completed in RAS 2 without the need for sequencing the work as described above. The OWNER will make the sole determination of which way to proceed at the appropriate time.

E. Solids Building.
1. Replace both Solids Building at the same time.
2. Insure the exhaust fan EXF-1002 does not run without the supply fan running to prevent damage to the duct work.

1.7 LIQUIDATED DAMAGES AND INCENTIVES

A. OWNER and CONTRACTOR recognize that time is of the essence for this Agreement and that the OWNER will suffer financial loss if the WORK is not completed by the listed milestones, plus any extensions thereof allowed in accordance with Article 12 of the

General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss suffered by the OWNER if the WORK is not completed on time. Accordingly, instead of requiring any such proof, the OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty), the CONTRACTOR shall pay the OWNER $500.00 for each calendar day thereafter, until the WORK is ready for use.

1.8 SAFETY PLAN

A. At the Preconstruction Conference, the CONTRACTOR shall submit a Safety, Health and Environmental Action Plan (SHEAP). SVWRF will review the SHEAP to ensure its compatibility with the safety policies of SVWRF. The CONTRACTOR shall address the topics provided on the SVWRF-SHEAP outline (outline is included in appendix to specifications).

B. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all health safety and environmental issues for his or her employees, including all aspects of onsite construction, operation and activities associated with the contract.

C. The CONTRACTOR shall provide the following insurance and safety data, for each of the past three years including the current year to date. See form entitled "Job Related Accident Reports" (form is included in appendix to specification)

D. The CONTRACTOR shall provide a list of employees including employees of subcontractors that will be coming to the SVWRF. Include names, positions and length of service. CONTRACTOR agrees to provide valid photo identifications of all employees and employees of subcontractors that will be coming to the SVWRF and further agrees to allow SVWRF to copy said photo IDs for security and safety use at SVWRF.

1.9 GENERAL REQUIREMENTS FOR ALL WORK

A. During all rehabilitation, modification and demolition work, safe working conditions for the OWNER's and CONTRACTOR's personnel shall be maintained at all times. The foregoing includes, but is not limited to, proper trench excavation, the provision of temporary equipment guards, supports, warning signs, walkways, covers over openings, hand-railing and protection of electrical equipment and power supply. All temporary facilities shall be constructed in accordance with applicable codes and regulations so that they operate safety and properly. Valves to be temporarily shut off during the WORK shall be tagged as such and shall be wired shut with a crimped lead seal and padlocked. Electrical and mechanical equipment shall be similarly shut down.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

-END OF SECTION-

SECTION 01070
ABBREVIATIONS OF INSTITUTIONS

PART 1 – GENERAL

1.1 GENERAL

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

1.2 ABBREVIATIONS

AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association, Inc.
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHAM	Association of Home Appliance Manufacturers
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANS	American Nuclear Society
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASA	Acoustical Society of America
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International

BHMA	Builders Hardware Manufacturer's Association
CBM	Certified Ballast Manufacturers
CEMA	Conveyors Equipment Manufacturer's Association
CGA	Compressed Gas Association
CLPCA	California Lathing and Plastering Contractors Association
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DCDMA	Diamond Core Drill Manufacturer's Association
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
EPA	Environmental Protection Agency
FM	Factory Mutual System
FPL	Forest Products Laboratory
HI	Hydronics Institute
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
ICEA	Insulated Power Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IME	Institute of Makers of Explosives
IP	Institute of Petroleum (London)
IPC	Institute of Printed Circuits
ISA	Instrument Society of America
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
ITU	International Telecommunications Union
MBMA	Metal Building Manufacturer's Association
MPTA	Mechanical Power Transmission Association
MSS	Manufacturers Standardization Society
MTI	Marine Testing Institute
NAAMM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NLGI	National Lubricating Grease Institute
NMA	National Microfilm Association
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PPI	Plastics Pipe Institute
RCRA	Resource Conservation and Recovery Act
RIS	Redwood Inspection Service
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Makers Association

SMA	Screen Manufacturers Association
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPI	Society of the Plastics Industry, Inc.
SPIB	Southern Pine Inspection Bureau
SPR	Simplified Practice Recommendation
SSA	Swedish Standards Association
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Steel Structures Painting Council
SSPWC	Standard Specifications for Public Works Construction
TAPPI	Technical Association of the Pulp and Paper Industry
TFI	The Fertilizer Institute
TIA	Telecommunications Industry Association
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WEF	Water Environment Federation
WIC	Woodwork Institute of California
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

SECTION 01090
REFERENCE STANDARDS

PART 1 – GENERAL

1.1 GENERAL

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

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

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

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

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

B. References herein to "Building Code" or "International Building Code" shall mean International Building Code of the International Conference of Building Officials (ICBO). Similarly, references to "Mechanical Code" or "International Mechanical Code," "Plumbing Code" or "International Plumbing Code," "Fire Code" or "International Fire Code," shall mean International Mechanical Code, International Plumbing Code and International Fire Code of the International Conference of the Building Officials (ICBO). "Electric Code" or "National Electric Code (NEC)" shall mean the National Electric Code of the National Fire Protection Association (NFPA). The latest edition of the codes as approved by the Municipal Code and used by the local agency as of the date that the Work is advertised for bids, as adopted by the agency having jurisdiction, shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

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

D. The CONTRACTOR shall construct the Work indicated herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed herein.

E. Applicable Standard Specifications: References in the Contract Documents to the "Standard Specifications" shall mean the Uniform Standard Specifications for Public Works Construction Off-Site Improvements, Salt Lake County Area, latest version.

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

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

H. References herein to “UDOT Standards” shall mean Standard Specifications for Road and Bridge Construction.

I. References herein to “MSHA Standards” shall mean Mine Safety and Health Administration, latest version.

1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

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

B. Where no specific regulations exist, all chemical, hazardous, and petroleum product piping and storage in underground locations must be installed with double containment piping and tanks, or in separate concrete trenches and vaults, or with an approved lining which cannot be penetrated by the chemicals, unless waived in writing by the OWNER.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

SECTION 01300
CONTRACTOR SUBMITTALS

PART 1 – GENERAL

1.1 GENERAL

A. CONTRACTOR "Submittals" may be Shop Drawings, schedules, surveys, reports, samples, plans, lists, drawings, documents, findings, programs, manuals, data, or any other item or information required by the Contract Documents to be submitted or offered by the CONTRACTOR in accomplishing the Work.

B. Wherever Submittals are required hereunder, all such documents shall be furnished to the OWNER.

C. The CONTRACTOR shall be responsible for the accuracy, completeness, and coordination of all Submittals. The CONTRACTOR shall not delegate this responsibility in whole or in part to any Subcontractor. Submittals may be prepared by the CONTRACTOR, Subcontractor, or Supplier, but the CONTRACTOR shall ascertain that each Submittal meets the requirements of the Contract and the Project. The CONTRACTOR shall ensure that there is no conflict with other Submittals and shall notify the OWNER in each case where its Submittal may affect the work of another Contractor or the OWNER. The CONTRACTOR shall ensure coordination of Submittals of related crafts and Subcontractors.

1.2 PRECONSTRUCTION CONFERENCE SUBMITTALS

A. At the preconstruction conference referred to in Section 01010 - Summary of Work, submit the following items for review:

1. A project overview bar chart in accordance with Section 01311 – Scheduling and Reporting.

2. The names and qualifications of Designated Safety Representative and Designated Competent Persons.

3. At the Preconstruction Conference, the Contractor shall submit a Safety, Health and Environmental Action Plan (SHEAP). SVWRF will review the SHEAP to ensure its compatibility with the safety policies of SVWRF.

1.3 SHOP DRAWINGS

A. Wherever called for in the Contract Documents, or where required by the OWNER, the CONTRACTOR shall furnish to the OWNER for review, 5 copies of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, list, graphs, catalog sheets, data sheets, and similar items. Whenever the CONTRACTOR is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state wherein the project is to be built, unless otherwise directed.

B. Except as may otherwise be indicated herein, the OWNER will return prints of each submittal to the CONTRACTOR with its comments noted thereon, within 20 working days following their receipt by the OWNER. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the OWNER by the second submission of a submittal item. The OWNER reserves the right to withhold monies due to the CONTRACTOR to cover additional costs of the OWNER's review beyond the second submittal.

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

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

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

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

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

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

I. The OWNER's review of CONTRACTOR shop drawings submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

1.4 OWNER'S MANUAL

A. The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OWNER'S MANUAL. It shall be written so that it can be used and understood by the OWNER'S operation and maintenance staff.

B. The OWNER'S MANUAL shall be subdivided first by specification section number; second, by equipment item; and last, by "Part." "Parts" shall conform to the following (as applicable):

1. Part 1 - Equipment Summary:

   a. Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.

   b. Form: The OWNER will supply an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the WORK. The CONTRACTOR shall fill in the relevant information on the form and include it in Part 1.

2. Part 2 - Operational Procedures:

   a. Procedures: CONTRACTOR-recommended procedures on the following shall be included in Part 2:

      Installation
      Adjustment
      Startup
      Location of controls, special tools, equipment required, or related instrumentation needed for operation
      Operation procedures
      Load changes
      Calibration
      Shutdown
      Troubleshooting
      Disassembly
      Reassembly
      Realignment
      Testing to determine performance efficiency
      Tabulation of proper settings for all pressure relief valves, low and high pressure switches, and other protection devices
      List of all electrical relay settings including alarm and contact settings

3. Part 3 - Preventive Maintenance Procedures:

   a. Procedures: Preventive maintenance procedures shall include all CONTRACTOR-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by leaving the equipment in place.

   b. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade, type, and temperature ranges, shall be covered.

4. Part 4 - Parts List:

    a. Parts List: A complete parts list shall be furnished, including a generic description and CONTRACTOR's and original manufacturer's identification numbers for each part. Addresses and telephone numbers of the nearest CONTRACTOR and parts warehouse shall be included.

    b. Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.

5. Part 5 - Wiring Diagrams:

    a. Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items.

6. Part 6 - Shop Drawings:

    a. Drawings: This part shall include approved shop or fabrication drawings, complete with dimensions.

7. Part 7 - Safety:

    a. Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

8. Part 8 - Documentation:

    a. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

C. The CONTRACTOR shall furnish to the OWNER 3 identical OWNER'S MANUALS. Each set shall consist of one or more volumes, each of which shall be bound in a ITOYA Spring-Post Binder, 3-post, loose-leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder paper capacity shall not exceed 4 inches. Multiple binders may be required to form a set. Binders shall be sized appropriately. A table of contents indicating all equipment in the manuals shall be prepared.

D. OWNER'S MANUALS shall be submitted in final form to the OWNER not later than the date first VFD installation. The CONTRACTOR shall correct all discrepancies found by the OWNER in the technical manuals within 30 days from the date of written notification by the OWNER.

E. Incomplete or unacceptable OWNER'S MANUALS shall constitute sufficient justification to withhold 5-percent of the total price of the equipment due to the CONTRACTOR until the OWNER'S MANUAL is completed.

1.5 SPARE PARTS LIST

A. The CONTRACTOR shall furnish to the OWNER 3 identical sets of spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall

be limited to those spare parts which each CONTRACTOR recommends be maintained by the OWNER in inventory at the plant site. Each CONTRACTOR shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the OWNER in ordering. The CONTRACTOR shall cross-reference all spare parts lists to the equipment numbers designated in the Proposal Documents and shall include the original manufacturer. The spare parts lists shall be bound in the OWNER'S MANUAL.

1.6 CONTRACTOR'S SCHEDULE

A. The CONTRACTOR's construction schedules and reports shall be prepared and submitted to the OWNER in accordance with the provisions of Section 01311 – Scheduling and Reporting.

1.7 WEEKLY FORCE REPORT

A. The CONTRACTOR and each Subcontractor shall submit to the OWNER, or designee, a weekly force report. Deliver report not later than 9:00 A.M. of the Monday following the report date and include the following:

1. Days of week, date, CONTRACTOR name and Report number.

2. Summary of work in process (segregated by CONTRACTOR and Subcontractor).

3. Details of work accomplished including quantities of work installed.

4. Summary of equipment working and where working.

5. Summary of manpower by work element and Subcontractor.

6. Receipt of major equipment or materials.

7. All required testing performed and, if available, documented results.

1.8 REQUESTS FOR INFORMATION

A. In the event that the CONTRACTOR, Subcontractor or supplier, at any tier, determines that some portion of the drawings, specifications, or other Contract Documents requires clarification or interpretation by the OWNER, the CONTRACTOR shall submit a Request for Information in writing to the OWNER. Requests for Information may only be submitted by the CONTRACTOR and shall only be submitted on the Request for Information form provided by the OWNER. The CONTRACTOR shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the OWNER. In the Request for Information the CONTRACTOR shall set forth their own interpretation or understanding of the requirement along with reasons why they have reached such an understanding.

B. The OWNER will review all Requests for Information to determine whether they are Requests for Information within the meaning of this term. If the OWNER determines that the document is not a Request for Information it will be returned to the CONTRACTOR, unreviewed as to content, for resubmittal on the proper form and in the proper manner.

C. Responses from the OWNER will not change any requirement of the Contract Documents unless so noted by the OWNER in the response to the Request for Information. In the event the CONTRACTOR believes that a response to a Request for Information will cause a change to the requirements of the Contract Documents the CONTRACTOR shall immediately give written notice to the OWNER stating that the CONTRACTOR considers the response to be a Change Order. Failure to give such written notice immediately shall waive the CONTRACTOR's right to seek additional time or cost under the Contract.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

SECTION 01301
SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 GENERAL

A. This Section defines the process whereby the Schedule of Values shall be developed and incorporated into the cost loading function of the CPM Construction Schedule as specified in Section 01311 - Scheduling and Reporting. Monthly progress payment amounts shall be determined from the monthly progress updates of the CPM Schedule activities.

B. The Schedule of Values shall be developed independent of, but simultaneous with the development of the CPM schedule activities and logic.

1.2 PRELIMINARY SCHEDULE OF VALUES

A. The CONTRACTOR shall submit a preliminary Schedule of Values for the major components of the WORK at the Preconstruction Conference in accordance with Section 01010 - Summary of Work. The listing shall include, at a minimum, the proposed value for the following major WORK components:

1. Mobilization: Up to a maximum of three (3) percent of contract price.

2. The total value of electrical WORK.

3. The total value of demolition WORK.

4. The total value of all other WORK not specifically included in the above items.

B. The CONTRACTOR and RESIDENT PROJECT REPRESENTATIVE (RPR) shall meet and jointly review the preliminary Schedule of Values and make any adjustments in value allocations if, in the opinion of the RPR, these are necessary to establish fair and reasonable allocation of values for the major WORK components. Front end loading will not be permitted. The RPR may require reallocation of major WORK components from items in the above listing if in the opinion of the RPR such reallocation is necessary. This review and any necessary revisions shall be completed within 15 days from the date of Notice to Proceed.

1.3 DETAILED SCHEDULE OF VALUES

A. The CONTRACTOR shall add the additional items so identified by the RPR within 21 days from the date of Notice to Proceed. The detailed Schedule of Values shall be based on the accepted preliminary Schedule of Values for major WORK components. Because the ultimate requirement is to develop a detailed Schedule of values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM Schedule activities, sufficient detailed breakdown shall be provided to meet this requirement. The RPR shall be the sole judge of acceptable numbers, details and description of values established. If, in the opinion of the RPR, a greater number of Schedule of Values items than proposed by the

CONTRACTOR is necessary, the CONTRACTOR shall add the additional items so identified by the RPR.

1. The minimum detail of breakdown of the major WORK components is indicated below. Greater detail shall be provided as directed by the RPR. It is generally intended that a breakdown for each major facility and/or WORK element be provided.

    a. Mobilization - no breakdown required.

    b. Section 01311 - Scheduling and Reporting, broken down by submittal.

    c. The electrical WORK shall be broken down into conduit and raceway installation, cable and wire installation, electrical equipment installation, and terminations. Electrical WORK shall also be broken down by building or facility.

    d. Demolition work - breakdown by building or structure.

2. The CONTRACTOR and RPR shall meet and jointly review the detailed Schedule of Values within 35 days from the date of Notice to Proceed. The value allocations and extent of detail shall be reviewed to determine any necessary adjustments to the values and to determine if sufficient detail has been proposed to allow acceptable cost loading of the CPM Schedule activities. Any adjustment deemed necessary to the value allocation or level of detail shall be made by the CONTRACTOR and a revised detailed Schedule of Values shall be submitted within 40 days from the date of Notice to Proceed.

3. Following acceptance of the detailed Schedule of Values, the CONTRACTOR shall incorporate the values into the cost loading portion of the CPM Schedule. The CPM activities and logic shall have been developed concurrent with development of the detailed Schedule of Values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual Schedule activities. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM Schedule activities, where interfacing these two documents will require changes to each document. Schedule activities may need to be added to accommodate the detail of the Schedule of Values. Schedule of Value items may need to be added to accommodate the detail of the CPM Schedule activities. Where such instances arise, the CONTRACTOR shall propose changes to the Schedule of Values and to the CPM Schedule activities to satisfy the CPM Schedule cost loading requirements.

1.4 CROSS REFERENCE LISTING

A. To assist in the correlation of the Schedule of Values and the CPM Schedule, the CONTRACTOR shall provide a Cross Reference Listing which shall be furnished in two parts. The first part shall list each Scheduled Activity with the breakdown of the respective valued items making up the total cost of the activity. The second part shall list the valued item with the respective Scheduled Activity or Activities that make up the total cost indicated. In the case where a number of schedule

items make up the total cost for the valued item (shown in the Schedule of Values) the total cost for each scheduled item should be indicated.

B. These listings shall be updated and submitted in conjunction with the CPM monthly submittals as stated in Section 01311 - Scheduling and Reporting.

C. Approved change orders reflected in the CPM Schedule shall be incorporated into the Schedule of Values as a single unit identified by the change order number.

1.5 CHANGES TO SCHEDULE OF VALUES

A. Changes to the CPM Schedule which add activities not included in the original schedule but included in the original WORK (schedule omissions) shall have values assigned as approved by the RPR. Other activity values shall be reduced to provide equal value adjustment increases for added activities as approved by the RPR.

B. In the event that the CONTRACTOR and RPR agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01311 – SCHEDULING AND REPORTING

PART 1 GENERAL

1.1 GENERAL

A. Scheduling of the WORK shall be performed by the CONTRACTOR in accordance with the requirements of this Section.

1.2 INITIAL SCHEDULE SUBMITTALS

A. The CONTRACTOR shall submit one schedule document at the Preconstruction Conference which shall serve as the CONTRACTOR's Plan of Operation for the period of the Contract Time and to identify the manner in which the CONTRACTOR intends to complete all WORK within the Contract Time.

1. Project Overview Bar Chart. The overview bar chart shall indicate the major components of the WORK and the sequence relations between major components and subdivisions of major components. The overview bar chart shall indicate the relationships and time frames in which the various components of the WORK will be made substantially complete and placed into service in order to meet the project milestones. Sufficient detail shall be included for the identification of subdivisions of major components within the overall project scope. Planned durations and start dates shall be indicated for each work item subdivision. Each major component and subdivision component shall be accurately plotted on time scale sheets not to exceed 36-inch by 60-inch in size. Not more than four sheets shall be employed to represent this overview information.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

- END OF SECTION –

SECTION 01505
MOBILIZATION

PART 1 – GENERAL

1.1 GENERAL

A. Mobilization shall include the obtaining of all permits; moving onto the site of all plant and equipment; furnishing and erecting plants, temporary buildings, and other construction facilities; implementing security requirements; all as required for the proper performance and completion of the WORK. Mobilization shall include the following principal items.

1. Providing all required insurance certificates and bonds.

2. Moving on to the site, or portion of site as available, of all the CONTRACTOR's plant and equipment required for first month operations including office and storage trailers.

3. Providing on-site sanitary facilities and potable water facilities.

4. Constructing and implementing security features and requirements complying with Section 01520 - Security and Process Safety Management.

5. Obtaining all required permits.

6. Posting all OSHA required notices and establishment of safety programs.

7. Submitting initial submittals.

1.2 PAYMENT FOR MOBILIZATION

A. The CONTRACTOR shall include mobilization as an item on the Schedule of Values (Lump Sum Price breakdown). No payment for mobilization, or any part thereof, will be made until all mobilization items listed above have been completed as specified.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

SECTION 01510
TEMPORARY UTILITIES

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide temporary utilities as required to provide the Work and perform the services, complete, in accordance with the Contract Documents.

B. Types: The types of utility services required for general temporary use at the project site include the following:

Sanitary Facilities

1.2 JOB CONDITIONS

A. Scheduled Uses: In conjunction with establishment of the job progress schedule, establish a schedule for implementation and termination of service for each temporary utility or facility; at earliest feasible time, and when acceptable to OWNER, change over from use of temporary utility service to permanent service.

PART 2 – PRODUCTS

2.1 MATERIALS

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

PART 3 – EXECUTION

3.1 INSTALLATION OF TEMPORARY UTILITY SERVICES

A. Approval of Electrical Connections: All temporary connections for electricity shall be subject to approval of the RPR and shall be removed in like manner at the CONTRACTOR's expense prior to final acceptance of the Work.

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

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

3.2 INSTALLATION OF LIGHTING

A. Construction Lighting: All Work conducted at night or under conditions of deficient daylight shall be suitably lighted to insure proper Work and to afford adequate facilities for inspection and safe working conditions.

B. Temporary Lighting: The CONTRACTOR shall provide a general, weatherproof, grounded temporary lighting system in every area of construction work and provide sufficient illumination for safe work; and run circuit wiring generally overhead, and rise vertically in locations where it will be least exposed to possible damage from construction operations on grade, floors, decks, or other recognized areas of possible damage or abuse.

3.3 INSTALLATION OF SANITARY FACILITIES

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

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

3.4 OPERATIONS AND TERMINATIONS

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

B. Removal of Utility Connections: Before final acceptance of the WORK on the project, all temporary connections installed by the CONTRACTOR shall be entirely removed, and all affected improvements shall be restored to original condition or better, to the satisfaction of the RPR and to the agency owning the affected utility.

END OF SECTION

SECTION 01520
SECURITY AND PROCESS SAFETY MANAGEMENT

PART 1 – GENERAL

1.1 SECURITY PROGRAM

A. The CONTRACTOR shall:

1. Protect WORK, existing premises and OWNER's operations from theft, vandalism, and unauthorized entry.

2. Maintain program throughout construction period.

3. Require that the workers employed by the CONTRACTOR, his Subcontractors and his Vendors shall obey all Rules and Ordinances enacted by the SVWRF regarding the existence of firearms on SVWRF property. The CONTRACTOR shall immediately suspend any such worker who disobeys said Rules and Ordinances and remove such worker from the SVWRF property.

1.2 ENTRY CONTROL

A. The CONTRACTOR shall:

1. Limit entry of persons and vehicles into project site.

2. Allow entry only to authorized persons.

3. Require that all personal vehicles of the workers employed by the CONTRACTOR, his Subcontractors and his Vendors shall park their cars outside of the SVWRF property enclosed by SVWRF gates and fencing. At his option, the CONTRACTOR may construct a temporary parking facility on the OWNER'S property southwest of the main SVWRF entry gate to be used by the workers.
4. Entry to the SVWRF facility by the workers of the CONTRACTOR, his Subcontractors and his Vendors may be by walking through the front gate or by official shuttle bus operated by the CONTRACTOR.

B. OWNER will control entrance of persons and vehicles related to OWNER's operations.

C. The CONTRACTOR's and all Subcontractor's personnel shall report at the Lower Maintenance Building at the start and the end of the work day. Each person shall sign the daily roll log and indicate the time of sign-in and sign-out. The RPR will copy the daily roll log and submit to the OWNER's designated person to monitor for Process Safety Management purposes.

1.3 PERSONNEL IDENTIFICATION

A. The CONTRACTOR shall:

1. Maintain al list of authorized persons and submit copy to OWNER on request.
2. Require that an identifying badge shall be worn by each of the workers of the CONTRACTOR, his subcontractors and Vendors on the front of their construction hard hats. Further, the CONTRACTOR shall collect the Driver's License of each worker as he first comes on-site and submit them to the RPR. The RPR will oversee the production of the badges and will return the Driver's Licenses with Badges to the CONTRACTOR's Project Superintendent.

1.4 PROCESS SAFETY MANAGEMENT PLAN

A. The CONTRACTOR shall conform to the OWNER's Process Safety Management Plan which is available for review from the Owner's designated Safety officer.

B. Hot Work Permit. The CONTRACTOR's personnel shall obtain a Hot Work Permit when conducting work on any existing electrical equipment. Hot Work permits shall be completed daily by each employee and counter-signed by the OWNER.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01530
PROTECTION OF EXISTING FACILITIES

PART 1 – GENERAL

1.1 GENERAL

A. The CONTRACTOR shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than prior to such damage or temporary relocation.

1.2 RIGHTS-OF-WAY

A. The CONTRACTOR shall not do any WORK that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electrical transmission line; any fence; or any other structure, nor shall the CONTRACTOR enter upon the rights-of-way involved until notified that the OWNER has secured authority therefore from the proper party.

B. After authority has been obtained, the CONTRACTOR shall give said party due notice of its intention to begin WORK, if required by said party, and shall remove, shore, support, or otherwise protect such pipeline, transmission line, ditch, fence, or structure, re replace the same.

C. Some of the SVWRF facilities are located on Rocky Mountain Power (RMP) Rights-of-Way as shown on the Drawings. SVWRF has permanent easements to install remove, repair or replace sewer pipelines and other facilities on these easements. Copies of the easements and conditions for their use may be examined at the office of the SVWRF during regular business hours. The CONTRACTOR shall comply with the conditions of each easement. The CONTRACTOR shall maintain the minimum clearance mandated by RMP or 6-feet, whichever is greater, between the lowest conductor on the RMP power lines and maximum verti8cal reach of the equipment booms operated by the CONTRACTOR.

D. When two or more contracts are being executed at one time of the same or adjacent land in such manner the WORK on one contract may interfere with that on another, the OWNER shall determine the sequence and order of the WORK. When the territory of one contract is necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by the OWNER to CONTRACTOR so desiring, to the extent, amount, in the manner, and at the times permitted, No such decision as to the method or time of conducting the WORK or the use of territory shall be made the basis of any claim for delay or damage, except as provided for temporary suspension of the WORK in Article o the General Conditions of the Contract.

1.3 PROTECTION OF STREET OR ROADWAY MARKERS

A. The CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper

authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced. Survey markers or points disturbed by the CONTRACTOR shall be accurately restored after street or roadway resurfacing has been complete.

1.4 RESTORATION OF PAVEMENT

A. General: All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit. The pavement restoration requirement to match existing sections shall apply to all components of existing sections, including sub-base, base, and pavement. Temporary and permanent pavement shall conform to the requirements of the affected pavement owner. Pavements which are subject to partial removal shall be neatly saw cut in straight lines.

B. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the CONTRACTOR shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

C. Restoration of Sidewalks or Private Driveways: Wherever sidewalks or private roads have been removed for purposes of construction, the CONTRACTOR shall place suitable temporary sidewalks or roadways promptly after backfilling and shall maintain them in satisfactory condition until the final restoration thereof has been made.

1.5 EXISTING UTILITIES AND IMPROVEMENTS

A. General: The CONTRACTOR shall protect underground utilities and other improvements which may be impaired during construction operations, regardless of whether or not the utilities are indicated on the Drawings. The CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

B. Except where the Drawings indicate utilities have been field located during design or certain utility locations shall be exposed as part of the WORK, the CONTRACTOR shall be responsible for exploratory excavations as it deems necessary to determine the exact locations and depths of utilities which may interfere with its work. All such exploratory excavations shall be performed as soon as practicable after Notice to Proceed and , in any event, a sufficient time in advance of construction to avoid possible delays to the CONTRACTOR’s progress. When such exploratory excavations show the utility location as shown on the Drawings to be in error, the

CONTRACTOR shall so notify the RESIDENT PROJECT REPRESENTATIVE (RPR).

C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

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

E. Utilities to be Removed: Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which I indicated, the CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to the RPR and the owner of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal. Permanent relocation of any utility shall be noted on the CONTRACTOR's record drawings.

F. OWNER's Right of Access: The right is reserved to the OWNER and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the WORK of this Contract.

G. Underground utilities Indicated: Existing utility lines that are indicated or the locations of which are made known to the CONTRACTOR prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and if damaged, shall be immediately repaired or replaced by the CONTRACTOR, unless otherwise repaired by the owner of the damaged utility. If the owner of the damaged facility performs its own repairs, the CONTRACTOR shall reimburse said owner for the costs of repair.

H. Underground Utilities Not Indicated: In the event that the CONTRACTOR damages existing utility lines that are not indicated or the locations of which are not made know to the CONTRACTOR prior to excavation, a verbal report of such damage shall be made immediately to the RPR and a written report thereof shall be made promptly thereafter. The RPR will immediately notify the owner of the damaged utility. If the RPR is not immediately available, the CONTRACTOR shall notify the utility owner of the damage. If directed by the RPR, repairs shall be made by the CONTRACTOR under the provisions for changes and extra work contained in the General Conditions.

I. Costs of locating and repairing damage not due to failure of the CONTRACTOR to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Contract Documents with reasonable accuracy, and for equipment

on the project which was actually working on that portion of the WORK which was interrupted or idled by removal or relocation of such utility facilities, and which was necessarily idled during such work will be paid for as extra work in accordance with the provisions of Articles, 10, 11, and 12 of the General Conditions.

J. Approval of Repairs: All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement owner before being concealed by backfill or other work.

K. Maintaining in Service: Unless indicated otherwise, oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the WORK shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the RPR are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. The CONTRACTOR shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or it not discovered until after completion of the backfilling.

1.6 TREES OR SHRUBS WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

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

B. Trimming: Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. Cuts over 1-1/2 inches in diameter shall be coated with a tree paint product that is waterproof, adhesive, and elastic, and free from kerosenes, coal tar, creosote, or other materials injurious to the life of the tree.

C. Replacement: The CONTRACTOR shall immediately notify the jurisdictional agency and/or the OWNER if any tree or shrub is damaged by the CONTRACTOR's operations. If, in the opinion of said agency or the OWNER, the damage is such that replacement is necessary, the CONTRACTOR shall replace the tree or shrub at its own expense. The tree or shrub shall be of a like size and variety as the one damaged, or, if of a smaller size, the CONTRACTOR shall pay to the owner of said tree a compensatory payment acceptable to the tree or shrub owner, subject to the approval of the jurisdictional agency or OWNER. The size of the tree or shrub shall be not less than 1-inch diameter nor less than 6 feet in height. Planting of replacement trees and shrubs shall be in accordance with the recommendations of the nursery furnishing the plants. Unless otherwise indicated, the CONTRACTOR shall water and maintain the replacements trees and shrubs for 6 months after planting.

1.7 LAWN AREAS

A. Lawn or landscaped areas and irrigation systems damaged during construction shall be repaired to match the pre-construction condition to the satisfaction of the OWNER. The damaged lawn shall be replaced with sod on top of an adequate layer of topsoil. Damaged sprinkler heads shall be replaced with identical heads. Installation details for sprinkler system and sprinkler heads shall match existing.

1.8 NOTIFICATION BY THE CONTRACTOR

A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, the CONTRACTOR shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than 3 days nor more than 7 days prior to excavation so that a representative of said owners or agencies can be present during such work if they so desire. The CONTRACTOR shall notify RMP three days prior to mobilizing any machinery or equipment within reach of any overhead power lines and shall comply with RMP requirements regarding the operation of such machinery or equipment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01550
SITE ACCESS AND STORAGE

PART 1 – GENERAL

1.1 HIGHWAY LIMITATIONS

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

1.2 TEMPORARY CROSSINGS

A. General: Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants and parking lots. The CONTRACTOR shall cooperate with parties involved in removal of trash, and garbage so as to maintain existing schedules for such services.

B. Temporary Bridges: Wherever necessary, the CONTRACTOR shall provide suitable temporary bridges or steel plates over unfilled excavations. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation.

C. Street Use: Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, alleyway, or parking area during the performance of the WORK hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. Where excavation is being performed in streets, one lane in each direction shall be kept open to traffic at all times unless otherwise indicated. Fire hydrants on or adjacent to the WORK shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the CONTRACTOR to assure the use of sidewalks and the proper functioning of all gutters, storm drain inlets, and other drainage facilities.

1.3 CONTRACTOR'S WORK AND STORAGE AREA

A. The OWNER will designate and arrange for the CONTRACTOR's use, a portion of the property near to the WORK for its exclusive use during the term of the Contract as a storage and shop area for its construction operations relative to this Contract. Security at the CONTRACTOR's work and storage area is the responsibility of the CONTRACTOR. At completion of WORK, the CONTRACTOR shall return this area to its original condition, including grading and landscaping.

B. The CONTRACTOR shall make its own arrangements for any necessary off-site storage or shop areas necessary for the proper execution of the WORK.

C. The CONTRACTOR shall construct and use a separate storage area for hazardous materials used in constructing the WORK.

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

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

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

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

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

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

1.4 PARKING

A. The CONTRACTOR shall:

1. Park official company vehicles and equipment in areas as directed by the RPR.

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

3. See Section 01520 - Security and Process Safety Management for parking of personal vehicles.

1.5 VEHICLE CLEANING

A. All vehicles leaving the site shall be cleaned to prevent the carrying of mud, gravel or other debris onto the Plant access road system or 1300 West Street.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01560
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 – GENERAL

1.1 EXPLOSIVES AND BLASTING

A. Use of explosives on the WORK is not permitted.

1.2 DUST ABATEMENT

A. The CONTRACTOR shall prevent its operation from producing dust in amounts damaging to property, cultivated vegetation or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity. The CONTRACTOR shall be responsible for any damage resulting from dust originating from its operations. The dust abatement measures shall be continued throughout all phases of construction, including suspension of work, until final acceptance. The CONTRACTOR shall abate dust nuisance by cleaning, sweeping, or other means necessary. Use of water resulting in mud on access areas used by the public or OWNER will not be permitted as a substitute for sweeping or other methods.

1.3 RUBBISH CONTROL

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

1.4 CHEMICALS

A. All chemicals used during project construction or furnished for project operations, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or other classification shall show approval of either the USEPA or the USDA. Use of such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer(s). In addition, see the requirements set forth in the General Conditions.

1.5 AIR POLLUTION CONTROL

A. The CONTRACTOR shall not discharge smoke, dust or any other air contaminants into the atmosphere in such quantity as may violate the regulations of any legally constituted authority having jurisdiction.

1.6 WATER POLLUTION CONTROL

A. The CONTRACTOR shall exercise every reasonable precaution to protect plant facilities, drainage channels and storm facilities from pollution. It shall avoid muddying and silting of said channels. Water pollution control work shall consist of constructing those facilities which may be required to provide prevention, control and abatement of water pollution.

B. SVWRF Storm Water Pollution Prevention Plan Requirements for Contractors – South Valley WRF has an active Storm Water Discharge Permit. CONTRACTORS working at either of our facilities are required to take actions to minimize the potential of storm water contamination that come from their work activities. At our main facility, precipitation that falls on paved or packed dirt parking areas is collected and discharged directly into the Jordan River. Currently, the storm water receives no additional treatment, which requires SVWRF to be proactive in controlling potential pollution sources on site. As part of the SVWRF Storm Water Pollution Prevention Plan, CONTRACTORS are required under our Good Housekeeping Policy to take the necessary actions to minimize potential negative impacts on storm water. Following are some of situations and the expected actions to be taken by the CONTRACTOR to control possible storm water contamination. This is not meant to be a comprehensive list, but only a few examples of situations that might develop during construction. Included are the corrective actions required by SVWRF if a spill or leak occurs. Any spills or leaks on the construction site **must be reported immediately** to the Resident Project Representative, who in turn will report to the SVWRF Storm Water Pollution Prevention Plan Coordinator, Lee Rawlings, and/or the Safety and Security Coordinator, Jonathon Baronowski.

Item	Pollution Source	Required Action
Road and Parking Areas	Dirt, gravel, sand, etc., tracked onto roads by CONTRACTOR's equipment.	Remove immediately. Ongoing hauling /excavation may require scheduled hourly cleaning.
CONTRACTOR Equipment	Leaking oil, hydraulic fluid, antifreeze, routine maintenance, etc.	Contain the spill immediately to minimize contamination. Clean up the spilled material; i.e. remove contaminated soil, clean asphalt and replace if necessary. Clean cement.
Vehicle Fueling Area	Fuel spilled	Immediately clean up the spilled material; i.e. remove contaminated soil, clean asphalt and replace if necessary. Clean cement.
Chemicals and Other Hazardous Materials	Outside storage	Must be kept **completely** covered. Hazardous materials must be removed from site ASAP after using it for its intended purpose.
	Spills and leaks	Immediately clean up the spilled material; i.e. remove contaminated soil, clean asphalt and replace if necessary. Clean cement.
Above Ground Storage Tanks	Leakage and/or spills	Immediately clean up the spilled material; i.e. remove contaminated soil, clean asphalt and replace if necessary. Clean cement.

Item	Pollution Source	Required Action
Ground Water	Pumping to clear an excavation	Control measures must be in place to minimize silt, gravel, etc., from entering the storm water collection system. Only discharge of uncontaminated ground water is allowed by the SVWRF permit. Additional testing may be required before pumping begins.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01600 –
PRODUCTS, MATERIALS and EQUIPMENT

PART 1 - GENERAL

1.1 DEFINITIONS

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

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

1.2 QUALITY ASSURANCE

A. Source Limitations: To the greatest extent possible for each unit of work, the CONTRACTOR shall provide products, materials, and equipment of a singular generic kind from a single source.

B. Compatibility of Options: Where more than one choice is available as options for CONTRACTOR's selection of a product, material, or equipment, the CONTRACTOR shall select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material and equipment selections.

1.3 PRODUCT DELIVERY AND STORAGE

A. The CONTRACTOR shall deliver and store the WORK in accordance with methods and means that will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of products at the CONTRACTOR'S facility and the OWNER'S site and overcrowding of construction spaces. In particular, the CONTRACTOR shall ensure coordination to ensure minimum holding or storage times.

1.4 TRANSPORTATION AND HANDLING

A. Products shall be transported by methods to avoid damage and shall be delivered in undamaged condition.

B. The CONTRACTOR shall provide equipment and personnel to handle products, materials, and equipment, by methods to prevent soiling and damage while the equipment is in the CONTRACTOR'S control.

C. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

D. The CONTRACTOR shall be responsible to deliver the equipment to the job site. The CONTRACTOR will also be responsible for unloading, storing, protecting and installing the equipment at the job site. The CONTRACTOR shall notify the OWNER (14) calendar days prior to delivery of equipment.

1.5 STORAGE AND PROTECTION PRIOR TO SHIPMENT

A. Products shall be stored in accordance with component manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.

B. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.

C. Storage shall be arranged to provide access for inspection. The CONTRACTOR shall periodically inspect to assure products are undamaged and are maintained under required conditions.

D. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

1.6 MAINTENANCE OF STORAGE

A. Stored products shall be periodically inspected on a scheduled basis. The CONTRACTOR shall maintain a log of inspections and shall make the log available on request.

B. The CONTRACTOR shall maintain manufacturer-required environmental conditions continually.

C. The CONTRACTOR shall ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.

D. For mechanical and electrical components, the CONTRACTOR shall provide a copy of the component manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.

E. Products shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document prior to acceptance by the OWNER in accordance with the Proposal Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

-END OF SECTION-

SECTION 01612

SEISMIC DESIGN CRITERIA

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Seismic design criteria for the following:
   1. Anchorage of mechanical and electrical equipment.
   2. Seismic design and design of anchorage for small tanks fabricated off site and shipped to the Project site.
   3. Other structures or items as specified or indicated on the Drawings.

1.02 REFERENCES

A. American Society of Civil Engineers (ASCE):
   1. 7-10 - Minimum Design Loads for Buildings and Other Structures.

1.03 SYSTEM DESCRIPTION

A. Design in accordance with the requirements of the building code as specified in Section 01410 - Regulatory Requirements.

B. Design spectral acceleration at short period, S_{DS}: 0.918.

C. Design of non-structural components and their connections to structures:
   1. Component amplification factor, a_p: In accordance with ASCE 7, Tables 13.5-1 and 13.6-1.
   2. Component response modification factor, R_p: In accordance with ASCE 7, Tables 13.5-1 and 13.6-1.
   3. Component importance factor, I_p:

Table 1: Component Importance Factor, Ip

Component	Description	Ip
Electrical	Equipment and appurtenances provided and installed under Division 26.	1.5
All Other Equipment	Equipment and appurtenances provided and installed under any other Divisions.	Per ASCE 7-10, Section 13.1.3

D. Seismic Design Category (SDC):
   1. Seismic Design Category (SDC) for certification of mechanical and electrical equipment as required by ASCE 7: Seismic Design Category D.

E. Design requirements: Anchorage of equipment to structures.
   1. Do not use friction to resist sliding due to seismic forces. Do not design or provide connections that use friction to resist seismic loads. Resist seismic forces through direct tension and/or shear on anchors and fasteners.
   2. Anchoring and fastening to concrete and masonry:
      a. Provide anchors specified in Section 03055 - Adhesive-Bonded Reinforcing Bars and All Thread Rods.

1.04 SUBMITTALS

A. Shop drawings and calculations: Complete shop drawings and seismic calculations.

B. Calculations shall be signed and stamped by a civil or structural engineer licensed in the state of Utah.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01640 - DEMOLITION AND RECONSTRUCTION

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall demolish and reconstruct existing structural, electrical, and instrumentation facilities as indicated, in accordance with the Contract Documents.

1.2 COORDINATION

A. Existing facilities shall remain operational during all phases of demolition and construction. The CONTRACTOR shall schedule all demolition and reconstruction to minimize equipment 'down-time'. If necessary, the CONTRACTOR shall provide a sufficient number of temporary lights to maintain a well-lit and safe environment.

B. The WORK indicated in the Contract Documents is not all inclusive and the CONTRACTOR shall be responsible for performing the reconstruction indicated plus that which can be reasonably inferred from the Contract Documents as necessary to complete the Project. The CONTRACTOR shall comply with sequencing requirements in Section 01030 – Special Project Constraints.

C. The CONTRACTOR shall note that the Drawings used to indicate demolition and reconstruction are based on record drawings of the existing facilities, which have been reproduced to show existing conditions and to clarify the scope of work as much as possible. Prior to bidding, the CONTRACTOR shall conduct a comprehensive survey at the Site to verify the correctness and exactness of the Drawings, the scope of work, and the extent of auxiliary utilities. A complete set of record drawings is available for review at the South Valley Water Reclamation Facility (SVWRF) during regular business hours.

D. While demolition and reconstruction are being performed the CONTRACTOR shall provide adequate access for the continued operation and maintenance of equipment and treatment processes. The CONTRACTOR shall erect and maintain fences, warning signs, barricades, and other devices around the reconstruction as required for the protection of the CONTRACTOR's employees and the OWNER's personnel at the plant. The CONTRACTOR shall remove all such protection when reconstruction activities are complete, or as work progresses, or when directed by the OWNER.

1.3 CUTTING, DRILLING, & CORE-DRILLING

A. Perform cutting operations in a manner that will not damage or weaken structures or the Work.

B. CONTRACTOR shall layout locations of cuts, core-drills, and other drilling and shall notify OWNER for inspection prior to beginning Work. The OWNER may require non-destructive examination such as x-rays, ground penetrating radar, or other

means and methods of determining location of reinforcing steel, electrical conduits, etc. CONTRACTOR shall avoid cutting or damaging reinforcing steel, electrical conduits, etc. unless directed to by the ENGINEER.

C. Patched concrete surfaces will be keyed into remaining Work.

D. Interior concrete removal will be accomplished in a manner to minimize the spread of dust, i.e., wet cutting, vacuum at point of dust creation, work area enclosed. Remove all cuttings from Owner's property and legally dispose of cuttings and other debris resulting from these operations.

E. Do not allow dust and dirt to accumulate in work areas. Clean up at end of each shift and leave areas free from accumulation of materials and equipment so no interference results to plant operations.

1.4 REHABILITATION

A. Damage to existing civil, landscaping, structural, architectural, mechanical, HVAC electrical, and instrumentation work due to reconstruction activities shall be repaired and rehabilitated.

B. Damaged items shall be repaired or replaced with new items to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage.

C. In all demolition where electrical installation exists, remove the wiring and conduit back to the respective panel or remaining connection point. Where conduit can continue in service, remove old conductors back to the panel and run new conductors. Keep track of remaining circuits by labeling, coding, etc.

1.5 DISPOSAL

A. The CONTRACTOR shall be responsible for the offsite disposal of debris resulting from demolition and reconstruction in compliance with local, state, and federal codes and requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

-END OF SECTION-

SECTION 01642
SELECTIVE DEMOLITION

PART 1 – GENERAL

1.1 SECTION REQUIREMENTS

A. Unless otherwise indicated, demolished materials become Contractor's property and are to be removed from the project site at the Contractor's expense.

B. Items indicated to be removed and salvaged remain Owner's property. Remove, clean, and deliver to Owner's designated storage area.

C. Comply with EPA regulations and disposal regulations of authorities having jurisdiction.

D. Conduct demolition without disrupting Owner's use of the facility.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 DEMOLITION

A. Maintain and protect existing utilities to remain in service before proceeding with demolition, providing bypass connections as necessary to maintain service.

B. Conduct demolition operations and remove debris to prevent injury to people and damage to adjacent buildings and site improvements.

C. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.

D. Promptly patch and repair holes and damaged surfaces of building caused by demolition. Restore exposed finishes of patched areas and extend finish restoration into remaining adjoining construction.

E. Promptly remove demolished materials from Owner's property and legally dispose of them. Do not burn demolished materials.

-END OF SECTION-

SECTION 01700
PROJECT CLOSEOUT

PART 1 – GENERAL

1.1 FINAL CLEANUP

A. The CONTRACTOR shall promptly remove from the vicinity of the completed WORK, all rubbish, unused materials, construction equipment, and temporary facilities used during construction. Final acceptance of the WORK by the OWNER will be withheld until the CONTRACTOR has satisfactorily performed the final cleanup of the Site.

1.2 CLOSEOUT TIMETABLE

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

1.3 TECHNICAL MANUAL SUBMITTAL

A. No portion of the project will be accepted for partial utilization until approved Technical Manual(s) for each piece of mechanical equipment within that portion is submitted.

B. Approved Technical Manuals shall be submitted prior to shipment of individual pieces of equipment. Money claimed by the CONTRACTOR for stored materials related to the receipt of equipment will be withheld until approved Technical Manuals are submitted.

1.4 FINAL SUBMITTALS

A. The CONTRACTOR, prior to requesting final payment, obtain and submit the following items to the ENGINEER for transmittal to the OWNER:

1. Written guarantees, where required.

2. Technical Manuals and Instructions.

3. Maintenance stock items; spare parts; special tools.

4. Completed record drawings.

5. Release from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of the law.

1.5 MAINTENANCE AND GUARANTEE

A. The CONTRACTOR shall comply with the maintenance and guarantee requirements contained in the General Conditions.

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

1.6 BONDS

A. The CONTRACTOR shall provide bonds as required by the General Conditions.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

-END OF SECTION-

SECTION 05190

MECHANICAL ANCHORING AND FASTENING TO CONCRETE AND MASONRY

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Cast-in anchors and fasteners:
      a. Anchor bolts.
      b. Concrete inserts.
      c. Deformed bar anchors.
      d. Welded studs.
   2. Post-installed steel anchors and fasteners:
      a. Concrete anchors.
      b. Sleeve anchors.
      c. Screw anchors.
      d. Undercut concrete anchors.
   3. Appurtenances for anchoring and fastening:
      a. Anchor bolt sleeves.
      b. Isolating sleeves and washers.
      c. Thread coating for threaded stainless steel fasteners.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. 355.2 - Qualification of Post-Installed Mechanical Anchors in Concrete & Commentary.

B. American National Standards Institute (ANSI):
   1. B212.15 - Cutting Tools - Carbide-tipped Masonry Drills and Blanks for Carbide-tipped Masonry Drills.

C. American Welding Society (AWS):
   1. D1.1 - Structural Welding Code - Steel.
   2. D1.6 - Structural Welding Code - Stainless Steel.

D. ASTM International (ASTM):
   1. A29 - Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for.
   2. A36 - Standard Specification for Carbon Structural Steel.
   3. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   4. A108 - Standard Specification for Steel Bars, Carbon and Alloy, Cold Finished.
   5. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   6. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

7. A240 - Standard Specification for Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
8. A380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
9. A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
10. A563 - Standard Specification for Carbon and Alloy Steel Nuts.
11. B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
12. B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
13. E488 - Standard Test Methods for Strength of Anchors in Concrete Elements.
14. F436 - Standard Specification for Hardened Steel Washers.
15. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
16. F594 - Standard Specification for Stainless Steel Nuts.
17. F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.
18. F2329 - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

E. International Code Council Evaluation Service, Inc. (ICC-ES):
1. AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements.
2. AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry.
3. AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements.

1.03 DEFINITIONS

A. Built-in anchor: Headed bolt or assembly installed in position before filling surrounding masonry units with grout.

B. Cast-in anchor: Headed bolt or assembly installed in position before placing plastic concrete around.

C. Overhead installations: Fasteners installed on overhead surfaces where the longitudinal axis of the fastener is more than 60 degrees above a horizontal line so that the fastener resists sustained tension loads.

D. Passivation: Chemical treatment of stainless steel with a mild oxidant for the purpose of enhancing the spontaneous formation of the steel’s protective passive film.

E. Post-installed anchor: Fastener or assembly installed in hardened concrete or finished masonry construction, typically by drilling into the structure and inserting a steel anchor assembly.

F. Terms relating to structures or building environments as used with reference to anchors and fasteners:
    1. Corrosive locations: Describes interior and exterior locations as follows:
        a. Locations used for delivery, storage, transfer, or containment (including spill containment) of chemicals used for plant treatment processes.
        b. Exterior and interior locations at the following treatment structures:
            1) Wastewater treatment facilities: Liquids stream:
                a) Raw wastewater delivery and holding structures.
                b) Headworks and grit facilities.
                c) Primary clarifiers and primary clarifier flow splitting boxes.
                d) Chlorine contact structures.
            2) Wastewater treatment facilities: Solids stream:
                a) Sludge holding and thickening tanks.
                b) Digesters.
                c) Dewatering facilities.
    2. Wet and moist locations: Describes locations, other than “corrosive locations,” that are submerged, are immediately above liquid containment structures, or are subject to frequent wetting, splashing, or wash down. Includes:
        a. Exterior portions of buildings and structures.
        b. Liquid-containing structures:
            1) Locations at and below the maximum operating liquid surface elevation.
            2) Locations above the maximum operating liquid surface elevation and:
                a) Below the top of the walls containing the liquid.
                b) At the inside faces and underside surfaces of a structure enclosing or spanning over the liquid (including walls, roofs, slabs, beams, or walkways enclosing the open top of the structure).
        c. Liquid handling equipment:
            1) Bases of pumps and other equipment that handles liquids.
        d. Indoor locations exposed to moisture, splashing, or routine wash down during normal operations, including floors with slopes toward drains or gutters.
        e. Other locations indicated on the Drawings.
    3. Other locations:
        a. Interior dry areas where the surfaces are not exposed to moisture or humidity in excess of typical local environmental conditions.

1.04 SUBMITTALS

A. General:
    1. Submit as specified in Section 01300 - Contractor Submittals.
    2. Submit information listed for each type of anchor or fastener to be used.

B. Action submittals:
    1. Product data:
        a. Cast-in anchors:
            1) Manufacturer’s data including catalog cuts showing anchor sizes and configuration, materials, and finishes.

b. Post-installed anchors:
    1) For each anchor type, manufacturer's data including catalog cuts showing anchor sizes and construction, materials and finishes, and load ratings.

2. Samples:
    a. Samples of each type of anchor, including representative diameters and lengths, if requested by the Engineer.

3. Certificates:
    a. Cast-in anchors:
        1) Mill certificates for steel anchors that will be supplied to the site.
    b. Post-installed anchors:
        1) Manufacturer's statement or certified test reports demonstrating that anchors that will be supplied to the site comply with the materials properties specified.

4. Test reports:
    a. Post-installed anchors: For each anchor type used for the Work:
        1) Current ICC-ES Report (ESR) demonstrating:
            a) Acceptance of that anchor for use under the building code specified in Section 01410 - Regulatory Requirements.

5. Manufacturer's instructions:
    a. Requirements for storage and handling.
    b. Recommended installation procedures including details on drilling, hole size (diameter and depth), hole cleaning and preparation procedures, anchor insertion, and anchor tightening.
    c. Requirements for inspection or observation during installation.

1.05 QUALITY ASSURANCE

A. Qualifications:
    1. Post installed anchors shall be in accordance with building code specified in Section 01410 - Regulatory Requirements.

B. Special inspection:
    1. Provide special inspection of post-installed anchors as specified in Section 01455B - Special Tests and Inspections and this Section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver post-installed anchors in manufacturer's standard packaging with labels visible and intact. Include manufacturer's installation instructions.

B. Handle and store anchors and fasteners in accordance with manufacturer's recommendations and as required to prevent damage.

C. Protect anchors from weather and moisture until installation.

1.07 PROJECT CONDITIONS

A. As specified in Section 01610 - Project Design Criteria.

B. Seismic Design Category (SDC) for structures is indicated on the Drawings.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. General:
   1. Furnish threaded fasteners with flat washers and hex nuts fabricated from materials corresponding to the material used for threaded portion of the anchor.
      a. Cast-in anchors: Provide flat washers and nuts as listed in the ASTM standard for the anchor materials specified.
      b. Post-installed anchors: Provide flat washers and nuts supplied for that product by the manufacturer of each anchor.
   2. Size of anchors and fasteners, including diameter and length or minimum effective embedment depth: As indicated on the Drawings or as specified in this Section. In the event of conflicts, contact Engineer for clarification.
   3. Where anchors and connections are not specifically indicated on the Drawings or specified, their material, size and form shall be equivalent in quality and workmanship to items specified.

B. Materials:
   1. Provide and install anchors of materials as in this Section.

2.02 CAST-IN ANCHORS AND FASTENERS

A. Anchor bolts:
   1. Description:
      a. Straight steel rod having one end with an integrally forged head, and one threaded end. Embedded into concrete with the headed end cast into concrete at the effective embedment depth indicated on the Drawings or specified, and with the threaded end left to project clear of concrete face as required for the connection to be made.
      b. Furnish anchor bolts with heavy hex forged head or equivalent acceptable to Engineer.
         1) Rods or bars with angle bend for embedment in concrete (i.e., “L” or “J” shaped anchor bolts) are not permitted in the Work.
   2. Materials:
      a. Type 316 stainless steel:
         1) Bolts: ASTM F593, Group 2, Condition CW, coarse threads.
         2) Nuts: ASTM F594. Match alloy (group and UNS designation) and threads of bolts.
         3) Washers: Type 316 stainless steel.
      b. Type 304 stainless steel:
         1) Bolts: ASTM F593, Group 1, Condition CW, coarse threads.
         2) Nuts: ASTM F594. Match alloy (group and UNS designation) and threads of bolts.
         3) Washers: Type 304 stainless steel.
      c. Galvanized steel:
         1) Hot-dip galvanized coating in accordance with ASTM F2329.
         2) Bolt: ASTM F1554, Grade 36 heavy hex, coarse thread.
         3) Nuts: ASTM A563, Grade A heavy hex, threads to match bolt.
         4) Washers: ASTM F436, Type 1.

3. Materials:
    a. Stainless steel: Type 316:
        1) Rod: ASTM F593, Group 2, Condition CW, coarse threads.
        2) Nuts: ASTM F594. Match alloy (group and UNS designation) and threads of rods.
        3) Washers: Type 316 stainless steel.
        4) Plates (embedded): ASTM A240.
    b. Stainless steel: Type 304:
        1) Rod: ASTM F593, Group 1, Condition CW, coarse threads.
        2) Nuts: ASTM F594. Match alloy (group and UNS designation) and threads or rods.
        3) Washers: Type 304 stainless steel.
        4) Plates (embedded): ASTM A240.
    c. Galvanized: steel:
        1) Hot-dip galvanized with coating in accordance with ASTM F2329.
        2) Rod: ASTM F1554, Grade 36, coarse thread.
        3) Nuts: ASTM A563, Grade A, threads to match rod.
        4) Washers: ASTM F436, Type 1.
        5) Plates (embedded): ASTM A36.

B. Deformed bar anchors:
    1. Description: Steel rod with rebar-like deformations along its length and welding ferrule at one end for attachment to structural steel members (plates or shapes).
    2. Manufacturers: One of the following or equal:
        a. Nelson Stud Welding Co., D2L Deformed Bar Anchors (D2L-DBA).
        b. Stud Welding Products, Inc., Deformed Anchor Studs.
    3. Materials:
        a. Galvanized steel:
            1) Hot-dip galvanized coating in accordance with ASTM A153 where indicated on the Drawings.
            2) Steel: ASTM A496 wire deformed for concrete reinforcement.

C. Welded studs:
    1. Description: Anchor with forged head for embedment into concrete on one end, and welding ferrule for attachment to steel on the other. Welded to steel members or plates to provide anchorage for steel connections to concrete.
    2. Acceptance criteria:
        a. Welded studs in accordance with AWS D1.1, Type B.
    3. Manufacturers: One of the following or equal:
        a. Nelson Stud Welding Co., H4L Concrete Anchors or S3L Shear Connectors as indicated on the Drawings.
        b. Stud Welding Products, Headed Concrete Anchors (HCA) or Headed Shear Connectors (HSC) as indicated on the Drawings.
    4. Materials:
        a. Stainless steel: Type 316L.
        b. Stainless steel: Type 304L.
        c. Galvanized steel:
            1) Hot-dip galvanized after fabrication with coating in accordance with ASTM A123.

2) Steel: Carbon steel in accordance with ASTM A108 with 50,000 pounds per square inch minimum yield strength, and 60,000 pounds per square inch minimum tensile strength.

D. Steel plates or shapes for fabrications including assemblies with welded studs or deformed bar anchors:
   1. Stainless steel: Type 316L or Type 304L:
      a. Plates (embedded): ASTM A240.
   2. Galvanized steel:
      a. Hot dip galvanized in accordance with ASTM A123.
      b. Steel: ASTM A36.

2.03 POST-INSTALLED ANCHORS AND FASTENERS - ADHESIVE

A. Epoxy bonding of reinforcing bars, all thread rods, and threaded inserts in concrete: As specified in Section 03055 - Adhesive-Bonded Reinforcing Bars and All Thread Rods in Concrete.

B. Epoxy bonding of reinforcing bars, all thread rods, and threaded inserts in masonry: As specified in Section 04055 - Adhesive Bonding Reinforcing Bars and All Thread Rods in Masonry.

2.04 POST-INSTALLED ANCHORS AND FASTENERS - MECHANICAL

A. General:
   1. Post-installed anchors used for the Work shall hold a current ICC Evaluation Service Report demonstrating acceptance for use under the building code specified in Section 01410 - Regulatory Requirements.
      a. Conditions of use: The acceptance report shall indicate acceptance of the product for use under the following conditions:
         1) In regions of concrete where cracking has occurred or may occur.
         2) To resist short-term loads due to wind forces.
         3) To resist short-term loading due to seismic forces for the Seismic Design Category of the structure where the product will be used.
   2. Substitutions: When requesting product substitutions, submit calculations, indicating the diameter, effective embedment depth and spacing of the proposed anchors, and demonstrating that the substituted product will provide load resistance that is equal to or greater than that provided by the anchors listed in this Section.
      a. Calculations shall be prepared by and shall bear the signature and seal of a Structural Engineer licensed in the State of Utah.
      b. Decisions regarding the acceptability of proposed substitutions shall be at the discretion of the Engineer.

B. Concrete anchors:
   1. Description. Post-installed anchor assembly consisting of a threaded stud and a surrounding wedge expansion sleeve that is forced outward by torquing the center stud to transfer loads from the stud to the concrete through bearing,

friction, or both. (Sometimes referred to as “expansion anchors” or “wedge anchors.”)
    a. Do not use slug-in, lead cinch, and similar systems relying on deformation of lead alloy or similar materials to develop holding power.
2. Concrete anchors for anchorage to concrete:
    a. Acceptance criteria:
        1) Concrete anchors shall have a current ICC-ES Report demonstrating that the anchors have been tested and qualified for performance in both cracked and un-cracked concrete, and for short-term loading due to wind and seismic forces for Seismic Design Categories A through F in accordance with ACI 355.2 and with ICC-ES AC193 (including all mandatory tests and optional tests for seismic tension and shear in cracked concrete).
        2) Concrete anchor performance in the current ICC-ES Report shall be “Category 1” as defined in ACI 355.2.
    b. Manufacturers: One of the following or equal:
        1) Hilti, Kwik Bolt TZ Expansion Anchor.
        2) Powers Fasteners, PowerStud+ SD2.
        3) Simpson Strong-Tie, Strong Bolt 2 Wedge Anchor.
    c. Materials. Integrally threaded stud, wedge, washer, and nut:
        1) Stainless steel: Type 316.
            a) Type 304 stainless steel acceptable for use at wet and moist locations when accepted in writing by the Engineer.
        2) Galvanized: Carbon steel, zinc plated in accordance with ASTM B633, minimum 5 microns (Fe/Zn 5).
3. Concrete anchors for anchorage to concrete masonry (fully grouted cells):
    a. Acceptance criteria: Concrete anchors shall have a current ICC-ES Report demonstrating that the anchors have been tested and qualified in accordance with ICC-ES AC01, including all mandatory tests and optional seismic tests.
    b. Manufacturers: One of the following or equal:
        1) Hilti, Kwik Bolt 3 Expansion Anchor.
        2) Powers Fasteners, Power-Stud+ SD1.
        3) Simpson Strong-Tie, Wedge-All Anchor.
    c. Materials. Integrally threaded stud, wedge, washer, and nut:
        1) Stainless steel: Type 316.
            a) Type 304 stainless steel acceptable for use at wet and moist locations when accepted in writing by the Engineer.
        2) Galvanized: Carbon steel, zinc plated in accordance with ASTM B633, minimum 5 microns (Fe/Zn 5) or mechanically galvanized in accordance with ASTM B695, Class 55, Type 1.

C. Flush shells:
1. Description: Post-installed anchor assembly consisting of an internally threaded mandrel that is forced into a pre-drilled concrete hole with a setting tool until the top of the anchor is flush with the face of the concrete. Once installed, a removable threaded bolt is installed in the mandrel.
2. Flush shell anchors are not permitted in the Work.

D. Sleeve anchors:
   1. Description: Post-installed, torque-controlled anchor assembly consisting of an externally threaded stud with a spacer sleeve near the surface of the base material, and an expansion sleeve on the lower part of the stud. The expansion sleeve is forced outward by torquing of the center stud to transfer load.
      a. Do not use slug-in, lead cinch, and similar systems relying on deformation of lead alloy or similar materials in order to develop holding power.
   2. Sleeve anchors for anchorage to concrete:
      a. Acceptance criteria:
         1) Sleeve anchors shall have a current ICC-ES Report demonstrating that the anchors have been tested and qualified for performance in both cracked and un-cracked concrete, and for short-term loading due to wind and seismic forces for Seismic Design Categories A through F in accordance with ACI 355.2 and with ICC-ES AC193 (including all mandatory tests and optional tests for seismic tension and shear in cracked concrete).
         2) Sleeve anchor performance in the current ICC-ES Report shall be "Category 1" as defined in ACI 355.2.
      b. Manufacturers: One of the following or equal:
         1) Hilti, HSL-3 Heavy Duty Expansion (sleeve) Anchor.
         2) Powers Fasteners, Power Bolt+ Heavy Duty Sleeve Anchor.
      c. Materials:
         1) Galvanized steel: Carbon steel, zinc plated in accordance with ASTM B633, minimum 5 microns (Fe/Zn 5).
   3. Sleeve anchors for anchorage to concrete masonry (fully grouted only):
      a. Acceptance criteria: Sleeve anchors shall have a current ICC-ES Report demonstrating that anchors have been tested and qualified for performance in masonry, including short-term loading due to wind and seismic forces in accordance with ICC-ES AC01.
      b. Materials:
         1) Galvanized steel: Carbon steel, zinc plated in accordance with ASTM B633, minimum 5 microns (Fe/Zn 5).

E. Screw anchors:
   1. Description: Post-installed concrete anchor that develops tensile strength from mechanical interlock provided by creating a helical "key" that is larger than the diameter of the bolt itself along the length of the anchor shaft.
   2. Screw anchors for anchorage to concrete:
      a. Acceptance criteria:
         1) Screw anchors shall have a current ICC-ES Report demonstrating that the anchors have been tested and qualified for performance in both cracked and un-cracked concrete, and for short-term loading due to wind and seismic forces for Seismic Design Categories A through F in accordance with ACI 355.2 and ICC ES AC193 (including all mandatory tests and optional tests for seismic tension and shear in cracked concrete).
         2) Screw anchor performance in the current ICC-ES Report shall be "Category 1" as defined in ACI 355.2.

b. Manufacturers: Screw anchor: One of the following or equal:
    1) Hilti, Hex head, HUS-EZ Screw Anchor:
        a) With internally threaded head: HUS-EZ I Hanger Anchor.
    2) Powers Fasteners, Wedge-Bolt+:
        a) With internally threaded head: Vertigo+ Rod Hanging System.
    3) Simpson Strong-Tie, Titen® HD Screw Anchor:
        a) With internally threaded head: Titen® HD Rod Hanger.
c. Materials:
    1) Galvanized steel: Carbon steel, zinc plated in accordance with ASTM B633, minimum 5 microns (Fe/Zn 5) or equal.

3. Screw anchors for anchorage to concrete masonry (fully grouted only):
    a. Acceptance criteria:
        1) Acceptance criteria. Screw anchors shall have a current ICC-ES Report demonstrating that anchors have been tested and qualified for performance in masonry, including short-term loading due to wind and seismic forces in accordance with ICC-ES AC106.
    b. Manufacturers: One of the following or equal:
        1) Hilti, HUS-EZ Screw Anchor.
        2) Simpson Strong-Tie, Titen® HD Screw Anchor.
    c. Materials:
        1) Galvanized steel: Carbon steel. Zinc plated in accordance with ASTM B633, minimum 5 microns (Fe/Zn 5); or mechanically galvanized in accordance with ASTM B695; Class 55, Type I.

F. Undercut concrete anchors:
1. Description: Post-installed concrete anchor that develops tensile strength from mechanical interlock provided by creation of an undercut “key” at the embedded end of the anchor. The undercut may be achieved with a special drill before anchor installation, or by the anchor itself during installation.
2. Acceptance criteria:
    a. Acceptance criteria:
        1) Undercut concrete anchors shall have a current ICC-ES Report demonstrating that the anchors have been tested and qualified for performance in both cracked and un-cracked concrete, and for short-term loading due to wind and seismic forces for Seismic Design Categories A through F in accordance with ACI 355.2 and ICC ES AC193 (including all mandatory tests and optional tests for seismic tension and shear in cracked concrete).
        2) Undercut anchor performance in the current ICC-ES Report shall be “Category 1” as defined in ACI 355.2.
    b. Use pre-setting units.
3. Manufacturers: One of the following or equal:
    a. Hilti, HDA (carbon steel) or HAD-R (stainless steel) Undercut Anchor.
    b. Powers Fasteners, Atomic+ Undercut Anchor.
    c. Simpson Strong-Tie, Torq-Cut Anchor.
    d. USP Structural Connectors, DUC-L Undercut Anchors.
4. Materials:
    a. Stainless steel: Corrosive, wet, and moist and locations: Type 316.
    b. Galvanized: Carbon steel, zinc plated in accordance with ASTM B633, minimum 5 microns (Fe/Zn 5).

2.05 APPURTENANCES FOR ANCHORING AND FASTENING

A. Anchor bolt sleeves:
   1. Having inside diameter approximately 2 inches greater than bolt diameter and minimum 10-bolt diameters long.
   2. Plastic sleeves:
      a. High-density polyethylene, corrugated sleeve, threaded to provide adjustment of location on the anchor bolt.
   3. Fabricated steel sleeves: Construct as specified in Section 05500 - Metal Fabrications:
      a. At galvanized carbon steel anchor bolts, provide galvanized carbon steel sleeves.
      b. At stainless steel anchor bolts, provide stainless steel sleeves of same Type (304 or 316) as bolt, except that sleeves shall be constructed from low carbon stainless steel for welding (Type 304L or 316L.
   4. Fabricated steel sleeves:
      a. Fabricate to the following dimensions unless otherwise indicated on the Drawings:
         1) Inside diameter: At least 2 inches greater than bolt diameter.
         2) Inside length: Not less than 10 bolt diameters.
         3) Bottom plate:
            a) Square plate with dimensions equal to the outside diameter of the sleeve plus 1/2 inch each side.
            b) Thickness equal to or greater than one-half of the anchor bolt diameter.
      b. Carbon steel anchor bolts:
         1) Fabricated from ASTM A36 plate and ASTM A53, Grade B pipe.
         2) Welded connections: Conform to requirements of AWS D1.1.
         3) Hot dip galvanized in accordance with ASTM A153.
      c. Stainless steel anchor bolts:
         1) Fabricated from ASTM A240 plate and pipe. Type 304L or Type 316L to match Type of the anchor bolt.
         2) Welded connections: In accordance with AWS D1.6.

B. Isolating sleeves and washers:
   1. Manufacturers: One of the following or equal:
      a. Central Plastics Co.
      b. Corrosion Control Products PSI, Inc.
   2. Sleeves: Mylar, 1/32-inch thick, 4,000 volts per mil dielectric strength, of proper size to fit bolts and extending half way into both steel washers.
   3. One sleeve required for each bolt.
   4. Washers: The inside diameter of all washers shall fit over the isolating sleeve, and both the steel and isolating washers shall have the same inside diameter and outside diameter.
      a. Proper size to fit bolts.
      b. Two 1/8-inch thick steel washers for each bolt.
      c. G3 Phenolic: 2 insulating washers are required for each bolt:
         1) Thickness: 1/8 inch.
         2) Base material: Glass.
         3) Resin: Phenolic.
         4) Water absorption: 2 percent.

5) Hardness (Rockwell): 100.
6) Dielectric strength: 450 volts per mil.
7) Compression strength: 50,000 pounds per square inch.
8) Tensile strength: 20,000 pounds per square inch.
9) Maximum operating temperature: 350 degrees Fahrenheit.

C. Coating for repair of galvanized surfaces:
1. Manufacturers: One of the following or equal:
a. Galvinox.
b. Galvo-Weld.

D. Thread coating: For use with threaded stainless steel fasteners:
1. Manufacturers: One of the following or equal:
a. Never Seez Compound Corp., Never-Seez.
b. Oil Research, Inc., WLR No. 111.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine Work in place to verify that it is satisfactory to receive the Work of this Section. If unsatisfactory conditions exist, do not begin this Work until such conditions have been corrected.

3.02 INSTALLATION: GENERAL

A. Where anchors and fasteners are not specifically indicated on the Drawings or specified, make attachments with materials specified in this Section.

B. Substitution of anchor types:
1. Post-installed anchors may not be used as an alternative to cast-in/built-in anchors at locations where the latter are indicated on the Drawings.
2. Cast-in/built-in anchors may be used as an alternative to post-installed mechanical anchors at locations where the latter are indicated on the Drawings.

C. Protect products from damage during installation. Take special care to protect threads and threaded ends.

D. Accurately locate and position anchors and fasteners:
1. Unless otherwise indicated on the Drawings, install anchors perpendicular to the surfaces from which they project.
2. Install anchors so that at least 2 threads, but not more than 1/2 inch of threaded rod, projects past the top nut.

E. Interface with other products:
1. Where steel anchors come in contact with dissimilar metals (aluminum, stainless steel, etc.), use stainless steel anchors and separate or isolate dissimilar metals using isolating sleeves and washers.

2. Prior to installing nuts, coat threads of stainless steel fasteners with thread coating to prevent galling of threads.

3.03 INSTALLATION: CAST-IN ANCHORS

A. General:
   1. Accurately locate cast-in and built-in anchors.
      a. Provide anchor setting templates to locate anchor bolts and anchor rods. Secure templates to formwork.
      b. Brace or tie off embedments as necessary to prevent displacement during placement of plastic concrete or of surrounding masonry construction.
      c. Position and tie cast-in and built-in anchors in place before beginning placement of concrete or grout. Do not “stab” anchors into plastic concrete, mortar, or grout.
      d. Do not allow cast-in anchors to touch reinforcing steel. Where cast-in anchors are within 1/4 inch of reinforcing steel, isolate the metals by wrapping the anchors with a minimum of 4 wraps of 10-mil polyvinyl chloride tape in area adjacent to reinforcing steel.
   2. For anchoring at machinery bases subject to vibration, use 2 nuts, with 1 serving as a locknut.
   3. Where anchor bolts or anchor rods are indicated on the Drawings as being for future use, thoroughly coat exposed surfaces that project from concrete or masonry with non-oxidizing wax. Turn nuts down full length of the threads, and neatly wrap the exposed thread and nut with a minimum of 4 wraps of 10-mil waterproof polyvinyl tape.

B. Anchor bolts:
   1. Minimum effective embedment: 10-bolt diameters, unless a longer embedment is indicated on the Drawings.
   2. Where indicated on the Drawings, set anchor bolts in plastic, galvanized steel or stainless steel sleeves to allow for adjustment. Seal top of sleeve to prevent grout from filling sleeve.

C. Deformed bar anchors:
   1. Butt weld to steel fabrications with automatic stud welding gun as recommended by manufacturer.
   2. Ensure that butt weld develops the full strength of the anchor.

D. Welded studs:
   1. Butt weld to steel fabrications with automatic stud welding gun as recommended by the manufacturer.
   2. Ensure that butt weld develops full strength of the stud.

3.04 INSTALLATION: POST-INSTALLED ADHESIVE ANCHORS

A. Epoxy and acrylic adhesive bonding of reinforcing bars, all thread rods, and internally threaded inserts in concrete: As specified in Section 03055 - Adhesive-Bonded Reinforcing Bars and All Thread Rods in Concrete.

B. Epoxy and acrylic adhesive bonding of reinforcing bars, all thread rods, and internally threaded inserts in masonry: As specified in Section 04055 - Adhesive Bonding Reinforcing Bars and All Thread Rods in Masonry.

3.05 INSTALLATION: POST-INSTALLED MECHANICAL ANCHORS

A. General:
   1. Install anchors in accordance with the manufacturer's instructions, ACI 355.2, the anchor's ICC-ES Report. Where conflict exists between the ICC-ES Report and the requirements in this Section, the requirements of the ICC-ES Report shall control.
   2. Where anchor manufacturer recommends the use of special tools and/or specific drill bits for installation, provide and use such tools.
   3. After anchors have been positioned and inserted into concrete or masonry, do not:
      a. Remove and reuse/reinstall anchors.
      b. Loosen or remove bolts or studs.

B. Holes drilled into concrete and masonry:
   1. Do not drill holes in concrete or masonry until the material has achieved its minimum specified compression strength (f'c or f'm).
   2. Accurately locate holes:
      a. Before drilling holes, use a reinforcing bar locator to identify the position of all reinforcing steel, conduit, and other embedded items within a 6-inch radius of each proposed hole.
      b. If the hole depth exceeds the range of detection for the rebar locator, the Engineer may require radiographs of the area designated for investigation before drilling commences.
   3. Exercise care to avoid damaging existing reinforcement and other items embedded in concrete and masonry.
      a. If embedments are encountered during drilling, immediately stop work and notify the Engineer. Await Engineer's instructions before proceeding.
   4. Unless otherwise indicated on the Drawings, drill holes perpendicular to the concrete surface into which they are placed.
   5. Drill using anchor manufacturer's recommended equipment and procedures:
      a. Unless otherwise recommended by the manufacturer, drill in accordance with the following:
         1) Drilling equipment: Electric or pneumatic rotary type with light or medium impact. Where edge distances are less than 2 inches, use lighter impact equipment to prevent micro-cracking and concrete spalling during drilling process.
         2) Drill bits: Carbide-tipped in accordance with ANSI B212-15. Hollow drills with flushing air systems are preferred.
   6. Drill holes at manufacturer's recommended diameter and to depth required to provide the effective embedment indicated.
   7. Clean and prepare holes as recommended by the manufacturer and as required by the ICC-ES Report for that anchor.
      a. Unless otherwise recommended by anchor manufacturer, remove dust and debris using brushes and clean compressed air.
      b. Repeat cleaning process as required by the manufacturer's installation instructions.

c. When cleaning holes for stainless steel anchors, use only stainless steel or non-metallic brushes.

C. Insert and tighten (or torque) anchors in full compliance with the manufacturer's installation instructions.
   1. Once anchor is tightened (torque), do not attempt to loosen or remove its bolt or stud.

D. Concrete anchors: Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Concrete Anchors			
Nominal Diameter	**Minimum Effective Embedment Length**		**Minimum Member Thickness**
	In Concrete	**In Grouted Masonry**	
3/8 inch	2 1/2 inch	2 5/8 inch	8 inch
1/2 inch	3 1/2 inch	3 1/2 inch	8 inch
5/8 inch	4 1/2 inch	4 1/2 inch	10 inch
3/4 inch	5 inch	5 1/4 inch	12 inch

E. Flush shell anchors:
   1. Flush shell anchors are not permitted in the Work.
   2. If equipment manufacturer's installation instructions recommend the use of flush shell anchors, contact Engineer for instructions before proceeding.

F. Sleeve anchors:
   1. Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Sleeve Anchors			
Nominal Diameter	**Minimum Effective Embedment Length**		**Minimum Member Thickness**
	In Concrete	**In Grouted Masonry**	
M8 (1/2 inch)	70 mm (2 3/4 inch)	Not accepted	100 mm (8 inch)
M10 (5/8 inch)	76 mm (3 inch)	Not accepted	250 mm (10 inch)
M12 (3/4 inch)	80 mm (3 1/4 inch)	Not accepted	300 mm (12 inch)

   2. Install with the sleeve fully engaged in the base material.

G. Screw anchors:
1. Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Screw Anchors			
Nominal Diameter	Minimum Effective Embedment Length		Minimum Member Thickness
	In Concrete	In Grouted Masonry	
3/8 inch	2 1/2 inch	3 1/4 inch	8 inch
1/2 inch	3 1/4 inch	4 1/2 inch	8 inch
5/8 inch	4 inch	5 inch	10 inch
3/4 inch	5 1/2 inch	6 1/4 inch	12 inch

2. Install screw anchors using equipment and methods recommended by the manufacturer. Continue driving into hole until the washer head is flush against the item being fastened.

H. Undercut concrete anchors:
1. Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Undercut Anchors			
Nominal Diameter (bolt)	Minimum Effective Embedment Length		Minimum Member Thickness[(1)]
	In Concrete	In Grouted Masonry	
M10 (3/8 inch)	100 mm (4 inch)	Not accepted	200 mm (8 inch)
M12 (1/2 inch)	125 mm (5 inch)	Not accepted	350 mm (14 inch)
M16 (5/8 inch)	190 mm (7 1/2 inch)	Not accepted	460 mm (18 inch)
M20 (7/8 inch)	250 mm (10 inch)	Not accepted	510 mm (20 inch)

Notes:
(1) Thickness indicated is for pre-set units. If through-set units are accepted, obtain minimum member thickness requirements from the Engineer.

2. Installations of undercut anchors shall not be allowed where edge distances are less than 12 times the nominal diameter of the anchor stud.
3. Undercut bottom of hole using cutting tools manufactured for this purpose by the manufacturer of the undercut anchors being placed.

3.06 FIELD QUALITY CONTROL

A. Contractor shall provide quality control over the Work of this Section as specified in Section 01450 - Quality Control.
1. Expenses associated with work described by the following paragraphs shall be paid by the Contractor.

B. Cast-in and built-in anchors:
   1. Verify position and orientation of anchors prior to casting in.

C. Post-installed anchors:
   1. Review anchor manufacturer's installation instructions and requirements of the Evaluation Service Report (hereafter referred to as "installation documents") for each anchor type and material.
   2. Observe hole-drilling and cleaning operations for conformance with the installation documents.
   3. Certify in writing to the Engineer that the depth and location of anchor holes, and the torque applied for setting the anchors conforms to the requirements of the installation documents.

3.07 FIELD QUALITY ASSURANCE

A. Owner or Owner's Representative will provide on-site observation and field quality assurance for the Work of this Section.
   1. Expenses associated with work described by the following paragraphs shall be paid by the Owner.

B. Field inspections and special inspections:
   1. Required inspections: Observe construction for conformance to the approved Contract Documents, the accepted submittals, and manufacturer's installation instructions for the products used.
   2. Record of inspections:
      a. Maintain record of each inspection.
      b. Submit copies to Engineer upon request.
   3. Statement of special inspections: At the end of the project, prepare and submit to the Engineer and the authority having jurisdiction inspector's statement that the Work was constructed in general conformance with the approved Contract Documents, and that deficiencies observed during construction were resolved.

C. Special inspections: Anchors cast into concrete and built into masonry.
   1. Provide special inspection during positioning of anchors and placement of concrete or masonry (including mortar and grout) around the following anchors:
      a. Anchor bolts.
      b. Deformed bar anchors.
      c. Welded studs.
   2. During placement, provide continuous special inspection at each anchor location to verify that the following elements of the installation conform to the requirements of the Contract Documents.
      a. Anchor:
         1) Type and dimensions.
         2) Material: Galvanized steel, Type 304 stainless steel, or Type 316 stainless steel as specified in this Section or indicated on the Drawings.
         3) Positioning: Spacing, edge distances, effective embedment, and projection beyond the surface of the construction.
         4) Reinforcement at anchor: Presence, positioning, and size of additional reinforcement at anchors indicated on the Drawings.

3. Following hardening and curing of the concrete or masonry surrounding the anchors, provide periodic special inspection to observe and confirm the following:
    a. Base material (concrete or grouted masonry):
        1) Solid and dense concrete or grouted masonry material within required distances surrounding anchor.
        2) Material encapsulating embedment is dense and well-consolidated.

D. Special Inspections: Post-installed mechanical anchors placed in hardened concrete and in grouted masonry.
    1. Provide special inspection during installation of the following anchors:
        a. Concrete anchors.
        b. Sleeve anchors.
        c. Screw anchors.
        d. Undercut concrete anchors.
    2. Unless otherwise noted, provide periodic special inspection during positioning, drilling, placing, and torquing of anchors.
        a. Provide continuous special inspection for post-installed anchors in “overhead installations” as defined in this Section.
    3. Requirements for periodic special inspection:
        a. Verify items listed in the following paragraphs for conformance to the requirements of the Contract Documents and the Evaluation Report for the anchor being used. Observe the initial installation of each type and size of anchor, and subsequent installation of the same anchor at intervals of not more than 4 hours.
            1) Any change in the anchors used, in the personnel performing the installation, or in procedures used to install a given type of anchor shall require a new “initial inspection.”
        b. Substrate: Concrete or masonry surfaces receiving the anchor are sound and of a condition that will develop the anchor’s rated strength.
        c. Anchor:
            1) Manufacturer, type, and dimensions (diameter and length).
            2) Material (galvanized, Type 304 stainless steel, or Type 316 stainless steel).
        d. Hole:
            1) Positioning: Spacing and edge distances.
            2) Drill bit type and diameter.
            3) Diameter, and depth.
            4) Hole cleaned in accordance with manufacturer’s required procedures. Confirm multiple repetitions of cleaning when recommended by the manufacturer.
            5) Anchor’s minimum effective embedment.
            6) Anchor tightening/installation torque.
    4. Requirements for continuous special inspection:
        a. The special inspector shall observe all aspects of anchor installation, except that holes may be drilled in his/her absence provided that he/she confirms the use of acceptable drill bits before drilling, and later confirms the diameter, depth, and cleaning of drilled holes.

E. Field tests:
   1. Owner or Owner's Representative may, at any time, request testing to confirm that materials being delivered and installed conform to the requirements of the Specifications.
      a. If such additional testing shows that the materials do not conform to the specified requirements, the Contractor shall pay the costs of these tests.
      b. If such additional testing shows that the materials do conform to the specified requirements, the Owner shall pay the costs of these tests.

3.08 SCHEDULES

A. Stainless steel. Provide and install stainless steel anchors at the following locations:
   1. "Corrosive locations" as defined in this Section 16050 - Common Work Results for Electrical: Type 316 stainless steel
   2. "Wet and moist locations" as defined in this Section 16050 - Common Work Results for Electrical: Type 316 stainless steel.
   3. "Other locations:"
      a. For connecting stainless steel members to concrete or masonry: Type 304 stainless steel.
      b. For connecting aluminum members to concrete or masonry.
      c. For connecting fiber-reinforced plastic (FRP) members to concrete or masonry.

B. Galvanized: Provide and install galvanized carbon steel anchors at the following locations:
   1. Locations not requiring stainless steel.

END OF SECTION

SECTION 16050

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Requirements for electrical:
      a. Basic design and performance criteria.
      b. Prescriptive requirements for common components.
      c. Installation.

B. Contract Drawings:
   1. Schematic diagrams:
      a. Controls are shown as de-energized.
      b. Add relays, where required, to provide all necessary contacts for the control system or where needed to function as interposing relays for control voltage coordination, equipment coordination, or control system voltage drop considerations.
      c. Mount devices shown on motor controller schematic diagrams in the controller compartment enclosure, unless otherwise noted.
   2. Plan drawings:
      a. The Electrical Drawings show desired locations, arrangements, and components of the electrical work in a diagrammatic manner.
      b. Locations and sizes of equipment are approximate only.
   3. Installation details:
      a. Develop installation details that may be necessary for completing the Work, and submit these details for review by the Engineer.

1.02 REFERENCES

A. Abbreviations:
   1. FAT: Factory acceptance test that is also referred to as source test.
   2. PCIS: Process control and instrumentation system.
   3. System integrator: The firm under contract to the Owner to provide PLC hardware, PCM cabinets including the Headworks VFD control sections and PLC programming.

B. Definitions:
   1. LCP: Local control panel: Operator interface panel that may contain pilot type control devices, operator interface devices, control relays, etc. and does not contain a PLC or RIO.
   2. PCM: Process control module: An enclosure containing any of the following devices: PLC, RTU, or RIO.
   3. Space: That portion of the switchgear, motor control center, panelboard, switchboard, or control panel that does not physically contain a device but is

capable of accepting a device with no modifications to the equipment, i.e., provide standoffs, bus, and hardware, as part of the space.

4. Spare: That portion of the switchgear, motor control center, panelboard, switchboard, or control panel that physically contains a device with no load connections to be made.

C. Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250 - Enclosures for Electrical Equipment (1000 V Maximum).
   2. National Fire Protection Association (NFPA):
      a. 70 - National Electrical Code (NEC).
   3. Underwriters' Laboratories, Inc. (UL).

1.03 SUBMITTALS (NOT USED)

1.04 QUALITY ASSURANCE

A. General:
   1. Furnish equipment listed by and bearing the label of UL or of an independent testing laboratory acceptable to the Engineer and the Authority Having Jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping precautions:
   1. After completion of shop assembly and successful factory testing, pack all equipment in protective crates, and enclose in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture.
   2. Place dehumidifiers, when required, inside the polyethylene coverings.
   3. Skid-mount the equipment for final transport.
   4. Provide lifting rings for moving without removing protective covering.
   5. Display boxed weight on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.

1.06 PROJECT OR SITE CONDITIONS

A. As specified in Section 01612 - Seismic Design Criteria.

1.07 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Loop drawings:
      a. Provide electrical information required in the preparation of loop drawings including, but not limited to:
         1) Conduit numbers and associated signal(s) contained within each conduit.
         2) Wire numbers.
         3) Equipment terminal numbers.
         4) Junction boxes and signal(s) contained within each junction box.

5) Equipment power sources, and associated circuit numbers.
6) As-built drawings detailing wiring.

B. Meetings:
1. As specified in Section 01312 - Project Meetings.

PART 2 PRODUCTS

2.01 GENERAL (NOT USED)

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Provide all field wiring and terminations.

B. Equipment mounting and anchoring:
1. Design equipment anchorage, supports, and connections for dead load, seismic load specified in Section 01612 - Seismic Design Criteria, and other loads as required for proper operation of equipment.
a. For equipment with an operating weight of 400 pounds or greater and all equipment that is supported higher than 4 feet above the floor, provide calculations for:
1) The operating weight and location of the centroid of mass for the equipment.
2) Forces and overturning moments.
3) Shear and tension forces in equipment anchorages, supports, and connections.
4) The design of equipment anchorage, supports, and connections based on calculated shear and tension forces.
2. Anchorage of equipment to concrete or masonry:
a. Perform calculations and determine number, size, type, strength, and location of anchor bolts or other connections.
b. Unless otherwise indicated on the Drawings, select and provide anchors from the types specified in Section 05190 - Mechanical Anchoring and Fastening to Concrete and Masonry.
c. Provide bolt sleeves around cast-in anchor bolts for 400 pounds or greater equipment.
1) Adjust bolts to final location and secure the sleeve.
3. Anchorage of equipment to metal supports:
a. Perform calculations and determine number, size, type, strength, and location of bolts used to connect equipment to metal supports.

2.03 MANUFACTURERS (NOT USED)

2.04 MATERIALS

A. Enclosures:
1. Provide enclosures for electrical, instrumentation and control equipment, regardless of supplier or subcontractor furnishing the equipment, that meet the requirements of NEMA Standard 250.

B. Plant area electrical Work requirements:
   1. Provide electrical materials in accordance with the following table, unless otherwise specifically indicated on the Drawings:
      a. Conduit installation requirements: As specified in Section 16130 - Conduits.

Table 1. Electrical Material Requirements				
PLANT AREA	**ENVIRONMENT W = WET D = DAMP C = CLEAN/DRY X = CORROSIVE H = HAZARDOUS**	**NEMA ENCLOSURE TYPE**	**EXPOSED CONDUIT TYPE (as specified in Section 16130 - Conduits)**	**SUPPORT MATERIALS**
Headworks Pump Station	C	12	GRC	GRC
RAS/WAS Buildings	C	12	GRC	GRC
Solids Building	C	12	GRC	GRC

PART 3 EXECUTION

3.01 EXAMINATION

A. Portions of this Project involve installation in existing facilities and interfaces to existing circuits, power systems, controls, and equipment:
   1. Perform and document comprehensive and detailed field investigations of existing conditions (circuits, power systems, controls, equipment, etc.) before starting any Work.
   2. Determine information necessary to document, interface with, modify, upgrade, or replace existing circuits, power systems, controls, and equipment.
   3. Provide and document interface with, modifications to, upgrades, or replacement of existing circuits, power systems, controls, and equipment.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. Demolition:
   1. As specified in Technical Sections or as indicated on the Drawings.
   2. Disconnect utilities:
      a. Disconnect electrical equipment.
   3. Remove and dispose of conduit, wire, electrical equipment, controls, etc. associated with the items and/or areas to be demolished as indicated on the Drawings unless otherwise indicated.
   4. For each piece of equipment to be removed, remove all ancillary components (e.g., instruments, solenoid valves, disconnect switches, etc.).

5. Conduit:
    a. Where conduit removal, other than associated with equipment to be removed, is indicated on the Drawings:
        1) Remove exposed conduit to the point of encasement or burial.
        2) Cut conduit flush and plug or cap encased or buried conduit.
    b. Where conduits are to remain in place and removal is not indicated on the Drawings:
        1) Cap conduit open ends.
        2) Re-label empty conduits as spare.
6. Remove all wire back to the source for all conduits to be removed or abandoned in place.
7. Provide new nameplates for modified electrical distribution equipment, motor control centers etc. to identify equipment and circuits that are no longer used as spares.
8. Provide new typewritten schedules for all modified panelboards.

B. Equipment:
    1. Where the Drawings do not show dimensions for locating equipment, install equipment in the approximate locations indicated on the Drawings.

C. Provide NEC required working space in front of all electrical equipment as if it could be worked on energized.

D. Conductors shall not pass through equipment they are not terminating in unless indicated on the Drawings or approved by the Engineer.

3.04 COMMISSIONING

A. Functional Testing
    1. Inspection activities conducted during construction do not satisfy inspection or testing requirements as specified in Section 16950 - Field Electrical Acceptance Tests.

3.05 FIELD QUALITY CONTROL

A. Workmanship:
    1. Leave wiring in panels, manholes, boxes, and other locations neat, clean, and organized:
        a. Neatly coil and label spare wiring lengths.
        b. Shorten, re-terminate, and re-label excessive used, as well as spare, wire and cable lengths, as directed by the Engineer.

3.06 ADJUSTING (NOT USED)

3.07 CLEANING

A. General:
    1. Clean and vacuum all enclosures to remove all metal filings, surplus insulation and any visible dirt, dust, or other matter before energization of the equipment or system start-up:
        a. Use of compressors or air blowers for cleaning is not acceptable.

2. Clean luminaries in the areas affected by the construction.

END OF SECTION

SECTION 16070

HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Mounting and supporting electrical equipment and components.

1.02 REFERENCES

A. As specified in Section 16050 - Common Work Results for Electrical.

B. ASTM International (ASTM):
   1. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   2. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   3. A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

1.03 DEFINITIONS

A. As specified in Section 16050 - Common Work Results for Electrical.

1.04 SYSTEM DESCRIPTION

A. Design requirements:
   1. Conform to the requirements of the Building Code as specified in Section 01090 - Reference Standards.
   2. Demonstrate the following using generally accepted engineering methods:
      a. That the anchors to the structure are adequate to resist the loads generated in accordance with the Building Code and equipment requirements.
      b. That the required load capacity of the anchors can be fully developed in the structural materials to which they are attached.
   3. Design loading and anchoring requirements:
      a. As indicated in the Building Code unless otherwise specified.
      b. Seismic loading requirements:
         1) Freestanding, suspended, or wall-hung equipment shall be anchored in place by methods that will satisfy the requirements for the seismic design specified in Section 01612 - Seismic Design Criteria.
      c. Minimum safety factor against overturning: 1.5.
      d. The foundation and structures to which hangers and supports are attached shall be capable of withstanding all anchor loads.

B. Performance requirements:
   1. Hangers and supports individually and as a system shall resist all weights and code-required forces without deflections and deformations that would damage the supporting elements, the equipment supported, or the surrounding construction.

1.05 SUBMITTALS

A. Furnish submittals as specified in Section 01300 - Contractor Submittals.

B. Product data:
   1. Supports:
      a. Materials.
      b. Geometry.
      c. Manufacturer.
   2. Hardware:
      a. Materials.
      b. Manufacturer.

C. Shop drawings:
   1. Complete dimensioned and scalable shop drawings of all supporting structures, trapezes, wall supports, etc.
   2. Complete anchoring details for equipment, lighting and raceway, supporting structures, trapezes, and wall supports for all equipment:
      a. For free standing supports and wall supports supporting equipment weight in excess of 200 pounds:
         1) Stamped by a professional engineer licensed in the state where the Project is being constructed.
      b. Said submittals, by virtue of the fact that they bear the stamp of a registered engineer, will be reviewed for general consistency with the requirements specified in the Contract Documents, but not for context, accuracy, or method of calculation.
   3. Include data on attachment hardware and construction methods that will satisfy the design loading and anchoring criteria.

D. Installation instructions:
   1. Furnish anchorage instructions and requirements based on the seismic and wind conditions of the Site:
      a. Stamped by a professional engineer licensed in the state where the Project is being constructed.

1.06 QUALITY ASSURANCE

1.07 DELIVERY, STORAGE, AND HANDLING

1.08 PROJECT OR SITE CONDITIONS

A. As specified in Section 01612 - Seismic Design Criteria.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or equal:
   1. Preformed channel:
      a. Thomas & Betts.
      b. Power-Strut.
      c. Unistrut.
      d. Cooper B-Line.
      e. Robroy.
      f. Tyco.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS

A. Use materials appropriate for the area as specified in Section 16050 - Common Work Results for Electrical.

B. Preformed channel:
   1. Hot dip galvanized steel:
      a. Supports:
         1) In accordance with ASTM A123 or A153.
         2) Minimum zinc coating thickness of 2.5 mils.
      b. Hardware:
         1) Electro-galvanized.
         2) In accordance with ASTM A153.

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES

A. Anchor bolts:
   1. As specified in Section 05190 - Mechanical Anchoring and Fastening to Concrete and Masonry.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. Preformed Channel:
   1. Mount all raceways, cabinets, boxes, fixtures, instruments, and devices on Contractor-fabricated racks unless otherwise indicated on the Drawings.
      a. Provide the necessary sway bracing to keep trapeze type structures from swaying under seismic events or wind loading.
   2. Brace and anchor freestanding equipment supports using methods that provide structural support based on the seismic loads and wind loads:
      a. Lateral deflection at top of supports not to exceed support height divided by 240 unless otherwise approved by the Engineer.
   3. Provide fabricated steel support pedestals for wall mounted panels that weigh more than 200 pounds:
      a. Fabricate pedestals out of welded angle, tube sections, or preformed channel.
      b. If the supported equipment is a panel or cabinet, match the supported equipment in physical appearance and dimensions.
      c. Provide auxiliary floor supports for transformers hung from stud walls and weighing more than 200 pounds.
   4. Mount all equipment, cabinets, boxes, instruments, and devices in damp or wet locations on minimum of 7/8-inch preformed mounting channel.
      1) Mount channel vertically along the length of the device so that water or moisture may run freely behind the device.
   5. Corrosion protection:
      a. Isolate dissimilar metals, except where required for electrical continuity.
         1) Use neoprene washers, 9-mil polyethylene tape, or gaskets for isolation.
   6. Raceway:
      a. Furnish all racks and trapeze structures needed to support the raceway from the structure.
         1) Group raceway and position on racks to minimize crossovers.
         2) Provide the necessary bracing to keep trapeze type structures from swaying under loads from cable installation, seismic forces, or wind forces.
   7. Anchoring methods:
      a. Solid concrete: Anchor bolts, anchor rods or post-installed anchors as specified in Section 05190 - Mechanical Anchoring and Fastening to Concrete and Masonry.
      b. Metal surfaces: Machine screws or bolts.
      c. Hollow masonry units: Post installed anchors as specified in Section 05190 - Mechanical Anchoring and Fastening to Concrete and Masonry.
   8. Recoat or seal all drilled holes, cut or scratched surfaces or with products recommended by the manufacturer.

END OF SECTION

SECTION 16075

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Identification of electrical equipment, devices and components.
   2. Material, manufacturing and installation requirements for identification devices.

1.02 REFERENCES

A. As specified in Section 16050 - Common Work Results for Electrical.

B. Occupational Safety and Health Administration (OSHA).

1.03 DEFINITIONS

A. As specified in Section 16050 - Common Work Results for Electrical.

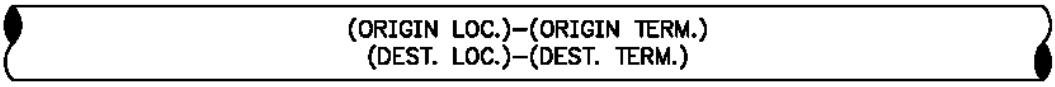
1.04 SYSTEM DESCRIPTION

A. Nameplates:
   1. Provide a nameplate for each piece of electrical equipment and devices, control panel and control panel components.
   2. Provide all nameplates of identical style, color, and material throughout the facility.
   3. Device nameplates information:
      a. Designations as indicated on the Drawings and identified on the Process and Instrumentation Drawings.

B. Wire numbers:
   1. Coordinate the wire numbering system with all vendors of equipment so that every field wire has a unique number associated with it for the entire system:
      a. Wire numbers shall correspond to the wire numbers on the control drawings or the panel and circuit numbers for receptacles and lighting.
      b. Wire numbers shall correspond to the terminal block number to which they are attached in the control panel.
      c. Internal panel wires on a common terminal shall have the same wire number.
      d. Multi-conductor cables shall be assigned a cable number that shall be attached to the cable at intermediate pull boxes and stub-up locations beneath freestanding equipment. All multi-conductor and instrumentation cables shall be identified at pull points as described above:
         1) Label armored multi-conductor cable using the conduit number as indicated on the Drawings, following the requirements for conduit markers in Section 16130 - Conduits.

2. Provide the following wiring numbering schemes throughout the project for field wires between process control module, (PCM), vendor control panels, (VCP), motor control centers, (MCC), field starters, field instruments, etc.

OR



Where:

ORIGIN LOC .= Designation for originating panel or device
ORIGIN TERM. = Terminal designation at originating panel or device
DEST. LOC. = Designation for destination panel or device
DEST. TERM. = Terminal designation at destination panel or device or PLC I/O address at destination panel:

a. Identify equipment and field instruments as the origin.
b. PCMs are always identified as the destination.
c. Location is the panel designation for VCP, LCP, or PCM. For connections to MCCs, location is the specific starter tag and loop number. Location is the tag and loop number for motor starters, field instruments and equipment. Any hyphen in the panel designation or tag and loop number shall be omitted.
d. Terminal designation is the actual number on the terminal block where the conductor terminates at field devices and vendor control panels. For multi-conductor cables, all terminal numbers shall be shown, separated by commas.
e. Terminal designations at motor leads shall be the motor manufacturer's standard terminal designation (e.g. T1, T2, T3, etc.).
f. Terminal designations at PCMs where the field conductor connects to field terminal blocks for a PLC input or output shall be the PLC address (Note: the following PLC I/O numbering scheme is typical for Allen-Bradley, the numbering scheme should be modified to match that of the actual PLC manufacturer used for the project):
    1) Discrete Point: W:X:Y/Z.
       Analog Point: W:X:Y.Z.
       Where:
       W= I for input, O for output
       X= PLC number (1, 2, 3…)
       Y= Slot number (01, 02, 03…)
       Z= Terminal number (00, 01, 02…) for a discrete point or a word number for an analog point (1, 2, 3…)
g. Terminal designations at PCMs where the conductor does not connect to a PLC I/O point shall be the terminal number with a "C" prefix (e.g. C0010). For common power after a fuse or neutrals after a switch, the subsequent points shall have and capital letter suffix starting with "A" (e.g. C0010A).

3. **Case 3**: Motor control center (MCC) to process control module (PCM):
   Field wire number/label: G-B/C-D
   B =Terminal number within Motor Control Center (manufacturer's or vendor's standard terminal number)
   C = Process control module without hyphen (PCM#)
   D = Either the PLC address if the field terminal is connected directly to a PLC input or output point or the terminal number with a "C" prefix if not connected directly to a PLC I/O point (C0010)
   G = Actual starter designation in the motor control center without hyphen (MMS#)

   Examples: MMS#-10/PCM#-I: 1:01/01
   MMS#-10/PCM#-O: 1:10/07
   MMS#-10/PCM#-C0100

4. **Case 5**: Motor leads to a motor control center (MCC):
   Field wire number/label: H-I/G-B
   B = Terminal number within motor control center (manufacturer's standard terminal number)
   G = Actual starter designation in the motor control center without hyphen (MMS#)
   H = Equipment tag and loop number without hyphen (PMP#)
   I = Motor manufacturer's standard motor lead identification (e.g. T1, T2, T3, etc.)

   Example: PMP-#-T3/MMS#-T3

5. **Case 6**: Remote or separately mounted starter or variable frequency drive (VFD) to process control module (PCM):
   Field wire number/label: J-B/C-D
   B = Terminal number within starter or variable frequency drive (manufacturer's standard terminal number)
   C = Process control module number without hyphen (VCP#)
   D = Either the PLC address if the field terminal is connected directly to a PLC input or output point or the terminal number with a "C" prefix if not connected directly to a PLC I/O point (C0010)
   J = Starter or variable frequency drive tag and loop number without hyphen (MMS#)

   Examples: MMS#-10/PCM#-I: 1:01/01
   MMS#-10/PCM#-O: 2: 10/07
   MMS#-10/PCM#-C0010

1.05 SUBMITTALS

A. Furnish submittals as specified in Sections 01300 - Contractor Submittals.

B. Product data:
    1. Nameplates:
        a. Color.
        b. Size:
            1) Outside dimensions.
            2) Lettering.
        c. Material.
        d. Mounting means.
    2. Nameplate schedule:
        a. Show exact wording for each nameplate.
        b. Include nameplate and letter sizes.
    3. Wire numbers:
        a. Manufacturer's catalog data for wire labels and label printer.

C. Record documents:
    1. Update the conduit schedule to reflect the exact quantity of wire numbers including spares and destination points for all wires.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nameplates and signs:
    1. One of the following or equal:
        a. Brady.
        b. Seton.

B. Conductor and cable markers:
    1. Heat-shrinkable tubing:
        a. One of the following or equal:
            1) Raychem.
            2) Brady.
            3) Thomas & Betts.
            4) Kroy.
            5) Panduit.

C. Conduit and raceway markers:
    1. Non-metallic, one of the following or equal:
        a. Almetek: Mini Tags.
        b. Lapp Group: Maxi System.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS

A. Nameplates:
    1. Colors:
        a. Warning nameplates: White-center, red face.
        b. Other nameplates: Black-center, white face.

2. Laminated plastic engraving stock:
    a. 3/32-inch-thick material.
    b. 2-ply.
3. With chamfered edges.
4. Lettering:
    a. Block style engraved characters of adequate size to be read easily from a distance of 6 feet:
    b. Minimum letter height: 1/8-inch.

B. Conductor and cable markers:
1. Lettering:
    a. Machine printed black characters on white tubing.
    b. Minimum letter height: 10-point type or larger.

C. Conduit and raceway markers:
1. Non-metallic:
    a. UV resistant holder and letters.
    b. Black letters on yellow background.
    c. Minimum letter height: 1/4-inch.
    d. Adhesive labels are not acceptable.

2.04 SOURCE QUALITY CONTROL

A. Nameplates:
1. Provide all nameplates for control panel operator devices (e.g. pushbuttons, selector switches, pilot lights, etc.):
    a. Same material and same color and appearance as the device nameplates, in order to achieve an aesthetically consistent and coordinated system.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. Nameplates:
1. Attach nameplates to equipment with rivets, bolts or sheet metal screws, approved waterproof epoxy-based cement or install in metal holders welded to the equipment.
2. Provide a nameplate for each disconnecting means with the following:
    a. Equipment served, voltage, and fuse size as required.
    b. Identification of the circuit source that supplies the disconnecting means.
3. Nameplates shall be aligned and level or plumb to within 1/64 inch over the entire length:
    a. Misaligned or crooked nameplates shall be remounted or provide new enclosures at the discretion of the Engineer.

B. Conductor and cable markers:
   1. Apply all conductor and cable markers before termination.
   2. Heat-shrinkable tubing:
      a. Tubing shall be shrunk using a heat gun that produces low temperature heated air.
      b. Tubing shall be tight on the wire after it has been heated.
      c. Characters shall face the open panel and shall read from left to right or top to bottom.
      d. Marker shall start within 1/32 inch of the end of the stripped insulation point.

C. Conduit markers:
   1. Furnish and install conduit markers for every conduit in the electrical system that is identified in the conduit schedule or part of the process system:
      a. Conduit markings shall match the conduit schedule.
   2. Mark conduits at the following locations:
      a. Each end of conduits that are greater than 10 feet in length.
      b. The middle of conduits that are 10 feet or less in length.
      c. Where the conduit penetrates a wall or structure.
      d. Where the conduit emerges from the ground, slab, etc.
   3. Mark conduits after the conduits have been fully painted.
   4. Position conduit markers so that they are easily read from the floor.
   5. Attach non-metallic conduit markers with nylon cable ties:
      a. Provide ultraviolet resistant cable ties for conduit markers exposed to direct sunlight.

3.04 FIELD QUALITY CONTROL

A. Replace any nameplates, conductor markers, cable markers, or raceway labels that in the sole opinion of the Engineer do not meet the Engineer's aesthetic requirements.

END OF SECTION

SECTION 16123

600-VOLT OR LESS WIRES AND CABLES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. 600-volt class or less wire and cable.

1.02 REFERENCES

A. As specified in Section 16050 - Common Work Results for Electrical.

B. ASTM International (ASTM):
   1. B3 - Standard Specification for Soft or Annealed Copper Wire.
   2. B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

C. CSA International (CSA).

D. Insulated Cable Engineer's Association (ICEA):
   1. S-90-661 - Individually Unshielded Twisted Pair Indoor Cables for Use in Communication Wiring Systems.

E. National Electrical Manufacturers Association /Insulated Cable Engineers Association (NEMA/ICEA):
   1. NEMA WC 57/ICEA S-73-532 - Standard for Control, Thermocouple Extension, and Instrumentation Cables.
   2. NEMA WC 66/ICEA S-116-732 - Standard for Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use in LAN Communication Wiring Systems.
   3. NEMA WC 70/ICEA S-95-658-1999 - Standard for Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.

F. National Fire Protection Association (NFPA):
   1. 70 - National Electrical Code (NEC).
   2. 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

G. Telecommunications Industry Association (TIA):
   1. 568.2-D - Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
   2. 569-B - Commercial Building Standards for Telecommunications Pathways and Spaces.

H. Underwriter's Laboratories Inc., (UL):
   1. 44 - Standard for Thermoset-Insulated Wires and Cables.

2. 1277 - Electrical Power and Control Tray Cables with Optional-Fiber Members.
3. 1569 - Standard for Metal-Clad Cables.
4. 1666 - Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts.

1.03 DEFINITIONS

A. As specified in Section 16050 - Common Work Results for Electrical.

B. Specific definitions and abbreviations:
1. AWG: American wire gauge.
2. BCCS: Bare copper-covered steel.
3. CPE: Chlorinated polyethylene.
4. FEP: Fluorinated ethylene propylene.
5. FHDPE: Foam high-density polyethylene.
6. FPE: Foam polyethylene.
7. OD: Outside diameter.
8. PVC: Polyvinyl chloride.
9. XHHW: Cross-linked high heat water resistant insulated wire.

C. Definitions of terms and other electrical considerations as set forth in the:
1. ASTM.
2. ICEA.

1.04 SYSTEM DESCRIPTION

A. Furnish and install the complete wire and cable system.

1.05 SUBMITTALS

A. Furnish submittals as specified in Section 01300 - Contractor Submittals.

B. Product data:
1. Manufacturer of wire and cable.
2. Insulation:
   a. Type.
   b. Voltage class.
3. AWG size.
4. Conductor material.
5. Pulling compounds.

C. Shop drawings:
1. Show splice locations.
   a. For each proposed splice location provide written justification describing why the splice is necessary.

D. Test reports:
1. Submit test reports for meg-ohm tests.

E. Calculations:
   1. Submit cable pulling calculations to the Engineer for review and comment for all cables that will be installed using mechanical pulling equipment. Show that the maximum cable tension and sidewall pressure will not exceed manufacturer recommended values:
      a. Provide a table showing the manufacturer's recommended maximum cable tension and sidewall pressure for each cable type and size included in the calculations.
      b. Submit the calculations to the Engineer a minimum of 2 weeks before conduit installation.

F. Cable lengths:
   1. Submit installed cable lengths using a conduit measuring tape for all 3-phase circuits including, but not limited to:
      a. 480 V circuits.
      b. 208 V circuits.
   2. Submit installed lengths of cable for the following single-phase circuits:
      a. Circuits feeding single-phase transformers.
      b. Circuits feeding single-phase panelboards.

1.06 QUALITY ASSURANCE

A. All wires and cables shall be UL listed and labeled.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or equal:
   1. 600-volt class wire and cable:
      a. General Cable.
      b. Okonite Co.
      c. Southwire Co.
      d. Service Wire.
   2. Instrumentation class wire and cable:
      a. Alpha Wire Co.
      b. Belden CDT.
      c. General Cable.
      d. Okonite Co.
      e. Rockbestos Surprenant Cable Corp.
   3. Network cables:
      a. General Cable.
      b. Belden.
      c. CommScope.

2.02 MATERIALS

A. Conductors:
   1. Copper in accordance with ASTM B3.

2.03 MANUFACTURED UNITS

A. General:
   1. Provide new wires and cables manufactured within 1 year of the date of delivery to the Site.
   2. Permanently mark each wire and cable with the following at 24-inch intervals:
      a. AWG size.
      b. Voltage rating.
      c. Insulation type.
      d. UL symbol.
      e. Month and year of manufacture.
      f. Manufacturer's name.
   3. Identify and mark wire and cable as specified in Section 16075 - Identification for Electrical Systems:
      a. Use integral color insulation for #2 AWG and smaller wire.
      b. Wrap colored tape around cable larger than #2 AWG.

B. 600-volt class wire and cable:
   1. Provide AWG or kcmil sizes as indicated on the Drawings or in the Conduit Schedules:
      a. When not indicated on the Drawings, size wire as follows:
         1) In accordance with the NEC:
            a) Use 75-degree Celsius ampacity ratings.
            b) Ampacity rating after all derating factors, equal to or greater than rating of the overcurrent device.
         2) Provide #12 AWG minimum for power conductors.
         3) Provide #14 AWG minimum for control conductors.
   2. Provide Class B stranding in accordance with ASTM B8:
      a. Provide Class C stranding where extra flexibility is required.
   3. Insulation:
      a. XHHW-2.
      b. 90-degree Celsius rating.

C. Instrumentation class cable:
   1. Type TC.
   2. Suitable for use in wet locations.
   3. Voltage rating: 600 volts.
   4. Temperature rating:
      a. 90 degree Celsius rating in dry locations.
      b. 75 degree Celsius rating in wet locations.
   5. Conductors:
      a. Insulation:
         1) Flame-retardant PVC, 15 mils nominal thickness, with nylon jacket 4 mils nominal thickness.
      b. #16 AWG stranded and tinned.
      c. Color code: ICEA Method 1:
         1) Pair: Black and white.
         2) Triad: Black, white and red.
         3) Multiple pairs or triads:
            a) Color-coded and numbered.

6. Drain wire:
    a. #18 AWG.
    b. Stranded, tinned.
7. Jacket:
    a. Flame retardant, moisture and sunlight resistant PVC.
    b. Ripcord laid longitudinally under jacket to facilitate removal.
8. Shielding:
    a. Individual pair/triad:
        1) Minimum 1.35-mil double-faced aluminum foil-polyester tape overlapped to provide 100 percent coverage.
    b. Multiple pair or triad shielding:
        1) Group shield: Minimum 1.35-mil double-faced aluminum foil-polyester tape overlapped to provide 100 percent coverage.
        2) Completely isolate group shields from each other.
        3) Cable shield: 2.35 mils double-faced aluminum and synthetic polymer backed tape overlapped to provide 100 percent coverage.
    c. All shielding to be in contact with the drain wire.

D. Network cables:

1. Copper Ethernet cable:
    a. Provide copper Ethernet cable types as indicated in the Drawings and Specifications.
    b. General requirements:
        1) All cables shall meet the standards set by TIA-568.2-D and verified by third-party testing laboratory.
        2) Conductors:
            a) Four balanced twisted pairs.
                (1) #22 to #24 AWG thermoplastic insulated solid copper conducts enclosed by a thermoplastic jacket. Copper clad aluminum is not allowed.
        3) Insulation:
            a) Non-Plenum: Polyolefin.
            b) Plenum: Fluoropolymer.
        4) Color coded per T568B.
        5) Outer jacket with ripcord.
        6) Shielding:
            a) Provide F/UTP cables with drain wire for cables inside any equipment, enclosures, or raceway that also contains circuits exceeding 480 VAC and as indicated on the Drawings**.**
        7) Electrical rating:
            a) Equipment cables: 600 VAC.

        8) Approvals and listings:
            a) Meets any necessary NEC and NFPA requirements for each application.
            b) Riser applications: CMR in accordance with UL 1666.
            c) Plenum applications: CMP in accordance with NFPA 262.
        9) Certification:
            a) Provide Category 6 cables with NEMA WC 66/ICEA S-116-732 certification.

2.04 EQUIPMENT (NOT USED)

2.05 COMPONENTS (NOT USED)

2.06 ACCESSORIES

A. Wire ties:
   1. One of the following or equal:
      a. T&B, "Ty-Rap" cable ties.
      b. Panduit, cable ties.

B. Wire markers:
   1. As specified in Section 16075 - Identification for Electrical Systems.

2.07 SOURCE QUALITY CONTROL

A. Assembly and testing of cable shall comply with the applicable requirements of NEMA WC 70/ICEA S-95-658-1999.

B. Test Type XHHW-2 in accordance with the requirements of UL 44.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. As specified in Section 16050 - Common Work Results for Electrical.

B. Color-coding:
   1. Color-coding shall be consistent throughout the facility.
   2. The following color code shall be followed for all 240/120 volt and 208/120 volt systems:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
      d. Single phase system: Black for 1 hot leg, red for the other.
      e. Neutral: White.
      f. High phase or wild leg: Orange.
      g. Equipment ground: Green.
   3. The following color code shall be followed for all 480/277 volt systems:
      a. Phase A: Brown.
      b. Phase B: Orange.
      c. Phase C: Yellow.
      d. Neutral: Gray.
      e. Equipment ground: Green.
   4. The following color code shall be followed for all 120 VAC control wiring:
      a. Power: Red.

b. Neutral: White.

5. The following color code shall be followed for all general purpose DC control circuits:
   a. Grounded conductors: White with blue stripe.
   b. Ungrounded conductors: Blue.
6. Wire colors shall be implemented in the following methods:
   a. Wires manufactured of the desired color.
   b. Continuously spiral wrap the first 6 inches of the wire from the termination point with colored tape:
      1) Colored tape shall be wrapped to overlap 1/2 of the width of the tape.

C. Install conductors only after the conduit installation is complete, and all enclosures have been vacuumed clean, and the affected conduits have been swabbed clean and dry:
   1. Install wires only in approved raceways.
   2. Do not install wire:
      a. In incomplete conduit runs.
      b. Until after the concrete work and plastering is completed.

D. Properly coat wires and cables with pulling compound before pulling into conduits:
   1. For all #4 AWG and larger, use an approved wire-pulling lubricant while cable is being installed in conduit:
      a. Ideal Products.
      b. Polywater Products.
      c. 3M Products.
      d. Greenlee Products.
      e. Or equal as recommended by cable manufacturer.
      f. Do not use oil, grease, or similar substances.

E. Cable pulling:
   1. Prevent mechanical damage to conductors during installation.
   2. For cables #1 AWG and smaller, install cables by hand.

F. Install and terminate all wire in accordance with manufacturer's recommendations.

G. Neatly arrange and lace conductors in all pull boxes, and terminal cabinets by means of wire ties:
   1. Do not lace wires in gutter or panel channel.
   2. Install all wire ties with a flush cutting wire tie installation tool:
      a. Use a tool with an adjustable tension setting.
   3. Do not leave sharp edges on wire ties.

H. Terminate stranded conductors on equipment box lugs such that all conductor strands are confined within the lug:
   1. Use ring type lugs if box lugs are not available on the equipment.

I. Splices:
   1. Provide continuous circuits from origin to termination whenever possible:
      a. Obtain Engineer’s approval prior to making any splices.
   2. Lighting and receptacle circuit conductors may be spliced without prior approval from the Engineer.

3. Where splices are necessary because of extremely long wire or cable lengths that exceed standard manufactured lengths:
    a. Splice box NEMA rating requirements as specified in Section 16050 - Common Work Results for Electrical.
    b. Make splices in labeled junction boxes for power conductors.
    c. Make splices for control and instrument conductors in terminal boxes:
        1) Provide terminal boards with setscrew pressure connectors, with spade or ring lug connectors.
4. Power and control conductors routed in common raceways may be spliced in common junction boxes.
5. Clearly label junction and terminal boxes containing splices with the word "SPLICE LOCATED WITHIN".
6. Leave sufficient slack at junction boxes and termination boxes to make proper splices and connections. Do not pull splices into conduits.
7. Install splices with compression type butt splices and insulate using a heat-shrink sleeve:
    a. In NEMA Type 4 or NEMA Type 4X areas, provide heat-shrink sleeves that are listed for submersible applications.
8. Splices in below grade pull boxes, in any box subject to flooding, and in wet areas shall be made waterproof using:
    a. A heat shrink insulating system listed for submersible applications.
    b. Or an epoxy resin splicing kit.

J. Apply wire markers to all wires at each end after being installed in the conduit and before meg-ohm testing and termination.

K. Instrumentation class cable:
1. Install instrumentation class cables in separate raceway systems from power cables:
    a. Install instrument cable in metallic conduit within non-dedicated manholes or pull boxes.
    b. Install cable without splices between instruments or between field devices and instrument enclosures or panels.
2. Do not make intermediate terminations, except in designated terminal boxes as indicated on the Drawings.
3. Shield grounding requirements as specified in Section 16060 - Grounding and Bonding.

L. Copper Ethernet cables:
1. In accordance with TIA-568.2-D.
2. Pathways:
    a. For initial installation, the maximum fill capacity for pathways (i.e., conduit, raceways, trays, baskets) is 40 percent. The maximum fill capacity of 60 percent is allowed to accommodate future additions after initial installation.
    b. Conduit should be run in the most direct route possible with no more than two 90 degree bends between pull boxes and serve no more than 3 outlet boxes.

3. Cable bend radius:
    a. Proper cable bend radius control must be maintained throughout the pathways. The bend radius needs to be at a minimum 10 times the cable diameter.
4. Cable pulling:
    a. Provide cable pulling swivel system to prevent winding and tangling of rope and cables during pull.
    b. The maximum pulling tension is not to exceed manufacturer recommendations. Cable installation should not in any way deform the cable jacket.
    c. 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.
5. Cable management:
    a. Organize and manage cables for quick and easy moves, adds and changes.
6. Cable termination:
    a. Install equipment outlet connector hardware (e.g., RJ45, M12, etc.), and connect to field equipment outlet (e.g., instrument, VFD, actuator, etc.).
    b. Use shielded connectors as required by the installation.
    c. Coordinate cable termination at copper patch panels with ICSC and General Contractor.
7. Testing:
    a. Copper Ethernet cable testing requirements as specified in Section 16950 - Field Electrical Acceptance Tests.
8. Separation from EMI sources:
    a. Comply with TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
    b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
        1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
        2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
        3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
    c. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
        1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
        2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
        3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
    d. 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:
        1) Electrical Equipment Rating Less Than 2 kVA: No requirement.

M. Signal cable:
   1. Separate and isolate electrical signal cables from sources of electrical noise and power cables by minimum 12 inches.

N. Wiring allowances:
   1. Equipment locations may vary slightly from the drawings. Include an allowance for necessary conductors and terminations for motorized equipment, electrical outlets, fixtures, communication outlets, instruments, and devices within 10 linear feet of locations indicated on the Drawings.

END OF SECTION

SECTION 16125

FIBER OPTIC CABLE AND APPURTENANCES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Fiber optic cable.
   2. Fiber splices and terminations.
   3. Accessories.

1.02 REFERENCES

A. Abbreviations:
   1. N/Cm: Newtons per centimeter.
   2. OTLS: Optical Loss Test Set (Tier 1 test).
   3. OTDR: Optical Time Domain Reflectometer (Tier 2 test).

B. Definitions:
   1. As specified in Section 17050 - Common Work Results for Process Control and Instrumentation Systems.

C. Standards:
   1. Bellcore Standards:
      a. GR-409, “Generic Requirements for Indoor Fiber.”
   2. Electronic Industry Association (EIA) 455B "Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components":
      a. FOTP-25 - Impact testing of Fiber Optic Cables and Cable Assemblies.
      b. FOTP-33 - Fiber Optic Cable Tensile Loading and Bending Test.
      c. FOTP-41 - Compressive Loading Resistance of Fiber Optic Cables.
      d. FOTP-81 - Compound Flow (Drip) Test for Filled Fiber Optic Cable.
      e. FOTP-104 - Fiber Optic Cable Cyclic Flexing Test.
      f. FOTP-181 - Lightning Damage Susceptibility Test for Fiber Optic Cables with Metallic Components.
   3. Insulated Cable Engineer’s Association (ICEA):
      a. S-83-596, “Optic Fiber Premises Distribution Cables.”
      b. S-87-640, “Optic Fiber Outside Plant Communications Cable.”
      c. S-104-696, “Indoor-Outdoor Optic Fiber Cable.”
   4. TIA/EIA Standards:
      a. 598 - “Optical Fiber Cable Color Coding.”
      b. 11801 - Information technology - Generic cabling for customer premises.
   5. Underwriters Laboratories, Inc. (UL):
      A. 1666 - Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts.
      b. 1685 - Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables.

1.03 DELEGATED DESIGN (NOT USED)

1.04 SUBMITTALS

A. Furnish submittals as specified in Section 01300 - Contractor Submittals.

B. Product data:
   1. Complete manufacturer's brochures that identify materials and options.
   2. Completed data sheets, including catalog number and source for determining catalog number.
   3. Manufacturer's installation instructions.
   4. Include the following:
      a. Manufacturer's data on testing equipment used on this project.
      b. Manufacturer's specifications and data sheets for all fiber types.
      c. Manufacturer's specifications and data sheets for all connectors, bulkheads, splicing kits, breakout devices, and appurtenances used in connecting and terminating the fiber spans.
   5. Catalog data on all testing devices proposed for use plus certifications of accuracy, calibration, and traceability to standards of the NIST.
   6. Manufacturer's test procedures and quality assurance procedures:
      a. After review, the Engineer may require that additional tests be performed before installation.

C. Shop drawings:
   1. Interconnection cabling diagrams for the complete system including every fiber in each cable.
   2. Drawings indicating the locations of all pull boxes including pull box identifiers and lengths.
   3. Submit optical power budget calculations for all fiber segments. Include the following:
      a. Minimum transmit power of active devices.
      b. Minimum receive sensitivity.
      c. Available power, in dBm.
      d. Loss for each segment in dBm, including cable attenuation and connector losses. Use manufacturer's data for cable attenuation, at the wavelength to be used. Assume 0.5 dB per connector.
      e. Demonstrate that remaining power budget at each receiver is equal to or greater than 3.0 dBm.

D. Installation instructions:
   1. Submit a cable pulling and splicing work plan that includes the following:
      a. Pull tension calculations.
      b. Detailed description of pull operation methods for all conduit runs.
      c. Tools and equipment to be used for cable installation and testing.
      d. Physical location of equipment setup and type.
      e. Exact locations of splice points.
      f. Safety and manual assist cable-pulling operations.
      g. Detailed schedule for pulling and testing cables.
      h. The name and qualifications of the supervisory personnel directly responsible for the installation of the conduit system.
      i. Sample fiber optic cable test sheets.

j. All signed test sheet results.

E. Technical manuals:
1. Compile completed test reports, instruction manuals, and manufacturer's information into the operating manuals and submitted in accordance with Section 01700 - Project Closeout.

F. Test reports:
1. Submit the results of all specified tests to the Engineer.
2. Submit 3 copies of all test reports showing the results of all tests specified herein or in Section 16950 - Field Electrical Acceptance Tests:
a. Test forms shall include the following information at a minimum:
1) Test type.
2) Test location.
3) Test date.
4) Wavelength.
5) Index of refraction.
6) Cable identification.
7) Fiber type.
8) Fiber number.
9) Fiber color.
10) Result of the value of the tested parameter.
3. Furnish hard copy and electronic copy for all OTDR traces.
4. Submit certification that the fiber optic cable has passed each testing stage:
a. Submit separate documentation for each testing stage result.

G. Record documents:
1. Furnish updated electrical drawings, network diagrams, and fiber cable block diagrams at the end of construction and submit as Record Drawings.

H. Calculations:
1. Cable pulling calculations for all conduit runs:
a. Indicate on the submittal any additional pull boxes that are required, including pull box identifiers and a written description of the location.

1.05 QUALITY ASSURANCE

A. Furnish all cable and appurtenances manufactured within 1 year of installation.

B. Proof test all optical fibers by the fiber manufacturer at a minimum load of 50 kpsi.

C. Provide 100 percent attenuation testing for all optical fibers:
1. Include with each cable reel the attenuation of each fiber.

D. Provide information on at least 5 successful fiber optic cable installations of comparable size and complexity in the past 3 years with name, address, and telephone number of facility owner, name of project with completion date, and type of conduit system and length of cable pulled.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package the cable for shipment on wooden reels:
   1. Seal both ends of the cable to prevent the ingress of moisture.
   2. Place fiber cable assemblies on reels such that both cable ends are available for testing.
   3. Weatherproof cable reel markings shall include the following:
      a. Manufacturer.
      b. Date of manufacture.
      c. Shipping date.
      d. Cable identification.
      e. Cable configuration/fiber count.
      f. Cable length.
      g. Gross weight.
      h. Cable test date.
      i. Handling instructions.
      j. Direction to unreel.

1.07 PROJECT OR SITE CONDITIONS

A. As specified in Section 16050 - Common Work Results for Electrical.

1.08 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
   1. Submit a cable pulling and splicing work plan a minimum of 45 days before the planned initiation of cable pulling. The cable pulling and splicing work plan must be approved a minimum of 15 days before pulling cable.
   2. Testing sequence:
      a. Perform testing of each fiber in each cable as follows:
         1) At the factory before shipment.
         2) At the project site upon delivery.
         3) Submit copies of the test results to the Engineer within 5 days after the delivery to the site.
         4) After installation, before breakout and terminations.
         5) After installation is complete.
      b. Submit test reports following each set of tests as specified in this Section.

B. Scheduling:
   1. Schedule Engineer, 5 days before installation, to witness all cable installations.
   2. Notify the Engineer and Owner a minimum of 15 days before post-installation testing.

PART 2 PRODUCTS

2.01 GENERAL (NOT USED)

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Install all fiber optic system components in accordance with the recommendations of the manufacturer.

2.03 MANUFACTURERS

A. Acceptable manufacturers are indicated with each component type as listed in the remainder of this specification.

2.04 MATERIALS (NOT USED)

2.05 MANUFACTURED UNITS

A. General fiber cable requirements:
   1. Suitable for the installed environment.
   2. Color-coded fibers according to EIA/TIA-598.
   3. Color-coded buffer tubes according to EIA/TIA-598.
   4. Furnish buffer tubes of a single layer nylon construction or of a material with similar mechanical performance.
   5. Fillers may be included in the cable core to lend symmetry to the cable cross-section where needed.
   6. Apply binders with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes:
      a. Provide binders that are:
         1) Non-hygroscopic.
         2) Non-wicking (or rendered so by the flooding compound).
         3) Dielectric with low shrinkage.
   7. Provide a minimum of 1 ripcord under the cable sheath.
   8. Provide the high tensile strength Aramid yarns, Kevlar, and/or fiberglass helically stranded evenly around the cable core:
      a. No metallic elements whatsoever are allowed in non-armored cable.
   9. The jacket or sheath shall be free of holes, splits, and blisters.
   10. Mark the jacket or sheath with:
      a. Manufacturer's name.
      b. The words "Optical Cable”.
      c. Year of manufacture.
      d. Sequential meter marks.
      e. Repeat markings every 1-meter.
      f. The actual length of the cable to be within 1 percent of the length marking.
      g. The marking must be in a contrasting color to the cable jacket.
      h. The height of the marking:
         1) Approximately 2.5 millimeters.
   11. The shipping, storage, and operating temperature range of the cable shall be -40 degrees Celsius to +70 degrees Celsius.

12. General performance characteristics:
    a. The rated tensile load of the cables:
        1) Indoor/outdoor:
            a) Short term: 1,330 N.
            b) Long term: 400 N.
    b. Non-armored fiber optic cables: Compressive load withstand of 220 N/cm applied uniformly over the length of the cable.
    c. Armored fiber optic cables: Compressive load withstand of 440 N/cm applied uniformly over the length of the cable.
    d. The average increase in attenuation for the fibers: Less than or equal to 0.10 dB at 1,550 nm for a cable subjected to this load:
        1) With no measurable increase in attenuation after load removal.
    e. Test in accordance with FOTP-41, "Compressive Loading Resistance of Fiber Optic Cable," except that the load must be applied at the rate of 3 millimeters to 20 millimeters per minute and maintained for 10 minutes.
    f. Capable of withstanding 25 cycles of mechanical flexing at a rate of 30 within 1 cycles/minute.
    g. The average increase in attenuation for the fibers: Less than or equal to 0.10 dB at 1,550 nm at the completion of the test.
    h. For armored cables, any visible cracks causing separation of the armor and propagating more than 5 millimeters constitutes failure.
    i. Outer cable jacket cracking or splitting observed under 10X times magnification, constitutes failure.

B. Indoor/outdoor cable:
    1. Cable construction:
        a. General:
            1) Cable type: Indoor/Outdoor - Flame retardant, low smoke, zero halogen, UV resistant.
            2) Fiber count: As indicated on the Drawings.
            3) Fiber type: As indicated on the Drawings.
            4) Buffer tube: Tight buffer.
            5) Armoring: None.
            6) Waterproofing: Water blocking layer.
            7) Strength member:
                a) Tight buffer: For cables with more than 12 fiber strands, utilize a central, nonmetallic strength member with a coefficient of thermal expansion similar to the fibers.
            8) Approvals and listings: UL 1666 and UL 1685.
            9) Design and test criteria: In accordance with ICEA S-104-696.
        b. Testing:
            1) All fibers in the cable:
                a) Proof test of 100 kpsi.
                b) Each optical fiber: Bellcore GR-409 strip force testing.
                c) No gaps are allowed between the coating material and the buffer material visible under a 50-power microscope.
        c. Outer jacket material:
            1) Linear low-density polyethylene.
            2) Meet all requirements of the NEC for use in all indoor/outdoor areas (excluding plenums) without being enclosed in conduit.
            3) Flame retardant OFNR riser rated conforming to UL 1666.

4) Printed with all necessary UL marks and manufacturer identification.
5) Sequential printing of footage in 2-foot increments.
6) With a ripcord incorporated under the cable jacket.

C. Single mode fibers:
1. All fibers in the cable must be usable fibers and meet required specifications.
2. Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding.
3. Single mode fiber characteristics:
a. Category: OS2 compliant with ITU-G.657.A1.
b. Jacket color: Yellow.

D. Indoor (tight buffer):
1. Corning Cable Systems, Freedm® One.
2. Optical Cable Corporation, DX-Series.

E. Indoor/outdoor:
1. Tight buffer:
a. Corning Cable Systems, Freedm® One.
b. Optical Cable Corporation, DX-Series.
c. CommScope, LazrSPEED/TerraSPEED.

2.06 EQUIPMENT (NOT USED)

2.07 COMPONENTS (NOT USED)

2.08 ACCESSORIES

A. Patch cords:
1. General:
a. Connector types to match supplied equipment and the patch panel terminations.
b. Maximum length of patch cords: 25 feet.
c. Provide 2 spare patch cords (or 1 duplex patch cord) of each type used at each PLC or network cabinet.
d. Factory assembled and optically tested.
2. Manufacturers: One of the following or equal:
a. CommScope.
b. Corning Cable Systems.

B. Fiber connectors:
1. As specified in Section 17733 - Control Systems: Network Materials and Equipment.

C. Fiber optic identification/warning tags:
1. Black letters on orange or yellow background.
2. UV resistant polyethylene or other suitable material.
a. Manufacturers: The following or equal.
1) Almetek.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify the condition of the conduit system before installation of the fiber optic cable or inner duct.

B. Pass a test mandrel through all fiber optic conduits prior to pulling fiber or installing inner duct.
   1. Run the mandrel in both directions.

C. Examine all materials and equipment before installation and verify they are free from physical damage and defects.

3.02 PREPARATION

A. Equipment support and anchoring to structures:
   1. Prepare anchor setting template(s) and use to position anchors during construction of supporting structures.
   2. Install anchors of type and material indicated on approved anchoring designs.
   3. Install anchors with embedment indicated on approved anchoring designs.

B. Before fiber splicing terminating or testing activities, verify sufficient workspace is available to perform the activity without interferences from other trades.

C. Pre-installation test:
   1. Upon arrival at the site:
      a. Inspect the cable and reel for damage.
      b. Test all fibers with an optical time domain reflectometer (OTDR) for fiber integrity.
      c. Verify that the fiber lengths are consistent with the cable manufacture.
      d. Verify that all traces yield no point discontinuities.
   2. Complete test sequence and obtain approval from the Engineer of submitted test results before cable installation.

3.03 INSTALLATION

A. Install fiber optic patch cords in open network trays or in dedicated conduits no longer than 25 feet in length.

B. Install fiber optic cable in continuous lengths without intermediate splices, except where approved by the Engineer.

C. Cable installation:
   1. Properly attach the fiber optic cable’s strength elements to a 600-pound breakaway swivel containing tension or shear pins using Kellums pulling grips that are a minimum of 18 inches long.
   2. Certify that cable tensile limits do not exceed cable pull tension and bend limits using tension monitoring devices.
   3. Leave an extra loop of fiber optic cable in each pull box.

4. Conform with the cable manufacturer's specifications, practices, and the following requirements:
    a. When power equipment is used to install fiber optic cables, use low speeds and do not exceed a rate of 30 meters per minute.
    b. Do not exceed the tensile and bending limitation for fiber optic cables under any circumstances.
    c. Use large diameter wheels, pulling sheaves, and cable guides to maintain the specified bending radius.
    d. Use commercial dynamometers or load cells to monitor pulling tension.
    e. A nonfreezing type of swivel inserted between the pulling line and cable pulling grip to prevent twisting under strain.
    f. All cable to be installed using a breakaway swivel.
5. Apply to all conduits a lubricant at each conduit ingress and egress location during the pull operation:
    a. Pour or pump lubricant into the end of the conduit at the feed location at a nominal application rate of 3 gallons per 1,000 feet of cable.
    b. If the conduit is open at intermediate locations, then apply the appropriate proportion of lubricant at each opening.
    c. Continuously lubricate the cable as it is being pulled by pouring or pumping the lubricant into the conduit at the feed location and at each intermediate location.
    d. Station workers at each intermediate location as required.
    e. Remove all excess lubricant that has collected.
    f. Remove and clean the surrounding area after cable installation.
6. Install using a hydraulic capstan or winch equipped with a recording running line dynamometer graph which measures and records pulling tensions:
    a. Use pulling equipment with “slip-load” capability to allow the winch to maintain a constant pulling force without taking up the winch line.
    b. Use pulling equipment equipped with a hydraulic bypass set so that a maximum tension of 600 pounds is not exceeded.
    c. Use only equipment designed to prevent a preset pulling tension from being exceeded.
    d. Fiber optic cable manufacturer to provide the pulling tension setpoint.
    e. If during the pulling operation excessive tension is detected, cease all operations and notify the Engineer.
7. Position the cable reel at the feed point in alignment with the raceway and in such a position that the cable can be passed from the top of the reel in a long, smooth bend into the raceway system:
    a. The use of a cable feeder is required, unless the cable is hand-pulled.
8. Supply all bull wheels, blocks, split wheels, cable feeders, and necessary equipment required to provide a clean and safe operation:
    a. The cable shall not be allowed to travel over any wheel or block that has a radius less than the minimum radius allowed by the cable manufacturer.
9. Minimize the use of snatch blocks and rollers to guide the cable into the conduit at the feed point:
    a. Slack feed by hand the cable into the feed point and raceway without the use of rollers.
10. Tend the cable reel at all times and turn by hand to provide the required cable slack:
    a. Under no circumstances shall the cable tension be allowed to turn the cable reel.

11. Use a rim roller, with a wheel radius greater than the minimum cable bending radius placed at the manhole or vault opening to prevent the cable from dragging on the manhole rim or steps.
12. Perform a continuous thorough visual inspection for flaws, breaks, and abrasions in the cable sheath as the cable leaves the reel, and maintain a slow pulling speed to permit this inspection.
13. Damage to the sheath or finish of the cable is cause for rejecting the cable:
    a. Replace any cable damaged in any way during installation.
14. If the cable becomes damaged during installation, stop operations, and notify the Engineer immediately:
    a. Engineer to determine whether to replace the entire reel of cable or to install a termination panel to eliminate the damaged section.
15. Document all pulls by a graph which is annotated with the following information:
    a. Reel number.
    b. Pull point ID.
    c. Date and time.
    d. Explanations for abnormalities in readings or interruptions.
    e. Sign-off by Contractor and Engineer.
16. Under no conditions shall the fiber optic cable be left exposed or unattended.

D. After the cables are installed and spliced:
1. Rack the cables.
    a. Loosely secure in racked position with wire ties.
    b. Attach imprinted plastic-coated cloth identification/warning tags to each cable in at least 2 locations in each handhole/manhole.

E. Splices:
1. Provide field splices in a splice tray located in a waterproof splice enclosure:
    a. Manufacturers: The following or equal:
        1) Tyco/Raychem, FOSC style splice enclosure.
2. Loop the individual fibers a minimum of 1 full turn within the splice tray to avoid macro/micro bending.
3. After completion of cable terminations, neatly dress all cables.
4. Protect all splices with a thermal shrink sleeve.
5. Provide fusion type fiber optic cable splicing meeting the following requirements:
    a. Joins multimode or single mode fibers.
    b. Establishes a permanent fusion splice.
    c. Waterproof.
    d. Re-enterable, rearrangable, and reusable.
    e. Splice loss less than 0.10 dB.
    f. Protected by a splice enclosure.
6. Requirement for outdoor fiber splice enclosures:
    a. Seal.
    b. Bond.
    c. Anchor.
    d. Protect fiber optic cable splices.
    e. Stand-alone unit that does not require an outer enclosure.
    f. Provide for a maximum of 6 cable entries in a butt-end configuration.
    g. Used in aerial, underground, and direct buried applications.

7. Requirement for indoor fiber splice enclosures:
    a. Anchor.
    b. Protect fiber optic cable splices.
    c. Stand-alone unit that does not require an outer enclosure.
    d. Suitable for the minimum number of splices at that location plus additional capacity for reconfigurations.
8. Re-splice any splice that has a loss greater than 0.10 dB.
9. Leave a minimum of 20 feet of fiber optic cable at each end of splice.

F. Terminations:
1. Terminate all fiber inside a patch panel.
    a. Direct landing to a switch, router hub, or PLC will not be allowed.
2. Terminate outdoor cables using a breakout kit that seals the cable and provides physical protection for the fiber strands.
3. Terminate indoor cables using breakout kits with field installed terminators.
4. Labeling:
    a. Permanently label all cable terminations. Use labels produced by a wire printer using pressure sensitive polyester labels.
    b. Label patch panels as specified in Section 16075 - Identification for Electrical Systems.

3.04 COMMISSIONING

A. Source testing:
1. Before shipment and while on the shipping reel, test 100 percent of all fibers for attenuation:
    a. Copies of the results shall be:
        1) Maintained on file.
        2) Attached to the cable reel in a waterproof pouch.
        3) Submitted before the delivery of the cable to the job site to Engineer for approval.
2. Conduct the flex test in accordance with FOTP-104 test condition I and III with a maximum sheave diameter of 20 times the cable OD.
3. Verify that the cable withstands 25 impact cycles with:
    a. The average increase in attenuation for the fibers less than 0.20 dB at 1,550 nm.
    b. No evidence of cracking or splitting.
    c. Conduct the test in accordance with FOTP-25.
4. Certify that the cable withstands a tensile load of 2,700 N (600 pounds):
    a. Without exhibiting an average increase in attenuation of greater than 0.10 dB.
    b. Test in accordance with FOTP-33 using a maximum mandrel and sheave diameter of 560 millimeters.
    c. Apply the load for 1 hour in Test Condition II.
5. Certify that the cable withstands a simulated lightning strike:
    a. Peak value of the current pulse greater than 105kA.
    b. Use a test current with a damped oscillatory maximum time-to-peak value of 15 µs (which corresponds to a minimum frequency of 16.7 kHz) and a maximum frequency of 30 kHz.
    c. The time to half-value of the waveform envelope 40 to 70 µs.
    d. Conduct the test in accordance with the FOTP-181.

e. In addition to the analysis criterion set forth in FOTP-181, the integrity of the buffer tubes (or analogous loose tube, i.e., core tube) and strength members must be intact after removal of the cable specimens from the test box.

6. Furnish test reports.

B. Functional Testing:
   1. Conduct post-installation tests of the fiber optic system as specified in Section 16950 - Field Electrical Acceptance Tests.

3.05 FIELD QUALITY CONTROL

A. Utilize personnel certified by the manufacturer with specific knowledge of the cable manufacturer's recommended installation procedures.

B. General:
   1. All test results shall meet or exceed manufacturer specifications:
      a. Test each fiber of each cable for breaks, abnormalities, and overall attenuation characteristics.
   2. Pre-installation tests and post-installation tests to be witnessed and signed off by Engineer and Owner.
   3. Perform OLTS test with equipment capable and calibrated to show anomalies of 0.1 dB as a minimum:
      a. Test single mode fibers at 1,310 and 1,550 nm.
   4. Perform OTDR tests on fiber cables less than 100 meters with the aid of a launch cable:
      a. Adjust OTDR pulse width settings to a maximum setting of 1/1000th of the cable length or 10 nanoseconds.

3.06 ADJUSTING (NOT USED)

3.07 CLEANING

A. Clean all fiber optic connectors after termination and before testing. After cleaning, cover all un-terminated connectors with a protective boot.

B. At the completion of construction, touch up the finish on all fiber patch panels and enclosures.

3.08 PROTECTION

A. Protect the fiber system from physical damage and the encroachment of dust, before, during, and after installation.

3.09 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16130

CONDUITS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Metallic conduits.
   2. Conduit bodies.
   3. Conduit fittings and accessories.
   4. Conduit installation.

1.02 REFERENCES

A. As specified in Section 16050 - Common Work Results for Electrical.

B. American National Standards Institute (ANSI):
   1. C80.1 - Electrical Rigid Steel Conduit.
   2. C80.3 - Steel Electrical Metallic Tubing.
   3. C80.5 - Electrical Rigid Aluminum Conduit.
   4. C80.6 - Electrical Intermediate Metal Conduit.

C. National Electrical Manufacturer's Association (NEMA):
   1. RN-1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Steel Conduit.
   2. TC2 - Electrical Polyvinyl Chloride (PVC) Conduit.
   3. TC3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
   4. TC7 - Smooth-Wall Coilable Electrical Polyethylene Conduit.
   5. TC13 - Electrical Nonmetallic Tubing.
   6. TC14 - Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

D. Underwriters Laboratories (UL):
   1. 1 - Standard for Flexible Metal Conduit.
   2. 6 - Standard for Electrical Rigid Metal Conduit - Steel.
   3. 6A - Standard for Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel.
   4. 360 - Standard for Liquidtight Flexible Steel Conduit.
   5. 651 - Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
   6. 651B - Standard for Continuous Length HDPE Conduit.
   7. 797 - Standard for Electrical Metallic Tubing - Steel.
   8. 1203 -Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.
   9. 1242 - Standard for Electrical Intermediate Metal Conduit - Steel.
   10. 1653 - Standard for Electrical Nonmetallic Tubing.
   11. 1660 - Standard for Liquidtight Flexible Nonmetallic Conduit.

12. 1684 - Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.03 DEFINITIONS

A. As specified in Section 16050 - Common Work Results for Electrical.

B. Specific definitions and abbreviations:
   1. Conduit bodies: A separate portion of a conduit system that provides access through a removable cover to the interior of the system at a junction of 2 or more conduit sections. Includes, but not limited to, Shapes C, E, LB, T, X, etc.
   2. Conduit fitting: An accessory that primarily serves a mechanical purpose. Includes, but not limited to, bushings, locknuts, hubs, couplings, reducers, etc.
   3. GRC: Galvanized rigid steel conduit.
   4. SLT: Sealtight-liquidtight flexible conduit.
   5. NPT: National pipe thread.

1.04 SUBMITTALS

A. Furnish submittals as specified in Section 01300 - Contractor Submittals.

B. Product data:
   1. Furnish complete manufacturer’s catalog sheets for every type and size of conduit, fitting, conduit body, and accessories to be used on the Project.
   2. Furnish complete manufacturer’s recommended special tools to be used for installation if required.

C. Record Documents:
   1. Incorporate all changes in conduit routing on electrical plan drawings.
   2. Dimension underground and concealed conduits from building lines.
   3. Furnish hard copy drawings.

1.05 QUALITY ASSURANCE

A. All conduits, conduit bodies, and fittings shall be UL listed and labeled.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not expose non-metallic conduit to direct sunlight.

B. Do not store conduit in direct contact with the ground.

1.07 PROJECT OR SITE CONDITIONS

A. As specified in Section 01612 - Seismic Design Criteria.

1.08 SEQUENCING

A. Before installing any conduit or locating any device box:
   1. Examine the complete set of Drawings and Specifications, and all applicable shop drawings.

2. Verify all dimensions and space requirements and make any minor adjustments to the conduit system as required to avoid conflicts with the building structure, other equipment, or the work of other trades.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Galvanized rigid steel conduit:
   1. One of the following or equal:
      a. Western Tube and Conduit.
      b. Allied Tube and Conduit.
      c. Wheatland Tube Co.

B. Sealtight-liquidtight flexible conduit:
   1. One of the following or equal:
      a. Southwire.
      b. AFC Cable Systems.
      c. Electri-Flex Co.
      d. Anaconda.

C. Conduit bodies:
   1. One of the following or equal:
      a. Crouse-Hinds.
      b. Appleton.
      c. O-Z/Gedney.
      d. Ocal, Inc.
      e. Robroy Ind.
      f. Calbond.
      g. Carlon.

D. Joint compound:
   1. The following or equal:
      a. Thomas & Betts.

E. Galvanized rigid steel conduit expansion fittings:
   1. One of the following or equal:
      a. Crouse-Hinds.
      b. Appleton.
      c. O-Z/Gedney.

F. Conduit hangers and supports:
   1. As specified in Section 16070 - Hangers and Supports.

2.02 SYSTEM DESCRIPTION

A. Provide conduits, conduit bodies, fittings, junction boxes, and all necessary components, whether or not indicated on the Drawings, as required, to install a complete electrical raceway system.

2.03 COMPONENTS

A. GRC:
   1. All threads: NPT standard conduit threads with a 3/4-inch taper per foot:
      a. Running conduit threads are not acceptable.
   2. Hot-dip galvanized inside and out:
      a. Ensures complete coverage and heats the zinc and steel to a temperature that ensures the zinc alloys with the steel over the entire surface.
      b. Electro-galvanizing is not acceptable.
   3. Manufactured in accordance with:
      a. UL-6.
      b. ANSI C80.1.

B. SLT:
   1. Temperature rated for use in the ambient temperature at the installed location but not less than the following:
      a. General purpose:
         1) Temperature range: -20 degrees Celsius to +80 degrees Celsius.
      b. Oil-resistant:
         1) Temperature range: -20 degrees Celsius to +60 degrees Celsius.
   2. Sunlight-resistant, weatherproof, and watertight.
   3. Manufactured from single strip steel, hot-dip galvanized on all 4 sides before conduit fabrication.
   4. Strip steel spiral wound resulting in an interior that is smooth and clean for easy wire pulling.
   5. Overall PVC jacket.
   6. With integral copper ground wire, built in the core, in conduit trade sizes 1/2 inch through 1-1/4 inch.

C. Conduit bodies:
   1. Material consistent with conduit type:
      a. Malleable iron bodies and covers when used with Type GRC.
   2. Conduit bodies to conform to Form 8, Mark 9, or Mogul design:
      a. Mogul design conforming to NEC requirements for bending space for large conductors for conduit trade sizes of 1 inch and larger with conductors #4 AWG and larger, or where required for wire-bending space.
   3. Gasketed covers attached to bodies with stainless steel screws secured to threaded holes in conduit body.

2.04 ACCESSORIES

A. Connectors and fittings:
   1. Manufactured with compatible materials to the corresponding conduit.

B. Insulated throat metallic bushings:
   1. Construction:
      a. Malleable iron or zinc-plated steel when used with steel conduit.
      b. Positive metallic conduit end stop.
      c. Integrally molded non-combustible phenolic-insulated surfaces rated at 150 degrees Celsius.

d. Use fully insulated bushings on nonmetallic conduit system made of high-impact 150 degrees Celsius rated non-combustible thermosetting phenolic.

C. Insulated grounding bushings:
   1. Construction:
      a. Malleable iron or steel, zinc-plated, with a positive metallic end stop.
      b. Integrally molded non-combustible phenolic-insulated surfaces rated at 150 degrees Celsius.
      c. Tin-plated copper grounding saddle for use with copper or aluminum conductors.

D. Electrical unions (Erickson Couplings):
   1. Construction:
      a. Malleable iron for use with steel conduit.
      b. Concrete tight, 3-piece construction.
      c. Rated for Class I Division 1 Group D in hazardous areas.

E. SLT fittings:
   1. Construction:
      a. Malleable iron.
      b. Furnished with locknut and sealing ring.
      c. Liquidtight, raintight, oiltight.
      d. Insulated throat.
      e. Furnish as straight, 45-degree elbows, and 90-degree elbows.
      f. Designed to prevent sleeving:
         1) Verify complete bonding of the raceway jacket to the plastic gasket seal.
      g. Equipped with grounding device to provide ground continuity irrespective of raceway core construction. Grounding device, if inserted into raceway and directly in contact with conductors, shall have rolled-over edges for sizes under 5 inches.
      h. Where terminated into a threadless opening using a threaded hub fitting, a suitable moisture-resistant/oil-resistant synthetic rubber gasket shall be provided between the outside of the box or enclosure and the fitting shoulder. Gasket shall be adequately protected by and permanently bonded to a metallic retainer.

F. Hubs for threaded attachment of steel conduit to sheet metal enclosures:
   1. Construction:
      a. Insulated throat.
      b. PVC-coated when used in corrosive areas.
      c. Bonding locknut.
      d. Recessed neoprene o-ring to ensure watertight and dusttight connector.
      e. 1/2-inch through 1-1/4-inch steel zinc electroplated.
      f. 1-1/2-inch through 6-inch malleable iron zinc plated.
   2. Usage:
      a. All conduits in damp, wet, outdoor, and corrosive areas shall use threaded hubs for connections to sheet metal enclosures.

G. Expansion/deflection couplings:
    1. Use to compensate for movement in any direction between 2 conduit ends where they connect.
    2. Shall allow movement of 3/4 inch from the normal in all directions.
    3. Shall allow angular movement for a deflection of 30 degrees from normal in any direction.
    4. Constructed to maintain electrical continuity of the conduit system.
    5. Materials:
        a. End couplings: Bronze or galvanized ductile iron.
        a. Sleeve: Neoprene.
        b. Bands: Stainless steel.
        c. Bonding jumper: Tinned copper braid.

H. Expansion couplings:
    1. Shall allow for expansion and contraction of conduit:
        a. Permitting 8-inch movement, 4 inches in either direction.
    2. Constructed to maintain electrical continuity of the conduit system.
    3. Materials:
        a. Head: Malleable or ductile iron.
        a. Sleeve: Steel.
        b. Insulating bushing: Phenolic.
        c. Finish: Hot-dip galvanized.

I. Conduit markers:
    1. As specified in Section 16075 - Identification for Electrical Systems.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. General:
    1. Conduit routing:
        a. The electrical drawings are diagrammatic in nature:
            1) Install conduit runs as specified with schematic representation indicated on the Drawings and as specified.
            2) Modify conduit runs to suit field conditions, as accepted by the Engineer:
                a) Make changes in conduit locations that are consistent with the design intent but are dimensionally different, or routing to bypass obstructions.
                b) Make changes in conduit routing due to the relocation of equipment.
                c) Install conduits and equipment in such a manner as to avoid obstructions and to preserve headroom and keep openings and passageways clear.

3) Where the Drawings do not indicate the exact mounting and/or supporting method to be used, use materials and methods similar to the mounting details indicated on the Drawings.
4) The electrical drawings do not indicate all required junction boxes and pull boxes:
a) Provide junction boxes and pull boxes to facilitate wire pulling as required:
(1) To meet cable manufacturer's pulling tension requirements.
(2) To limit total conduit bends between pull locations.
b) Install junction boxes and pull boxes at locations acceptable to the Engineer.

b. The Contractor is responsible for any deviations in general location, conduit size, routing, or changes to the conduit schedule without the express written approval or direction by the Engineer:
1) The Engineer is the sole source in determining whether the change is constituted as a deviation:
2) Perform any changes resulting in additional conduits, or extra work from such deviations.
3) Incorporate any deviations on the Record Documents.

2. Use only tools recommended by the conduit manufacturer for assembling the conduit system.
a.
3. Do not install 1-inch or larger conduits in or through structural members unless approved by the Engineer.
4. Run conduits exposed to view parallel with or at right angles to structural members, walls, or lines of the building:
a. Install straight and true conduit runs with uniform and symmetrical elbows, offsets, and bends.
b. Make changes in direction with long radius bends or with conduit bodies.
5. Install conduits with total conduit bends between pull locations less than or equal to 270 degrees.
6. Route all exposed conduits to preserve headroom, access space and workspace, and to prevent tripping hazards and clearance problems:
a. Install conduit runs so that runs do not interfere with proper and safe operation of equipment and do not block or interfere with ingress or egress, including equipment-removal hatches.
b. Route conduits to avoid drains or other gravity lines. Where conflicts occur, relocate the conduit as required.
7. When installing conduits through existing slabs or walls, make provisions for locating any possible conflicting items where the conduit is to penetrate. Use tone signal or X-ray methods to make certain that no penetrations will be made into the existing conduits, piping, cables, post-tensioning cables, etc.
8. Plug conduits brought into pull boxes, manholes, handholes, and other openings until used to prevent entrance of moisture.
9. For existing and new 2-inch and larger conduit runs, snake conduits with a conduit cleaner equipped with a cylindrical mandrel of a diameter not less than 85 percent of nominal diameter of the conduit:
a. Remove and replace conduits through which mandrel will not pass.
10. Provide all sleeves and openings required for the passage of electrical raceways or cables even when these openings or sleeves are not specifically indicated on the Drawings.

11. Install complete conduit systems before conductors are installed.
12. Provide metallic conduits terminating in equipment conduit windows with grounding bushings and ground with a minimum No. 6 AWG ground wire.

B. Equipment grounding conductors:
   1. Provide a separate, green insulated, grounding conductor in each raceway independent of raceway material:
      a. Multi-conductor power and control cables shall include an integral green insulated grounding conductor.
      b. Provide a separate grounding conductor in each individual raceway for parallel feeders.
   2. Conductors shall be the same type and insulation as the circuit conductors:
      a. Use 600-volt insulation for the equipment grounding conductors for medium voltage systems.
   3. Minimum size in accordance with the NEC.

C. Conduit usage:
   1. Exposed conduits:
      a. Rigid conduit:
         1) Install the rigid conduit type for each location as specified in Section 16050 - Common Work Results for Electrical.
         2) Minimum size: 3/4-inch.
      b. Flexible conduit:
         1) Use flexible conduit for final connections between rigid conduit and motors, vibrating equipment, instruments, control equipment, or where required for equipment servicing:
            a) Use Type SLT with rigid metallic conduit.
         2) Minimum size: 3/4-inch:
            a) 1/2 when required for connection to instruments.
         3) Maximum length:
            a) Fixed equipment:

Conduit Trade Size	Flexible Conduit Length (inch)
3/4	18
1	18
1-1/4	18
1-1/2	18
2	36
2-1/2	36
3	36
3-1/2	38
4	40

            b) Removable instruments or hinged equipment:
               (1) As required to allow complete removal or full movement without disconnecting or stressing the conduit.

2. GRC:
    a. Conduit shall be cut square and reamed before threading.

D. Conduit joints and bends:
    1. General:
        a. Keep bends and offsets in conduit runs to an absolute minimum.
        b. All bends shall be symmetrical.
        c. The following conduit systems shall use large radius sweep elbows:
            1) Conduits containing fiber optic cables.
        d. Provide large-radius factory-made bends for 1-1/4-inch trade size or larger.
        e. Make field bends with a radius of not less than the requirements found in the NEC:
            1) The minimum bending radius of the cable must be less than the radius of the conduit bend.
            2) Make all field bends with power bending equipment or manual benders specifically intended for the purpose:
                a) Make bends so that the conduit is not damaged, and the internal diameter is not effectively reduced.
                b) For the serving utilities, make bends to meet their requirements.
        f. Replace all deformed, flattened, or kinked conduit.
    2. Threaded conduit:
        a. Cut threads on rigid metallic conduit with a standard conduit-cutting die that provides a 3/4-inch per foot taper and to a length such that all bare metal exposed by the threading operation is completely covered by the couplings or fittings used. In addition, cut the lengths of the thread such that all joints become secure and wrench-tight just preceding the point where the conduit ends would butt together in couplings or where conduit ends would butt into the ends or shoulders of other fittings.
        b. Thoroughly ream conduit after threads have been cut to remove burrs.
        c. Use bushings or conduit fittings at conduit terminations.
        d. On exposed conduits, repair scratches and other defects with galvanizing repair stick, Enterprise Galvanizing “Galvabar™,” or CRC “Zinc It.”
        e. Coat conduit threads with an approved electrically conductive sealant and corrosion inhibitor that is not harmful to the conductor insulation:
            1) Apply to the male threads and tighten joints securely.
            2) Clean excess sealant from exposed threads after assembly.
        f. Securely tighten all threaded connections.
        g. Any exposed threaded surfaces must be cleaned and coated with a galvanizing solution so that all exposed surfaces have a galvanized protective coating.

E. Conduit supports:
    1. General:
        a. Provide appropriate hangers, supports, fasteners, and seismic restraints to suit applications:
            1) As specified in Section 16070 - Hangers and Supports.
            2) Provide support materials consistent with the type of conduit being installed as specified in Section 16050 - Common Work Results for Electrical.
        b. Support conduit at the intervals required by the NEC.

c. Perforated strap and plumbers' tape are not acceptable for conduit supports.

2. Conduit on concrete or masonry:
   a. Use 1-hole malleable iron straps with metallic or plastic expansion anchors and screws or support from preset inserts.
   b. Use preset inserts in concrete when possible.
   c. Use pipe spacers (clamp backs) in wet locations.
3. Conduit on metal decking:
   a. Use 1-hole malleable iron straps with 1-inch-long cadmium-plated Type A panhead sheet-metal screws. Fully or partially hammer-driven screws are not acceptable.
4. Suspended conduit:
   a. Use malleable-iron factory-made split-hinged pipe rings with threaded suspension rods sized for the weight to be carried (minimum 3/8-inch diameter), Kindorf, or equal.
   b. For grouped conduits, construct racks with threaded rods and tiered angle iron or preformed channel cross members. Clamp each conduit individually to a cross member. Where rods are more than 2-feet long, provide rigid sway bracing.
5. Supports at structural steel members:
   a. Use beam clamps.
   b. Drilling or welding may be used only as specified or with approval of the Engineer.

F. Expansion or expansion/deflection fittings:
1. General:
   a. Align expansion coupling with the conduit run to prevent binding.
   b. Follow manufacturer's instructions to set the piston opening.
   c. Install expansion fittings across concrete expansion joints and at other locations where necessary to compensate for thermal or mechanical expansion and contraction.
   d. Furnish fittings of the same material as the conduit system.
2. For metallic conduit, provide expansion or expansion/deflection couplings, as appropriate, where:
   a. Install expansion fittings a minimum of every 200 feet in straight conduit runs.

G. Empty conduits:
1. Seal ends of all conduits with approved, manufactured conduit seals, caps, or plugs immediately after installation:
   a. Keep ends sealed until immediately before pulling conductors.

H. Miscellaneous:
1. Provide electrical unions at all points of union between ends of rigid conduit systems that cannot otherwise be coupled:
   a. Running threads and threadless couplings are not allowed.
2. Replace any conduits installed that the Engineer determines do not meet the requirements of this Specification.

END OF SECTION

SECTION 16134

BOXES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Raceway system boxes.

1.02 REFERENCES

A. As specified in Section 16050 - Common Work Results for Electrical.

B. American Association of State Highway and Transportation Officials (AASHTO):
   1. Standard Specifications for Highway Bridges.

C. ASTM International (ASTM):
   1. A47 - Standard Specification for Ferritic Malleable Iron Castings.
   2. D149 - Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
   3. D495 - Standard Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation.
   4. D570 - Standard Test Method for Water Absorption of Plastics.
   5. D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
   6. D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   7. D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

D. Joint Industry Conference (JIC).

E. Underwriters Laboratories, Inc. (UL):
   1. 94 - Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.03 DEFINITIONS

A. As specified in Section 16050 - Common Work Results for Electrical.

B. Specific definitions:
   1. Arcing parts: Circuit breakers, motor controllers, switches, fuses, or any device intended to interrupt current during its operation.
   2. Raceway system boxes: Boxes that are used for wire and cable pullboxes, conduit junction boxes, or terminal boxes.

1.04 SYSTEM DESCRIPTION

A. Provide boxes as indicated on the Drawings or as needed to complete the raceway installation.

1.05 SUBMITTALS

A. Furnish submittals as specified in Section 01300 - Contractor Submittals.

B. Product data:
   1. Manufacturer.
   2. Materials.
   3. Dimensions:
      a. Height.
      b. Width.
      c. Depth.
      d. Weight.
      e. NEMA rating.
   4. Conduit entry locations.
   5. Catalog cutsheets.
   6. Installation instructions.

C. Shop drawings:
   1. Include identification and sizes of pullboxes.

1.06 QUALITY ASSURANCE

A. Regulatory requirements:
   1. Outlet boxes shall comply with all applicable standards of:
      a. JIC.
      b. NEC.
      c. NEMA.
      d. UL.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or equal:
   1. Formed steel enclosures:
      a. Hoffman.
      b. Thomas and Betts.
      c. Stahlin.
      d. Rittal.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS

A. Formed steel enclosures:
   1. Steel:
      a. NEMA Type 12.
      b. Fabricated from 14-gauge steel, minimum.
      c. All seams continuously welded ground smooth.
      d. Door:
         1) Rolled lip around 3 sides.
         2) Attached to enclosure by means of a continuous stainless steel hinge and pin.
      e. Neoprene door gasket to provide a watertight, dusttight, oiltight seal:
         1) Attached with an adhesive.
         2) Retained by a retaining strip.
      f. Fabricate all external removable hardware for clamping the door to the enclosure body from zinc-plated heavy gauge steel:
         1) With a hasp and staple for padlocking.
      g. Provide large enclosures with door and body stiffeners for extra rigidity.
      h. No holes or knockouts.
      i. Finish:
         1) ANSI-61 gray electrostatically applied polyester powder inside and out over cleaned and primed surfaces.
         2) White electrostatically applied polyester powder mounting plate.
      j. Heavy gauge steel external mounting brackets when surface mounted.

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES

A. Fasteners:
   1. Electroplated or stainless steel in boxes with wiring devices.
   2. Screws, nuts, bolts, and other threaded fasteners:
      a. Stainless steel.

B. Provide breather and drain fittings where appropriate.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. General:
   1. Provide materials and construction suitable for environmental conditions at the location of the box as specified in Section 16050 - Common Work Results for Electrical.

   2. Size boxes in accordance with NEC requirements and to provide sufficient room for the future components and cables indicated on the Drawings.

B. Pullboxes and junction boxes:
   1. Size pullboxes in accordance with NEC requirements and to provide sufficient room for any future conduits and cables as indicated on the Drawings.
   2. Install pullboxes such that access to them is not restricted.

C. For boxes not indicated:
   1. Provide types and mountings as required to suit the equipment and that will be consistent with the conduit system and environmental conditions as indicated in Section 16050 - Common Work Results for Electrical.

END OF SECTION

SECTION 16136

WIREWAY

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Wireway systems as indicated on the Drawings.

1.02 REFERENCES

A. As specified in Section 16050 - Common Work Results for Electrical.

B. National Electrical Manufacturers Association (NEMA):
   1. ICS-6 - Industrial Control and Systems: Enclosures.

C. Underwriter’s Laboratories (UL):
   1. Article 870 - Wireways, Auxiliary Gutters, and Associated Fittings.

1.03 DEFINITIONS

A. As specified in Section 16050 - Common Work Results for Electrical.

1.04 SYSTEM DESCRIPTION

A. System includes horizontal and/or vertical straight runs of wireway, fittings, covers, splices, barriers, and related accessory and supports:
   1. Connected to form a complete system.

1.05 SUBMITTALS

A. Furnish submittals as specified in Sections 01300 - Contractor Submittals.

B. Product data:
   1. Technical information:
      a. Catalog cutsheets.
      b. Wireway construction and materials.
      c. Maximum loading and span.
      d. NEMA enclosure type.
   2. Dimensions:
      a. Width.
      b. Depth.
   3. Weight of wireway sections and fittings.
   4. Complete bill of materials.
   5. Manufacturer's installation instructions.

C. Shop drawings:
   1. Provide complete details and scaled drawings for the layout of the installed wireway system showing all components and proposed mounting details.

D. Calculations:
   1. Provide cross sectional area and fill calculations.
      a. Cross sectional area and fill shall be in accordance with the NEC.
   2. Provide structural calculations to ensure that the installed system meets all structural, seismic requirements as specified in Section 01612 - Seismic Design Criteria, at the Project Site with respect to support and mounting:
      a. Stamped by a professional engineer licensed in the state where the Project is being constructed.

1.06 QUALITY ASSURANCE

A. Manufacturer qualifications:
   1. Member of NEMA for the manufacturer of wireway systems and fittings of types and capacities required.

B. Wireway shall be UL listed and labeled.

1.07 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.08 PROJECT OR SITE CONDITIONS (NOT USED)

1.09 SEQUENCING

A. The Drawings indicate the general route of the wireway systems. Data presented on those drawings are as accurate as preliminary surveys and planning can determine until final equipment selection is made.

B. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions. Make field surveys as part of the work before ordering material.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metallic wireway:
   1. One of the following or equal:
      a. B-Line.
      b. Hoffman.
      c. Hammond.
      d. Rittal Electromate.

2.02 EQUIPMENT

A. Provide wireways as indicated on the Drawings with respect to:
   1. Type (lay-in or feed-through or trough).

2. Dimensions.
3. NEMA enclosure rating.
4. Wireway material.

2.03 COMPONENTS

A. Fittings:
   1. Elbows, tees, and crossings:
      a. Of the same materials and construction as the straight runs.
   2. Expansion fittings:
      a. Provide flexible or sliding fittings.

B. Covers:
   1. Hinged on one side.
   2. Held closed with latches or bolts.

C. Gaskets:
   1. As required to meet NEMA enclosure requirements:
      a. Provide gaskets at each flange and door opening to ensure complete seal between wireway components.
      b. Held in place with adhesive or formed in place.

2.04 ACCESSORIES

A. Mounting hardware and supports:
   1. As specified in Section 16070 - Hangers and Supports.

2.05 MIXES (NOT USED)

2.06 FABRICATIONS (NOT USED)

2.07 FINISHES (NOT USED)

2.08 SOURCE QUALITY CONTROL

A. Manufactured in accordance with NEMA ICS-6.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all dimensions and route before ordering wireway:
   1. Make all necessary field measurements.
   2. Coordinate with all subcontractors and suppliers to determine structural dimensions and equipment dimensions to avoid all potential conflicts with other systems.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. Install the wireway per the manufacturer's guidelines and submitted installation instructions to meet the seismic requirements at the project site.

B. General:
   1. Install in straight runs as much as possible, minimizing the number of turns.
   2. Expansion fittings:
      a. Install as recommended by the manufacturer to accommodate thermal expansion.
      b. Install where wireway crosses structural expansion joints.
   3. Fittings:
      a. Not all fittings are indicated on the Drawings:
         1) Provide all fittings required to suit the installation.
   4. Wireway supports:
      a. Support wireway in accordance with manufacturer's instructions and as required by the seismic conditions.
      b. Support bracket spacing shall meet the requirements of the wireway manufacturer, and NEC.
      c. Provide wireway supports with channels under the entire width of wireway.
      d. Secure wireway to supports with manufacturer-approved fittings.
   5. Mounting:
      a. Oriented to allow hinged doors to be opened minimum 90 degrees.
      b. Oriented to allow safe access to doors for maintenance and future installations.
   6. Wiring installation:
      a. In accordance with the NEC.
      b. Begin wiring installation only after the complete raceway system is installed.
      c. Verify that all wireway surfaces and accessories are smooth, free from burrs or sharp edges.
      d. Only install wiring that is UL listed for wireway use.

3.04 FIELD QUALITY CONTROL

A. Inspect entire wireway system for the following:
   1. Secure anchoring.
   2. Proper supports.
   3. Burrs or sharp edges.
   4. Sufficient clearance from ducts and piping, especially hot pipes.

END OF SECTION

SECTION 16150

LOW VOLTAGE WIRE CONNECTIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Wire connecting devices.
   2. Terminations.
   3. Splices.
   4. Power Distribution Blocks

1.02 REFERENCES

A. As specified in Section 16050 - Common Work Results for Electrical.

B. ASTM International (ASTM):
   1. D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.

C. CSA International (CSA):
   1. C22.2 - No. 197-M1983 (R2208) - PVC Insulating Tape.

D. Underwriters Laboratories, Inc. (UL):
   1. 510 - Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
   2. 1953 - Outline of Investigation for Power Distribution Blocks.

1.03 DEFINITIONS

A. As specified in Section 16050 - Common Work Results for Electrical.

1.04 SYSTEM DESCRIPTION

A. Provide a complete system of wiring connectors, terminators, fittings, etc. for a complete wiring system suitable for the cables and conductors used.

1.05 SUBMITTALS

A. Furnish submittals as specified in Section 01300 - Contractor Submittals.

B. Product data:
   1. Catalog cutsheets.
   2. Installation instructions.

1.06 QUALITY ASSURANCE

A. All materials shall be UL listed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers for each type of technology are specified with the equipment in this Section.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT

A. Control connections:
   1. Use insulated ring type wire terminators for connections to all screw terminals:
      a. With chamfered/funneled terminal barrel entry.
      b. Deep internal serrations.
      c. Long barrel design to reduce electrical resistance and increased insulator-barrel surface area to ensure that the insulator remains in contact with the barrel.
      d. Electroplated-tin copper conductor.
      e. Manufacturers: The following or equal:
         1) Thomas & Betts, Sta-Kon.
   2. For process equipment connections work from manufacturer's drawings.

B. Joints, splices, taps, and connections:
   1. 600-volt conductors:
      a. Use solderless connectors.
      b. Use only plated copper alloy connectors or lugs:
         1) Aluminum connectors or lugs are not acceptable for copper conductors.
      c. Under those specific conditions where aluminum conductors have been allowed or are specified then the connectors for aluminum conductors shall be specifically designed for that purpose.
      d. For wire Number 10 AWG and smaller use compression splice caps, with insulating caps:
         1) Manufacturers: The following or equal:
            a) Buchanan, 2006S or 2011S, with 2007 or 2014 insulating caps.
      e. For wire Number 8 AWG and larger, use heavy duty copper compression connectors:
         1) Manufacturers: One of the following or equal:
            a) Burndy.
            b) Thomas & Betts.
      f. Heat shrink tubing:
         1) Suitable for indoors, outdoors, overhead, direct burial or submerged applications.
         2) Minimum shrink ratio: 4 to 1.
         3) Continuous operating temperature: -55 degrees Celsius to 110 degrees Celsius.

4) Internally applied adhesive sealant.
5) Cross-linked polyolefin:
a) Manufacturers: One of the following or equal:
(1) 3M, ITCSN.
(2) Thomas & Betts, Shrink-Kon.

2. Instrumentation class cable splices:
a. Suitable for indoor, outdoors, weather exposed, direct buried, or submersed applications.
b. Utilizing an epoxy, polyurethane, and re-enterable compounds.
c. For use with shielded or unshielded plastic- and rubber-jacketed, signal, control, and power cables rated up to 1 kilovolt.
d. Two-part mold body with tongue and groove seams and built-in spacer webbing.
e. Manufacturers: The following or equal:
1) 3M, Scotchcast 72-N.

C. Insulating tape:
1. General purpose insulating tape:
a. Minimum 7 mil vinyl tape.
b. Suitable for application in an ambient of -18 degrees Celsius (0 degrees Fahrenheit).
c. Operating range up to 105 degrees Celsius (220 degrees Fahrenheit).
d. Flame retardant, hot- and cold- weather resistant, UV resistant.
e. For use as a primary insulation for wire cable splices up to 600 VAC.
f. Meeting and complying with:
1) ASTM D3005 Type I.
2) UL 510.
3) CSA C22.2.
g. Manufacturers: The following or equal:
1) 3M, Scotch Number Super 33+.
2. General-purpose color-coding tape:
a. Minimum 7 mil vinyl tape.
b. Suitable for application on PVC and polyethylene jacketed cables.
c. For use indoors and outdoors in weather protected enclosures.
d. Available with the following colors:
1) Red.
2) Yellow.
3) Blue.
4) Brown.
5) Gray.
6) White.
7) Green.
8) Orange.
9) Violet.
e. For use as phase identification, marking, insulating, and harnessing.
f. Meeting and complying with:
1) UL 510.
2) CSA C22.2.
g. Manufacturers: The following or equal:
1) 3M, Scotch Number 35.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. Load connections:
   1. Connect loads to the circuits as indicated. Color-code all branch circuits as specified in Section 16123 - 600-Volt or Less Wires and Cables.

B. Zero to 600-volt systems:
   1. Make all connections with the proper tool and die as specified by the device manufacturer.
   2. Use only tooling and dies manufactured by the device manufacturer.
   3. Insulate all connections and splices with Scotch 33+ tape and Scotchfill, or pre-molded plastic covers, or heat shrink tubing and caps.
   4. Number all power and control wires before termination.

C. Motor connections (600 volts and below):
   1. Terminate all leads and wires with compression type ring lugs.
   2. Terminations on all motor leads, including leads that are connected together to accommodate the motor voltage, and the machine wires entering the motor terminal box from the power source, shall have ring type compression lugs.
   3. Cover bolted connectors with a heat shrinkable, cross-linked polyolefin material formed as a single opening boot:
      a. In damp and wet locations, use a complete kit containing mastic that shall seal out moisture and contamination.
      b. Shrink cap with low heat as recommended by manufacturer.
   4. Wire markers shall be readable after boot installation.
   5. Manufacturers: The following or equal:
      a. Raychem, MCK.

END OF SECTION

SECTION 16412

LOW VOLTAGE MOLDED CASE CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Low voltage molded case circuit breakers.

1.02 REFERENCES

A. As specified in Section 16050 - Common Work Results for Electrical.

B. Underwriter's Laboratories (UL):
   1. 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

1.03 DEFINITIONS

A. As specified in Section 16050 - Common Work Results for Electrical.

B. In accordance with UL 489.

1.04 SYSTEM DESCRIPTION

A. Molded case thermal magnetic or solid-state circuit breakers as indicated on the Drawings and connected to form a completed system.

1.05 SUBMITTALS

A. Furnish submittals as specified in Sections 01300 - Contractor Submittals.

B. Product data:
   1. Catalog cutsheets.
   2. Manufacturer's time-current curves for all molded case circuit breakers furnished.

1.06 QUALITY ASSURANCE

A. Low voltage molded case circuit breakers shall be UL listed and labeled.

1.07 DELIVERY, STORAGE AND HANDLING

A. As specified in Section 16050 - Common Work Results for Electrical.

1.08 PROJECT OR SITE CONDITIONS (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or equal:
   1. Eaton.
   2. GE by ABB.
   3. Schneider Electric.
   4. ABB.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS

A. General:
   1. Conforming to UL 489.
   2. Operating mechanism:
      a. Quick-make, quick-break, non-welding silver alloy contacts.
      b. Common Trip, Open and Close for multi-pole breakers such that all poles open and close simultaneously.
      c. Mechanically trip free from the handle.
      d. Trip indicating handle - automatically assumes a position midway between the manual ON and OFF positions to clearly indicate the circuit breaker has tripped.
      e. Lockable in the "OFF" position.
   3. Arc extinction:
      a. In arc chutes.
   4. Voltage and current ratings:
      a. Minimum ratings as indicated on the Drawings.
      b. Minimum frame size 100A.
   5. Interrupting ratings:
      a. Minimum ratings as indicated on the Drawings.
      b. Modify as required to meet requirements of the short circuit fault analysis - as specified in Section 16305 - Electrical System Studies.
      c. Not less than the rating of the assembly (panelboard, switchboard, motor control center, etc.).

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS

A. Terminals:
   1. Line and load terminals suitable for the conductor type, size, and number of conductors in accordance with UL 489.

B. Case:
   1. Molded polyester glass reinforced.
   2. Ratings clearly marked.

C. Trip units:
   1. Provide thermal magnetic or solid-state trip units as indicated on the Drawings.
   2. Thermal magnetic:
      a. Instantaneous short circuit protection.
      b. Inverse time delay overload.
      c. Ambient or enclosure compensated by means of a bimetallic element.
   3. Solid state:
      a. With the following settings as indicated on the Drawings.
         1) Adjustable long time current setting.
         2) Adjustable long time delay.
         3) Adjustable short time pickup.
         4) Adjustable short time delay.
         5) Adjustable instantaneous pickup.
         6) Adjustable ground fault pickup as indicated on the Drawings.
         7) Adjustable ground fault delay as indicated on the Drawings.
         8) Energy reducing maintenance switch on breakers 1,200 amps and above and on additional breakers as indicated on the Drawings.
            a) Indication on the breaker.

D. Provide ground fault trip devices as indicated on the Drawings.

E. Molded case circuit breakers for use in panelboards:
   1. Bolt-on type:
      a. Plug-in type breakers are not acceptable.
   2. Ground fault trip devices as indicated on the Drawings.

2.07 SOURCE QUALITY CONTROL

A. Test breakers in accordance with:
   1. UL 489.
   2. Manufacturer’s standard testing procedures.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 16950

FIELD ELECTRICAL ACCEPTANCE TESTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Responsibilities for testing the electrical installation.
   2. Adjusting and calibration.
   3. Acceptance tests.

B. Copyright information:
   1. Some portions of this Section are copyrighted by the InterNational Electrical Testing Association, Inc. (NETA). See NETA publication ATS for details.

1.02 REFERENCES

A. General standards:
   1. As specified in Section 16050 - Common Work Results for Electrical.
   2. Specification sections for the electrical equipment being tested.
   3. Shop drawings.

B. National standards:
   1. American National Standards Institute (ANSI).
   2. Institute of Electrical and Electronics Engineers (IEEE):
      a. 43 - IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery.
      b. 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.
      c. 95 - IEEE Recommended Practice for Insulation Testing of AC Electric Machinery (2300 V and Above) With High Direct Voltage.
      d. 421.3 - IEEE Standard for High-Potential Test Requirement for Excitation Systems for Synchronous Machines.
      e. 450 - IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.
      f. 1106 - IEEE Recommended Practice for Installation, Maintenance, Testing, and Replacement of Vented Nickel-Cadmium Batteries for Stationary Applications.
      g. 1188 - IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications.
      h. C57.13 - IEEE Standard Requirements for Instrument Transformers.
      i. C57.13.1 - IEEE Guide for Field Testing of Relaying Current Transformers.
      j. C57.13.3 - IEEE Guide for Grounding of Instrument Transformer Secondary Circuits and Cases.

k. C57.104 - IEEE Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers.
3. Insulated Cable Engineer's Association (ICEA).
4. InterNational Electrical Testing Association (NETA).
   a. ATS- Standard for Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
5. International Electrotechnical Commission (IEC).
6. Manufacturer's testing recommendations and instruction manuals.
7. National Fire Protection Association (NFPA):
   a. 70 - National Electrical Code (NEC).
   b. 110 - Standard for Emergency and Standby Power Systems.
8. National Institute of Standards and Technology (NIST).

1.03 DEFINITIONS

A. Project definitions:
   1. As specified in Section 16050 - Common Work Results for Electrical.

B. Specific definitions:
   1. Testing laboratory: The organization performing acceptance tests.

1.04 SYSTEM DESCRIPTION

A. General requirements:
   1. Testing of all electrical equipment installed under this Contract in accordance with the manufacturer's requirements and as specified in this Section.
   2. Conduct all tests in the presence of the Engineer or the Engineer's representative:
      a. Engineer will witness all visual, mechanical, and electrical tests, and inspections.
   3. The testing and inspections shall verify that the equipment is operational within the tolerances required and expected by the manufacturer, and these Specifications.

B. Responsibilities:
   1. Contractor responsibilities:
      a. Ensure that all resources are made available for testing, and that all testing requirements are met.
   2. Electrical subcontractor responsibilities:
      a. Perform routine tests during installation.
      b. Demonstrate operation of electrical equipment.
      c. Commission the electrical installation.
      d. Provide the necessary services during testing, and provide these services to the testing laboratory, Contractor, and other subcontractors, including but not limited to:
         1) Providing electrical power as required.
         2) Operating of electrical equipment in conjunction with testing of other equipment.
         3) Activating and shutting down electrical circuits.
         4) Making and recording electrical measurements.
         5) Replacing blown fuses.

6) Installing temporary jumpers.

3. Testing laboratory responsibilities:
   a. Perform all acceptance tests specified in this Section.
   b. Provide all required equipment, materials, labor, and technical support during acceptance tests.

1.05 SUBMITTALS

A. General submittal requirements:
   1. Furnish submittals as specified in Sections 01300 - Contractor Submittals.

B. Copper Ethernet test form:
   1. Cable test reports:
      a. Submit 3 copies of test reports showing the results of all tests specified in this Section:
         1) Test type.
         2) Test location.
         3) Test date.
         4) Cable number.
         5) Cable length.
         6) Certification that the cable meets or exceeds the specified standard.
      b. Furnish hard copy and electronic copy for all traces.

C. Manufacturers' testing procedures:
   1. Submit manufacturers' recommended testing procedures and acceptable test results for review by the Engineer prior to beginning testing.

D. Test report:
   1. Include the following:
      a. Summary of Project.
      b. Description of equipment tested.
      c. Description of tests performed.
      d. Test results.
      e. Conclusions and recommendations.
      f. Completed test forms.
      g. List of test equipment used and calibration dates.
      h. LAN cable test reports.

E. Test data records:
   1. Include the following:
      a. Identification of the testing organization.
      b. Equipment identification.
      c. Nameplate data.
      d. Humidity, temperature and or other conditions that may affect the results of the tests and or calibrations.
      e. Dates of inspections, tests, maintenance and or calibrations.
      f. Indication of the inspections, tests, maintenance, and or calibrations to be performed and recorded.
      g. Expected results when calibrations are to be performed.
      h. Indication of as-found and as-left results as applicable.
      i. Indication of all test results outside specified tolerances.

F. Testing laboratory qualifications:
   1. Submit a complete resume and statement of qualifications from the proposed testing laboratory detailing their experiences in performing the tests specified:
      a. This statement will be used to determine whether the laboratory is acceptable, and shall include:
         1) Corporate history and references.
         2) Resume of individual performing test.
         3) Equipment list and test calibration data.

G. Division of responsibilities:
   1. Submit a list identifying who is responsible for performing each portion of the testing.

1.06 QUALITY ASSURANCE

A. Testing laboratory qualifications:
   1. The testing laboratory may be qualified testing personnel from the electrical subcontractor's staff or an independent testing company.
   2. NETA certification required.
   3. Selection of the testing laboratory and testing personnel is subject to approval by the Engineer based on testing experience and certifications of the individuals and testing capabilities of the organization.

1.07 SEQUENCING

A. Prior to testing:
   1. At least 30 days before commencement of the acceptance tests, submit the manufacturer's complete field testing procedures to the Engineer and to the testing laboratory, complete with expected test results and tolerances for all equipment to be tested.

B. Perform testing in the following sequence:
   1. Perform routine tests as the equipment is installed including:
      a. Insulation-resistance tests.
      b. Continuity tests.
      c. Rotational tests.
   2. Adjusting and preliminary calibration.
   3. Acceptance tests.
   4. Demonstration.
   5. Commissioning and plant start-up.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION

A. Test instrument calibration:
   1. Utilize a testing laboratory with a calibration program which maintains all applicable test instrumentation within rated accuracy.
      a. The calibrating standard shall be of better accuracy than that of the equipment tested.
   2. The accuracy shall be traceable to the NIST in an unbroken chain.
   3. Calibrate instruments in accordance with the following frequency schedule:
      a. Field instruments: 6 months maximum.
      b. Laboratory instruments: 12 months maximum.
      c. Leased specialty equipment where the accuracy is guaranteed by the lessor (such as Doble): 12 months maximum.
   4. Dated calibration labels shall be visible on all test equipment.
   5. Maintain an up-to-date instrument calibration record for each test instrument:
      a. The records shall show the date and results of each calibration or test.
   6. Maintain an up-to-date instrument calibration instruction and procedure for each test instrument.

B. Requirements prior to testing:
   1. Do not begin testing until the following conditions have been met:
      a. All instruments required are available and in proper operating condition.
      b. All required dispensable materials such as solvents, rags, and brushes are available.
      c. All equipment handling devices such as cranes, vehicles, chain falls and other lifting equipment are available or scheduled.
      d. All instruction books, calibration curves, or other printed material to cover the electrical devices are available.
      e. Data sheets to record all test results are available.

3.03 INSTALLATION

A. Test decal:
   1. The testing laboratory shall affix a test decal on the exterior of equipment or equipment enclosure of protective devices after performing electrical tests.
   2. The test decal shall be color coded to communicate the condition of maintenance of the protective. The color scheme for condition of maintenance of overcurrent protective devices shall be:
      a. White: electrically and mechanically acceptable.
      b. Yellow; minor deficiency not affecting fault detection and operation, but minor electrical or mechanical condition exists.
   3. The decal shall include the following information at a minimum:
      a. Testing organization.
      b. Project identifier.
      c. Test date.
      d. Technician identifier.

3.04 FIELD ACCEPTANCE TESTING

A. Low voltage cables, 600 volt maximum:
   1. Visual and mechanical inspection:
      a. Compare cable data with the Drawings and Specifications.
      b. Inspect exposed sections of cable for physical damage and correct connection as indicated on the Drawings.
      c. Inspect bolted electrical connections for high resistance by one of the following methods:
         1) Use of low-resistance ohmmeter.
         2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:
            a) Refer to manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
      d. Inspect compression applied connectors for correct cable match and indentation.
      e. Inspect for correct identification and arrangement.
      f. Inspect cable jacket insulation and condition.
   2. Electrical tests:
      a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
      b. Perform insulation resistance test on each conductor sized #8 AWG or larger with respect to ground and adjacent conductors:
         1) Applied potential shall be 500 volts dc for 300 volt rated cable and 1,000 volts dc for 600 volt rated cable.
         2) Test duration shall be 1 minute.
      c. Perform continuity tests on all power and control conductors to insure correct cable connection.
      d. Verify uniform resistance of parallel conductors.
   3. Test values:
      a. Compare bolted connection resistance values to values of similar connections:
         1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      b. Insulation-resistance values shall be in accordance with manufacturer's published data:
         1) Refer to NETA ATS tables in the absence of manufacturer's published data.
         2) Investigate values of insulation-resistance less than the allowable minimum.
      c. Cable shall exhibit continuity.
      d. Deviations in resistance between parallel conductors shall be investigated.

B. Low voltage molded case and insulated case circuit breakers:
   1. Visual and mechanical inspection:
      a. Compare equipment nameplate data with the Contract Documents.
      b. Inspect physical and mechanical condition.
      c. Inspect anchorage and alignment.
      d. Verify the unit is clean.
      e. Operate the circuit breaker to ensure smooth operation.

f. Inspect bolted electrical connections for high resistance by one of the following methods:
    1) Use of low-resistance ohmmeter.
    2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:
        a) Refer to manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
g. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical tests:
    a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
    b. Perform insulation-resistance tests for 1 minute on each pole, phase-to-phase and phase-to-ground with the circuit breaker closed and across each open pole:
        1) Apply voltage in accordance with manufacturer's published data.
        2) Refer to NETA ATS tables in the absence of manufacturer's published data.
    c. Perform a contact/pole-resistance test.
    d. Determine long-time pickup and delay by primary current injection.
    e. Determine short-time pickup and delay by primary current injection.
    f. Determine ground-fault pickup and delay by primary current injection.
    g. Determine instantaneous pickup value by primary current injection.
    h. Test functions of the trip unit by means of secondary injection.
    i. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data.
    j. Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, anti-pump function and trip unit battery condition:
        1) Reset all trip logs and indicators.
    k. Verify operation of charging mechanism.

3. Test values:
    a. Compare bolted connection resistance values to values of similar connections:
        1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
    b. Bolt-torque levels shall be in accordance with manufacturer's published data:
        1) Refer to NETA ATS tables in the absence of manufacturer's published data.
    c. Insulation-resistance values shall be in accordance with manufacturer's published data:
        1) Refer to NETA ATS tables in the absence of manufacturer's published data.
        2) Investigate values of insulation-resistance less than the allowable minimum.
    d. Microhm or dc millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data:
        1) If manufacturer's data is not available, investigate any values which deviate from adjacent poles or similar breakers by more than 50 percent of the lowest value.

e. Long-time pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current characteristic tolerance band including adjustment factors:
    1) If manufacturer's curves are not available, trip times shall not exceed the value shown in NETA ATS tables.
f. Short-time pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current tolerance band.
g. Ground fault pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current tolerance band.
h. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances:
    1) Refer to NETA ATS tables in the absence of manufacturer's published data.
i. Pickup values and trip characteristics shall be within manufacturer's published tolerances.
j. Determine energy reducing maintenance switch pickup value by primary current injection.
k. Breaker open, close, trip, trip-free, anti-pump, and auxiliary features shall function as designed.
l. The charging mechanism shall operate in accordance with manufacturer's published data.

C. Variable frequency drive systems:
1. Visual and mechanical inspection:
    a. Compare equipment nameplate data with the Contract Documents.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, and grounding.
    d. Verify the unit is clean.
    e. Ensure vent path openings are free from debris and that heat transfer surfaces are clean.
    f. Verify correct connections of circuit boards, wiring, disconnects, and ribbon cables.
    g. Motor running protection:
        1) Verify drive overcurrent setpoints are correct for their application.
        2) If drive is used to operate multiple motors, verify individual overload element ratings are correct for their application.
        3) Apply minimum and maximum speed setpoints. Verify setpoints are within limitations of the load coupled to the motor.
    h. Inspect bolted electrical connections for high resistance using one of the following methods:
        1) Use of low-resistance ohmmeter.
        2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:
            a) Refer to manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
    i. Verify correct fuse sizing in accordance with manufacturer's published data.
    j. Perform visual and mechanical inspection of input circuit breaker as specified in this Section.

2. Electrical tests:
    a. Perform resistance measurements through bolted connections with low resistance ohmmeter.
    b. Test the motor overload relay elements by injecting primary current through the overload circuit and monitoring trip time of the overload element.
    c. Test for the following parameters in accordance with relay calibration procedures specified in NETA ATS or as recommended by the manufacturer:
        1) Input phase loss protection.
        2) Input overvoltage protection.
        3) Output phase rotation.
        4) Overtemperature protection.
        5) Direct current overvoltage protection.
        6) Overfrequency protection.
        7) Drive overload protection.
        8) Fault alarm outputs.
    d. Harmonic distortion measurements for both voltage and current is within the specification limits at the installed site.
    e. Peak voltage at the motor terminations is less than 90 percent of the motor insulation dielectric withstand level.
    f. Perform continuity tests on bonding conductors as specified in accordance with NETA ATS.
    g. Perform start-up of drive in accordance with manufacturer's published data. Calibrate drive to the system's minimum and maximum speed control signals.
    h. Perform operational tests by initiating control devices:
        1) Slowly vary drive speed between minimum and maximum. Observe motor and load for unusual noise or vibration.
        2) Verify operation of drive from remote start/stop and speed control signals.
    i. Perform electrical tests of input circuit breaker as specified in this Section.
    j. Measure fuse resistance.
3. Test values:
    a. Compare bolted connection resistance values to values of similar connections:
        1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
    b. Bolt-torque levels shall be in accordance with manufacturer's published data:
        1) Refer to NETA ATS tables in the absence of manufacturer's published data.
    c. Overload test trip times at 300 percent of overload element rating shall be in accordance with manufacturer's published time-current curve.
    d. Test values for input circuit breaker shall be as specified in this Section.
    e. Relay calibration results shall be as specified in this Section.
    f. Continuity of bonding conductors shall be in accordance with NETA ATS.
    g. Control devices shall perform in accordance with system requirements.
    h. Operational tests shall conform to system design requirements.
    i. Investigate fuse resistance values that deviate from each other by more than 15 percent.

D. Fiber-optic cables:
   1. Visual and mechanical inspection:
      a. Compare cable, connector, and splice data with the Contract Documents.
      b. Inspect cable and connections for physical and mechanical damage.
      c. Verify that all connectors and splices are correctly installed.
   2. Optical tests:
      a. Perform cable length measurement, fiber fracture inspection, and construction defect inspection using an optical time domain reflectometer (OTDR):
         1) OTDR test performed on fiber cables less than 100 meters shall be performed with the aid of a launch cable.
         2) Adjust OTDR pulse width settings to a maximum setting of 1/1,000th of the cable length or 10 nanoseconds.
      b. Perform connector and splice integrity test using an optical time domain reflectometer.
      c. Perform cable attenuation loss measurement with an optical power loss test set:
         1) Perform attenuation tests with an Optical Loss Test Set capable and calibrated to show anomalies of 0.1 dB as a minimum.
         2) Test multimode fibers at 850 nanometer and 1,300 nanometer.
         3) Test single mode fibers at 1,310 nanometer and 1,550 nanometer.
      d. Perform connector and splice attenuation loss measurement from both ends of the optical cable with an optical power loss test set:
         1) At the conclusion of all outdoor splices at 1 location, and before they are enclosed and sealed, all splices shall be tested with OTDR at the optimal wavelengths (850 and 1,300 for multimode, 1,310 and 1,550 for single mode), in both directions. The splices shall be tested for integrity as well as attenuation.
      e. Perform fiber links integrity and attenuation tests using each link shall be an OTDR and an Optical Loss Test Set:
         1) OTDR traces shall be from both directions on each fiber at the 2 optimal wavelengths, 850 nanometer, and 1,300 nanometer for multimode fibers.
         2) Optical loss testing shall be done with handheld test sets in 1 direction at the 2 optimal wavelengths for the appropriate fiber type. Test equipment shall equal or exceed the accuracy and resolution of Agilent/HP 8147 high performance OTDR.
   3. Test values:
      a. Cable and connections shall not have been subjected to physical or mechanical damage.
      b. Connectors and splices shall be installed in accordance with industry standards.
      c. The optical time domain reflectometer signal should be analyzed for excessive connection, splice, or cable backscatter by viewing the reflected power/distance graph.
      d. Attenuation loss measurement shall be expressed in dB/km. Losses shall be within the manufacturer’s recommendations when no local site specifications are available.
      e. Individual fusion splice losses shall not exceed 0.1 dB. Measurement results shall be recorded, validated by trace, and filed with the records of the respective cable runs.

E. Copper Ethernet cable installation testing:
   1. Pre-installation:
      a. Immediately prior to installation, verify that cable to be installed matches that which was submitted.
      b. Verify that no damage has been done to the cable during shipping or handling.
      c. Inspect cable for physical and mechanical damage.
      d. Engineer shall be notified if a cable fails to meet inspection and the cable shall not be installed unless otherwise directed by the Engineer.
   2. Post-installation:
      a. Prior to copper Ethernet cable termination, perform cable end-to-end continuity validation testing on all installed cables, conductor pairs and cable shields using toner and probe kit. Any cable that fails testing shall be removed and replaced.
      b. Inspect equipment outlet connectors for damage and ensure connectors hold tightly in field device ports.
   3. Test equipment:
      a. Certification equipment used for the testing shall be capable of verifying twisted pair cable installation with end-to-end continuity testing.
      b. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
      c. Manufacturers: The following or equal:
         1) Fluke Networks, IntelliTone Pro 200 Toner and Probe Kit, MT-8200-60-KIT.
      d. Refer to Section 17950 - Commissioning for Instrumentation and Controls for Permanent Link testing requirements.

3.05 CLEANING

A. As specified in Section 16050 - Common Work Results for Electrical.

B. After the acceptance tests have been completed, dispose of all testing expendables, vacuum all cabinets, and sweep clean all surrounding areas.

END OF SECTION