CONTRACT DOCUMENTS FOR

11800 South Pump Station Upgrade

Volume 1 of 2

PROJECT #: 4209

June 2021

OWNER

Jordan Valley Water Conservancy District
8215 South 1300 West
West Jordan, Utah
801.565.4300

ENGINEER

Jordan Valley Water Conservancy District

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PROJECT NAME: 11800 South Pump Station Upgrade

DESCRIPTION OF WORK: Furnish and install one culinary water pump with associated valves and pipe fittings, one 1250 horsepower motor for the pump, one 4160 Volt soft starter for the motor, one 4000 kVA transformer, and HVAC upgrades, all within an existing structure. Include all work shown in the Contract Documents.

DISTRICT WEB SITE AND PLANHOLDERS LIST
Prospective bidders must register at the District's web site (www.jvwcd.org) under "Engineering Projects". Prospective bidders are required to check the District's web site for any addenda prior to submitting a responsive bid. The District's web site will be used to publish updated information relative to the project, including a plan holders list.

RECEIPT OF BIDS: Sealed bids will be received at the administration office of the Jordan Valley Water Conservancy District, Owner of the Work, located at 8215 South 1300 West, West Jordan, Utah 84088, until **3:00 pm, on June 23, 2021**, for construction of the 11800 South Pump Station Upgrade.

Electronic Bids will also be acceptable. Electronic bids shall be submitted to the Engineering Department's Administrative Assistant as listed below in the Address and Marking of Bid.

OBTAINING CONTRACT DOCUMENTS: The Contract Documents are entitled, "11800 South Pump Station Upgrade". All Contract Documents may be obtained from the District Project webpage at no charge.

OPENING OF BIDS: The bids will be publicly opened and read at the time and location identified above.

SITE OF WORK: 3257 W Winter Creek Cir, South Jordan, Utah.

PRE-BID SITE VISIT: A non-mandatory site visit will be held on **Tuesday, June 15, 2021 at 1:30 pm.** It is recommended that Bidders attend to see the existing pump station and ask questions of the District staff.

COMPLETION OF WORK: All work shall be completed within **290 calendar days** from the date of the Notice to Proceed.

AWARD OF CONTRACT: An Award of Contract, if it were awarded, will be made within 60 calendar days of the opening of bids.

NOTICE TO PROCEED: A Notice to Proceed, if it were issued, will be made within 60 calendar days of the Notice of Award.

NOTICE INVITING BIDS

BID SECURITY: Each bid shall be accompanied by a certified or cashier's check, money order or bid bond in the amount of five percent of the total bid price payable to the Jordan Valley Water Conservancy District as a guarantee that the bidder, if its bid is accepted, will promptly execute the contract, provide evidence of worker's compensation insurance, and furnish a satisfactory faithful performance bond in the amount of 100 percent of the total bid price and a payment bond in the amount of 100 percent of the total bid price.

ADDRESS AND MARKING OF BID: The envelope enclosing the bid shall be sealed and addressed to the Jordan Valley Water Conservancy District and delivered or mailed to 8215 South 1300 West, West Jordan, Utah 84088. The envelope shall be plainly marked in the upper left-hand corner with the name and address of the bidder and shall bear the words "Bid for," followed by the title of the Contract Documents for the work and the date and hour of opening of bids. The certified or cashier's check, money order, or bidder's bond shall be enclosed in the same envelope with the bid.

Electronic bids shall be submitted to the Engineering Department's Administrative Assistant, Ellisa Demetsky at EllisaD@jvwcd.org, as an email attachment with the words "Bid for," followed by the title of the Contract Documents for the work and the date and hour of opening of bids in the subject line of the email. Electronic bids shall be received prior to the time and date listed in the Receipt of Bids.

PROJECT ADMINISTRATION: All questions relative to this project prior to the opening of bids shall be directed to the Engineer for the project. It shall be understood, however, that no interpretations of the specifications will be made by telephone, nor will any "or equal" products be considered for approval prior to award of contract.

The Engineer is the Owner

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 in the interest of the Owner.

Owner
Jordan Valley Water Conservancy District
Project Manager: Kevin Rubow, P.E.
8215 South 1300 West
West Jordan, Utah 84088
Telephone: (801) 565-4300
Email: KevinR@jvwcd.org

INSTRUCTIONS TO BIDDERS

FORM OF BID: The bid shall be made on the bidding schedule(s) bound herein. The bid shall be enclosed in a sealed envelope bearing the name of the bidder and name of the project. In the event there is more than one bidding schedule, the bidder may bid on any individual schedule or on any combination of schedules.

DELIVERY OF BID: 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 his bid is received in proper time.

WITHDRAWAL OF BIDS: Bids shall be unconditionally accepted without alteration or correction, excepting that bidder may by means of written request, signed by the bidder or his properly authorized representative withdraw his bid. 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.

OPENING OF BIDS: The bids will be publicly opened and read at the time and place stipulated in the Notice Inviting Bids.

MODIFICATIONS AND ALTERNATIVE BIDS: Unauthorized conditions, limitations, or provisions attached to a bid may render it non-responsive and may cause its rejection. The completed bid forms shall be without interlineations, alterations, or erasures. Alternative bids will not be considered unless called for. Oral, telegraphic, or telephonic bids or modifications will not be considered.

DISCREPANCIES IN BIDS: In the event there is more than one bid item in a bidding schedule, the bidder shall furnish a price for all bid items in the schedule; failure to do so may render the bid non-responsive and subject to 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 Contractor shall be bound by said Correction. In the event there is more than one bid item in a bidding 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 Contractor shall be bound by said correction.

INSTRUCTIONS TO BIDDERS

BID SECURITY: 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 a contract within 10 calendar days after receipt of the contract from 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 Notice Inviting Bids. In case the apparent low bidder refuses or fails to enter into such contract or fails to provide the required insurance and insurance certificates, 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 his bid guarantee, he shall use the bid bond bound herein, or one conforming substantially to it in form.

BIDDER'S EXAMINATION OF CONTRACT DOCUMENTS AND SITE

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

1. Examine Contract Documents thoroughly.

2. Visit the site to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the work.

3. Consider federal, state and local laws and regulations that may affect cost, progress, and performance of furnishing of the work.

4. Study and carefully correlate the Bidder's observations with the Contract Documents.

5. Notify the Engineer of all conflicts, errors, or discrepancies in the Contract Documents.

Reference is made to the Supplemental General Conditions for identification of:

1. Those reports of exploration and tests of subsurface conditions at the site, which have been utilized by the Engineer in the preparation of the Contract Documents.

2. Those drawings 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 contiguous to the site and which were utilized by the Engineer in the preparation of the Contract Documents. Copies of such reports and drawings are available for inspection at the office of the Owner.

Information and data reflected in the Contract Documents with respect to underground facilities at/or contiguous to the site are based upon information and data furnished to the Owner and the Engineer by the owners of such underground facilities or others, and the Owner does not assume any responsibility for the accuracy or completeness thereof including any damages whatsoever that may be incurred by the Bidder or the Contractor through his reliance thereon unless it is expressly provided otherwise in the Supplemental General Conditions and/or the Technical Specifications.

Before submitting a bid, the bidder shall conduct such examination, investigations, studies and tests as are necessary to satisfy himself as to: the nature and location of the physical conditions (surface, subsurface and underground facilities), the general and local conditions particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, availability of utilities, local weather conditions, the character of equipment and facilities required preliminary to and during the prosecution of the work; any and all other conditions that may in any way affect the cost, progress, performance or furnishing of materials in accordance with the Contract Documents. All such examination, investigation, studies, tests and the like shall be at the Bidder's expense.

Upon reasonable request in advance, the Owner shall provide each Bidder access to the site to conduct such explorations, examination, investigation and tests as each Bidder may determine necessary for the submission of a Bid. The Bidder shall fill all holes, clean and restore the site to its former condition upon the completion of such activities.

The submission of a bid hereunder shall be considered prima facie evidence that the Bidder has made such examination as is set forth in the above paragraph and is knowledgeable as to the location and site conditions surrounding the work and the conditions to be encountered in performing the work and as to the requirements, conditions and terms of the Contract and Contract Documents.

The Owner assumes no responsibility for any understanding or representations made by any of its officers or agents during or prior to the execution of this Contract, for information contained in any reports, subsurface studies, or other information which may be made available for the Contractor's information and which are not included as Contract Documents, for any understanding or representations by the Owner or by others which are not expressly stated in the Contract Documents which liability is not expressly assumed by the Owner or its representatives or Engineer in the Contract Documents. Such information shall be deemed to be for the information of the Contractor and the Contractor shall have the obligation of evaluating any such information as to its accuracy and effect the Owner will not be liable or responsible for any such information or any conclusions that may be drawn there from by the Contractor.

The lands upon which the work is to be performed, right-of-ways and easements for access thereto together with other lands designated for use by the Contractor in performing the work are identified in the Contract Documents. All additional lands and access thereto that are 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.

The submission of a Bid shall constitute an incontrovertible representation by the Bidder that the Bidder has complied with every requirement of this Article, and that without exception the Bid is premised upon performing and furnishing the work required by the Contract Documents in compliance with such means, methods, techniques, sequences, or procedures of construction as may be indicated in or required by the Contract Documents; and that such means, methods, techniques, sequences or procedures described in the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing the work.

QUANTITIES OF WORK

The quantities of work or material stated in the Bid Schedule 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. The Owner reserves the right after award of the Contract to increase or decrease the quantities of any unit price item of the work by an amount up to and including 25 percent of the quantity of any bid item, or to omit portions of such work as may be deemed necessary or expedient by the Engineer or Owner, without a change in the unit price. Such right to revise and omit shall include the right to delete any bid item in its entirety, or to add additional bid items in quantities up to and including an aggregate total amount not to exceed 25 percent of the total amount of the Contract.

The Bidders nor the ultimate Contractor on the Project shall at any time after the submittal of a bid make or have any claim for damages or anticipated profits or loss of profit or otherwise because of any difference between the quantities of work actually done and material furnished and those stated in said unit price items of the Bid.

INSTRUCTIONS TO BIDDERS

COMPETENCY OF BIDDERS: In selecting the lowest responsible Bidder, consideration will be given to the general competency of the Bidder for the performance of the work covered by the Bid. To this end, each bid shall be supported by a statement of the bidder's experience as of recent date on the form entitled "Information Required of Bidder," bound herein. No bid for the work will be accepted from a contractor who does not hold an active Contractor's license in good standing applicable to the type of work bid upon at the time of opening bids.

After an award of the contract no substitution of the Project Manager or Project Superintendent will be allowed without the written approval by the Owner.

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. Reasonable grounds for believing that any bidder is interested in more than one bid for the work contemplated will cause the rejection of all bids in which such bidder is interested. If there is reason for believing that collusion exists among the bidders, all bids will be rejected.

RETURN OF BID GUARANTEE: Within 10 calendar days after award of the contract, the Owner will return the bid guarantees accompanying such of the bids as are not considered in making the award. All other bid guarantees will be held until a Notice to Proceed has been issued and accepted. They will then be returned to the respective bidders whose bids they accompany.

AWARD OF CONTRACT: Award of the Contract, if it be awarded, will be based primarily on the lowest overall cost to the Owner, and will be made to a responsive and responsible bidder whose bid complies with all the requirements prescribed. Any such award will be made by written notice and within 60 calendar days after opening of the bids, unless a different waiting period is expressly allowed in the Notice Inviting Bids. Unless otherwise indicated, an award will not be made for less than all the bid items in an individual bidding schedule. In the event the entire work is contained in more than one bidding schedule, the Owner may award schedules individually or in combination. In the case of two bidding schedules which are alternate to each other, only one of such alternate schedules will be awarded.

INSTRUCTIONS TO BIDDERS

EXECUTION OF CONTRACT: The Bidder to whom the award is made shall secure all insurance and shall furnish all certificates and bonds required by the specifications within ten calendar days after receipt of the Notice of Award from the Owner. The Bidder to whom the award is made shall execute a written contract with the Owner on the form of agreement provided within ten calendar days after receipt of the Agreement from the Owner. Failure or refusal to enter into a contract 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 guarantee. If the successful bidder refuses or fails to execute the contract, the Owner may award the contract to the second lowest responsible bidder or reject all bids and re-advertise the project for rebidding. If the second lowest responsible bidder refuses or fails to execute the contract, the Owner may award the contract to the third lowest responsible bidder. On the failure or refusal of such second or third lowest bidder to execute the contract, each such bidder's guarantees shall be likewise forfeited to the Owner.

ISSUANCE OF NOTICE TO PROCEED: The Owner intends to execute the Agreement and issue the Notice to Proceed specifying the Project start date within ten calendar days after its receipt of the executed Agreement, Purchase Order Assignment(s), (if applicable), bonds and insurance certificates from the successful bidder. If the Contract Time is expressed as a specific completion date in the Notice Inviting Bids and paragraph 3.1 of the Agreement rather than a specific number of successive days following the start date identified in the Notice to Proceed, then any delay by the Owner beyond the ten days in issuing the Notice to Proceed shall extend the completion date by the number of days of the delay.

LICENSES: Contractor must be licensed as a business qualified to do business within the state of Utah prior to issuance of a Notice of Award. Contractor must hold a current contractor’s license with classifications appropriate to the work being contracted.

BID

BID TO: JORDAN VALLEY WATER CONSERVANCY DISTRICT

The undersigned Bidder hereby proposes to furnish all plant machinery, labor, services, materials, equipment, tools, supplies, transportation, utilities, and all other items and facilities necessary to perform all work required under the Bidding Schedule of the Owner's Contract Documents entitled “11800 South Pump Station Upgrade” drawings and all addenda issued by said Owner prior to opening of the bids.

Addenda are only delivered by e-mail and through the internet.

The undersigned bidder acknowledges receipt of the following addenda:

No.	Date Received	No.	Date Received

Bidder agrees that, within 10 calendar days after receipt of Notice of Award from Owner, he will execute the Agreement in the required form, of which the Notice Inviting Bids, Instructions to Bidders, Bid, Information Required of Bidder, Technical Specifications, Drawings, and all addenda issued by Owner prior to the opening of bids, are a part, and will secure the required insurance and bonds and furnish the required insurance certificates; and that upon failure to do so within said time, then the bid guarantee furnished by Bidder shall be forfeited to Owner as liquidated damages for such failure; provided, that if Bidder shall execute the Agreement, secure the required insurance and bonds, and furnish the required insurance certificates within said time, his check, if furnished, shall be returned to him within five days thereafter, and the bid bond, if furnished, shall become void. It is further understood that this bid may not be withdrawn for a period of 45 days after the date set for the opening thereof, unless otherwise required by law.

Bidder hereby certifies he has registered and participates in the Status Verification System (E-Verify).

Dated: _____ Bidder: _____

By: _____
(Signature)

Title: _____

Bidder further agrees to complete all work required within the time stipulated in the Contract Documents, and to accept in full payment therefore the price(s) named in the above-mentioned Bidding Schedule(s).

BID

No.	Description	Unit	Estimated Quantity	Bid Price
General				
1.	Mobilization, demobilization, temporary facilities, and administrative items.	LS	1	$
Mechanical				
2.	Furnish and install pump discharge piping, pump head, piping, fittings, valves, pipe supports, air release, and other appurtenances as required for complete operation.	LS	1	$
3.	Furnish production pump (P4) with a minimum 86% efficiency.	LS	1	$
4.	Furnish 1250 HP motor (P4).	LS	1	$
5.	Install production pump (P4) and 1250 HP motor (P4).	LS	1	$
Electrical				
6.	Furnish and install electrical complete as required in the contract documents including 4000 kVA transformer, combination starter, conduit, wiring including all terminations, and other appurtenances as required for complete operation.	LS	1	$
7.	Furnish medium voltage incoming termination enclosure and soft starter manufactured by Benshaw.	LS	1	
8.	Install medium voltage incoming termination enclosure and soft starter.	LS	1	
Heating Ventilation and Air Conditioning (HVAC)				
9.	Furnish and install HVAC equipment including air handling unit, piping, fittings, valves, circulation pump, controls, and all other items as required for a working system.	LS	1	$
	Total Price of Base Bid Items			

The Contract shall be awarded to the Contractor with the lowest total price of the Base Bid Items, which is the total of Bid Items 1 through 9. Following the Award of Contract, the Owner reserves the right to substitute Alternate Item No. 1 with Base Bid Item 3 and reserves the right to substitute Alternate Item No. 2 with Base Bid Item 7.

BID

The Bidder acknowledges to the Owner that the Bid provided herein includes the total cost required to complete the 11800 South Pump Station Upgrade project with appurtenances and related items as outlined within these specifications and as shown on the drawings.

Total Sum of Base Bid Items (1 through 9): $_____

Total Bid Price in Words:

_____Dollars

and _____ Cents.

No.	Description	Unit	Estimated Quantity	Bid Price
Alternate Item No. 1				
ALT-1	Furnish production pump (P4) with a minimum 83% efficiency.	LS	1	$
Alternate Item No. 2				
ALT-2	Furnish medium voltage incoming termination enclosure and soft starter manufactured by an approved alternate as listed in Specification 26 18 38.	LS	1	$

BID BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____
as Principal, and _____
as Surety, are held and firmly bound unto the Jordan Valley Water Conservancy District (hereinafter called "Owner") in the sum of _____ dollars, (not less than five percent of the total amount of the bid) for the payment of which sum, will and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has submitted a bid to Owner to perform all work required under the bidding Schedule of the Owner's Contract Documents entitled “11800 South Pump Station Upgrade”, (hereafter called the “Project”).

NOW THEREFORE, if Principal is awarded Contract by Owner for the Construction of the Project and, within the time and in the manner required under the heading "Instructions to Bidders" enters into the written contract entitled "Agreement" bound with said Contract Documents, furnishes the required certificates of insurance, and furnishes the required Performance Bond and Payment Bond within 10 calendar days after receipt of such contract from Owner, then this obligation shall be null and void, otherwise it shall remain in full force and effect. In the event suit is brought upon this bond by Owner and judgment is recovered, Surety shall pay all costs incurred by Owner in such suit, including a reasonable attorney's fee to be fixed by the court.

SIGNED AND SEALED, this _____ day of _____, 20___.

_____ _____

By: _____ By: _____

Its: _____ Its: _____

(SEAL) (SEAL)

INFORMATION REQUIRED OF BIDDER

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

1. Contractor's name: _____
2. Contractor's address: _____
   _____
   _____

   Contractor's Primary Contact: _____
   Email address of Contractor's primary contact: _____
   Contractor's telephone number: _____

3. **Contractor must be qualified and licensed to do business in Utah.**
   Utah Department of Commerce Information
   Business Entity Number: _____
   Delinquent Date: _____

4. **Contractor must hold a current contractor's license, classification E100.**
   Contractor's Utah License Number: _____
   Expiration Date: _____
   Primary Classification: _____
   Supplemental Classification held, if any: _____

5. **Key Personnel Qualifications and Experience**
   List key personnel here and provide detailed information in Attachments A and B. More than one Project Manager and/or Project Superintendent may be proposed. Only personnel approved by the Owner will be allowed in the key positions.

   Project Manager A: _____
   Project Manager (Alternate 1): _____
   Project Manager (Alternate 2): _____

   Project Manager shall have:

   - At least five (5) years' construction experience
   - Have successfully performed as Project Manager on the construction of at least one (1) vertical turbine pump installation projects.

INFORMATION REQUIRED OF BIDDER

Project Superintendent A: _____
Project Superintendent (Alternate 1): _____
Project Superintendent (Alternate 2): _____

Project Superintendent shall have:

- At least ten (10) years' construction experience
- Three (3) projects with a vertical turbine pump installation
- One (1) drinking water project.

Note: One project may satisfy multiple requirements.

6. **Previous Contractor Project Experience**

Past project experience shall be provided for each requirement. The Owner shall be entitled to contact each, and every reference listed by the contractor. The Contractor, by submitting a bid, expressly agrees that any information concerning the CONTRACTORS in possession of said entities and references may be made available to the owner.

Provide the information identified in Attachment C for each project which meets the minimum requirements listed below:

Requirements:
Contractor shall have successfully completed at least three (3) projects which includes vertical turbine pump installation and at minimum one (1) drinking water project.

1. _____
2. _____
3. _____
4. _____

List at least one (1) project successfully completed with a total value of at least $1,000,000.

1. _____

Note: One project may satisfy multiple requirements.

INFORMATION REQUIRED OF BIDDER

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

_____

8. Name and title of officers of Contractor's firm:

_____

_____

_____

9. Number of persons employed full-time by the firm: _____

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

Name: _____

Date of Inspection: _____

11. Surety company who will provide the required bonds on this contract: _____

    Agent's Name:_____

    Telephone:_____

12. Workers Compensation Insurance Policy #: _____

INFORMATION REQUIRED OF BIDDER

ATTACHMENT A
(Copy as necessary – recommended to provide more projects than required)

Project Manager Data Sheet

Name: _____

Years experienced as Project Manager: _____

Years of prior experience: _____ Positions: _____

Qualifying Project #1: _____

Project Summary: _____

_____

_____

Year Completed: _____

Total Cost: _____

Owner: _____

Owner Contact Person: _____ Telephone: _____

Qualifying Project #2: _____

Project Summary: _____

_____

_____

Year Completed: _____

Total Cost: _____

Owner: _____

Owner Contact Person: _____ Telephone: _____

Qualifying Project #3: _____

Project Summary: _____

_____

_____

Year Completed: _____

Total Cost: _____

Owner: _____

Owner Contact Person: _____ Telephone: _____

INFORMATION REQUIRED OF BIDDER

ATTACHMENT B

(Copy as necessary – recommended to provide more projects than required)

Superintendent Data Sheet

Name: _____

Years experienced as Superintendent: _____

Years of prior experience: _____ Positions: _____

Qualifying Project #1: _____

Project Summary: _____

_____

_____

Year Completed: _____

Total Cost: _____

Owner: _____

Owner Contact Person: _____ Telephone: _____

Qualifying Project #2: _____

Project Summary: _____

_____

_____

Year Completed: _____

Total Cost: _____

Owner: _____

Owner Contact Person: _____ Telephone: _____

Qualifying Project #3: _____

Project Summary: _____

_____

_____

Year Completed: _____

Total Cost: _____

Owner: _____

Owner Contact Person: _____ Telephone: _____

INFORMATION REQUIRED OF BIDDER

ATTACHMENT C

(Copy as necessary – recommended to provide more projects than required)

Contractor Project Experience Summary

Project Name: _____

Project Location: _____

Project Manager: _____

Project Superintendent: _____

Project Description: _____

_____

_____

_____

_____

_____

_____

_____

_____

Pump capacity, motor size, voltage: _____

_____

Discharge piping material and diameter: _____

_____

Date Bid: _____ Date Completed: _____

Contract bid price: _____ Contract final price: _____

Contract duration at bid: _____ Final contract duration: _____

Owner's contact information: _____

AGREEMENT

An Agreement made as of the _____ day of _____, 20___, by and between the Jordan Valley Water Conservancy District, a water conservancy district organized under the laws of the State of Utah ("OWNER"), and _____, a _____ corporation qualified to do business and doing business in the State of Utah ("CONTRACTOR").

TERMS:

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

ARTICLE I
WORK

CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents for the _____. The Work is generally described as follows:

> Furnishing all labor, services, materials, equipment, and supplies except for such materials, equipment, and services as may be stipulated in the Contract Documents to be furnished by the OWNER; furnishing and removing all plant machinery, temporary structures, tools, supplies, transportation, utilities, and all other items, facilities and equipment, and to do everything required by this Agreement and the Contract Documents; accepting all responsibility for and paying for all loss and damage arising out of the nature of the Work aforesaid, or from the action of the elements, or from any unforeseen difficulties which may arise during the prosecution of the Work until its acceptance by OWNER, and for all risks of every description connected with the Work; also for all expenses resulting from the suspension or discontinuance of work, except as in the Contract Documents are expressly stipulated to be borne by OWNER.

ARTICLE II
ENGINEER

The Project has been designed by the OWNER. The OWNER will assume all duties and responsibilities and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

[ALTERNATE PARAGRAPH]The Project has been designed by _____, a _____ corporation qualified to do business and doing business in the State of Utah, who is hereinafter called "ENGINEER" and who is to act as OWNER's representative, assume all duties and responsibilities and have the rights and

authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

ARTICLE III
CONTRACT TIME

3.1 The Work shall be complete, in accordance with paragraphs 14.08 and 14.09 of the General Conditions, on or before _____.

3.2 Liquidated Damages: OWNER and 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 paragraph 3.1 above, 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 or arbitration proceeding the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any proof of loss, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER the amount specified in Article 14.07 of the General Conditions and in Article 18.01 of the Supplementary General Conditions for each day that expires after the time specified in paragraph 3.1 for final completion until the Work is substantially complete. And, after Substantial Completion if CONTRACTOR neglects, refuses or fails to complete the remaining Work within forty-five (45) days or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER the amount specified in Article 14.07 of the General Conditions and in Article 18.01 of the Supplemental General Conditions for each day that expires after the forty-five (45) days until readiness for final payment.

ARTICLE IV
CONTRACT PRICE

All payments to Contractor shall be made in accordance with the Contract Documents. OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents in current funds those prices stated in the approved Bid Schedule as named in the Notice of Award.

ARTICLE V
PAYMENT PROCEDURES

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

5.1 Progress Payments: OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment

as recommended by ENGINEER, on a monthly basis. All progress payments will be on the basis of the progress of the Work measured by the schedule of values established in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Conditions.

5.2 Final Payment: Upon final completion and acceptance of the Work in accordance with Article 14 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in Article 14.

ARTICLE VI
INTEREST

All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the rate of twelve percent (12%) per annum.

ARTICLE VII
CONTRACTOR'S REPRESENTATION

In order to induce OWNER to enter into the Agreement, CONTRACTOR makes the following representations:

7.1 CONTRACTOR has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the Work.

7.2 CONTRACTOR has studied carefully all exploration reports and test of subsurface conditions and drawings of physical conditions which are identified in the Supplementary General Conditions, as provided in paragraph 4.02 of the General Conditions, and accepts the Technical Data contained in such reports and drawings upon which CONTRACTOR is entitled to rely.

7.3 CONTRACTOR has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests, reports and studies (in addition to or to supplement those referred to in paragraph 7.2 above) which pertain to the subsurface or physical conditions at or contiguous to the site or otherwise may affect the cost, progress, performance or furnishing of the Work as CONTRACTOR considers necessary for the performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of paragraph 4.02 of the General Conditions; and no additional examinations, investigations, explorations, tests, reports,

studies or similar information or data are or will be required by CONTRACTOR for such purposes.

7.4 CONTRACTOR has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities.

7.5 CONTRACTOR has correlated the results of all observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Contract Documents.

7.6 CONTRACTOR has given ENGINEER written notice of all conflicts, errors or discrepancies that he had discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

ARTICLE VIII
CONTRACT DOCUMENTS

The Contract Documents for the _____, which comprise the entire agreement between OWNER and CONTRACTOR concerning the Work, consist of the following:

8.1 This Agreement;
8.2 Performance and Payment Bonds;
8.3 Notice of Award;
8.4 Notice to Proceed;
8.5 General Conditions;
8.6 Supplemental General Conditions;
8.7 Notice Inviting Bids;
8.8 Instructions to Bidders;
8.9 Information Required of Bidder;
8.10 Technical Specifications;
8.11 Drawings - Sheets Number One through _____;
8.12 Addendum Number One through _____; and,
8.13 CONTRACTOR's Bid, including all schedules and explanatory attachments; attached as Exhibit A.

The CONTRACTOR (1) acknowledges that he has received a copy of each document, specified above, (2) acknowledges that he has read and understands each document specified above and (3) agrees to every term, condition and contract obligation set forth in each document specified above.

There are no Contract Documents other than those listed above in this Article 8. The Contract Documents may only be amended, modified or supplemented as provided in paragraphs 3.03 of the General Conditions.

ARTICLE IX
FEDERAL REQUIREMENTS

The CONTRACTOR shall comply with federal regulations as stated in the Supplemental General Conditions, Article 21.

ARTICLE X
MISCELLANEOUS

10.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.

10.2 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, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.3 In the event any legal action or other proceeding is brought for the enforcement of this Agreement and/or the Contract Documents, or for damages, because of an alleged dispute, breach, default or misrepresentation in connection with any of the provisions thereof, the successful or prevailing party shall be entitled to recover reasonable attorneys' fees and other costs incurred in the action or proceeding, in addition to any other relief to which it may be entitled.

10.4 Any notice to be given hereunder shall be deemed given when sent by registered or certified mail, postage prepaid to the parties at their respective addresses stated below or at any other address when notice of such change of address has been given as provided in this Article 10.4.

[SIGNATURE PAGE FOLLOWS]

"OWNER":	"CONTRACTOR":
Jordan Valley Water Conservancy District 8215 South 1300 West West Jordan, Utah 84088	_____ _____ _____ Utah License No. _____
By: _____ Barton A. Forsyth Its General Manager/CEO	By: _____ Its: _____

EXHIBIT A

CONTRACTOR'S BID

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____, as Contractor, and as Surety, are held firmly bound unto the Jordan Valley Water Conservancy District hereinafter called "Owner," in the sum of $_____ 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.

WHEREAS, Contractor has been awarded and is about to enter into the annexed Agreement with Owner to perform all work required under the Bidding Schedule(s) of the Owner's Contract Documents entitled “11800 South Pump Station Upgrade”.

NOW THEREFORE, if Contractor shall perform all the requirements of the Agreement required to be performed on his 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 the Agreement, shall not in any way release Contractor or Surety thereunder, nor shall any extensions of the time granted under the provisions of the Agreement release either the Contractor or Surety, and notice of such alterations or extensions of the work, materials or time to complete made under the Agreement is hereby waived by Surety. This Bond is furnished in compliance and in accordance with 14-1-18, Utah Code Ann., as amended, and 63-56-38 Utah Code Ann., as amended.

SIGNED AND SEALED, this _____ day of _____, 20__.

_____ _____

By: _____ By: _____

Its: _____ Its: _____

(SEAL) (SEAL)

(SEAL AND NOTARIAL ACKNOWLEDGMENT OF SURETY)

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS,

That _____ as Contractor, and as Surety, are held firmly bound unto the Jordan Valley Water Conservancy District hereinafter called "Owner," in the sum of $_____ 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.

WHEREAS, Contractor has been awarded and is about to enter into the annexed Agreement with Owner to perform all work required under the Bidding Schedule(s) of the Owner's Contract Documents entitled, “11800 South Pump Station Upgrade”.

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, a reasonable attorney's fee 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.

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 the Agreement, shall not in any way release Contractor or Surety thereunder, nor shall any extensions of time granted under the provisions of said contract release either Contractor or the Surety, and notice of such alterations or extensions of the work, materials or time to complete made under the Agreement is hereby waived by Surety. This bond is furnished in compliance and in accordance with 14-1-18 and 19 Utah Code Ann., as amended, and 63-56-38 Utah Code Ann., as amended.

SIGNED AND SEALED, this _____ day of _____, 20___.

_____ _____

By: _____ By: _____

Its: _____ Its: _____

(SEAL) (SEAL)

(SEAL AND NOTARIAL ACKNOWLEDGMENT OF SURETY)

NOTICE OF AWARD

To: Contractor's Name and Address

Re: "11800 South Pump Station Upgrade".

You are hereby notified that the OWNER has accepted your bid for the above referenced project in the amount of $_____.

Furnish the required Contractor's Performance Bond, Payment Bond and Certificates of Insurance within ten calendar days from the date of this notice to you. An acknowledged copy of this Notice of Award, together with all future correspondence regarding this project, shall be sent to the District's Project Manager: Frank Roberts, Senior Engineer.

When the Agreement is provided, sign and return it within ten calendar days from receipt of the agreement.

Dated this ____ day of _____, 20___.

_____
Alan E. Packard, PE
Assistant General Manager & Chief Engineer

ACCEPTANCE OF NOTICE

Receipt of the above Notice of Award is hereby acknowledged by:

____(Contractor's Name goes here - underlined)_____

This _____ day of _____, 20___.

Signature:_____

Printed Name:_____

Title: _____

NOTICE TO PROCEED

To:

Re:

You are hereby notified to commence work in accordance with the Agreement dated _____, on (or before/after) _____, and you are to complete the work by, _____.

An acknowledged copy of this Notice to Proceed should be returned to the Owner, attention:_____.

Dated this _____ day of _____.

_____
Shane K Swensen, P.E.
Engineering Department Manager

ACCEPTANCE OF NOTICE

Receipt of the above Notice to Proceed is hereby acknowledged by:____(Contractor's Name goes here - underlined)_____

This _____ day of _____, 20___.

Signature:_____

Printed Name:_____

Title: _____

JORDAN VALLEY WATER CONSERVANCY DISTRICT

PAYMENT APPLICATIONAND CERTIFICATE No.___ DATE:_____

SHEET_____OF _____

PERIOD FROM _____ TO _____, 20___

PROJECT: _____

JVWCD PROJECT NO.: _____

CONTRACTOR: _____

ADDRESS: _____

ENGINEER: _____

1. ORIGINAL CONTRACT PRICE:..... $_____

2. NET CHANGE ORDERS APPROVED TO DATE: ..... $_____
(Attach Summary Sheet)

3. REVISED CONTRACT AMOUNT: ..... $_____
(Sum of Lines 1 & 2)

4. TOTAL VALUE OF WORK COMPLETED TO DATE ... . $_____
(Attached Payment Breakdown)

5. PERCENT PROJECT COMPLETE: ..... _____%
(Divide Line 4 by 3 and multiply by 100)

6. LESS AMOUNT RETAINED (5%) ..... $_____

7. MATERIALS ON HAND..... $_____
(95% of Value, Listing Attached)

8. SUBTOTAL (Sum of Lines 4, Line 6 and Line 7)..... $_____

9. LESS PREVIOUS PAYMENTS ..... $_____

10. CURRENT PAYMENT DUE: ..... $_____
(Line 8 & 9)

JORDAN VALLEY WATER CONSERVANCY DISTRICT

Payment Application and Certificate No _____

SHEET_____OF _____

CONTRACTOR'S Certification:

The undersigned CONTRACTOR certifies that: (1) all previous progress payments received from OWNER on account of work done under the Contract referred to herein have been applied to discharge in full all obligations of CONTRACTOR incurred in connection with work covered by prior Applications for Payment numbered 1 through _____ inclusive; and, (2) title to all materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to OWNER at time of payment free and clear of all liens, claims, security interests and encumbrances (except such as covered by bond acceptable to OWNER).

Dated: _____ CONTRACTOR: _____

By: _____

Engineer's Recommendation:

This Application (with accompanying documentation) meets the requirements of the Contract Documents and payment of the amount due this application is recommended.

ENGINEER

Dated_____

Project Representative

Dated_____

Project Manager

JORDAN VALLEY WATER CONSERVANCY DISTRICT

CHANGE ORDER

Change Order No. _____

Date: _____

Page ___ of ___

NAME OF PROJECT: _____

PROJECT NUMBER: _____

CONTRACTOR: _____

CONTRACT DATE: _____

The following changes are hereby made to the CONTRACT DOCUMENTS:

1)

2)

3)

Total Change to CONTRACT PRICE: ..... $

Original CONTRACT PRICE: ..... $

Current CONTRACT PRICE adjusted by previous CHANGE ORDER(S)..... $

The new CONTRACT PRICE including this CHANGE ORDER will be ..... $

The CONTRACT TIME will be increased by _____ calendar days.

The date for Substantial Completion will be _____, 20___.

The Contractor agrees to furnish all labor and materials and perform all work as necessary to complete the change order items for the price named herein, which includes all supervision and miscellaneous costs. This change order constitutes full and mutual accord and satisfaction for all time and all costs related to this change. By acceptance of this change order the Contractor agrees that the change order represents an equitable adjustment to the Contract, and further agrees to waive all right to file a claim arising out of or as a result of this change. This document will become a supplement to the Contract, and all provisions will apply hereto, upon approval by the Owner.

JORDAN VALLEY WATER CONSERVANCY DISTRICT

CHANGE ORDER
(CONTINUED)

Change Order No. _____

Date: _____

Page ___ of ___

Recommended: _____ _____

Engineer - Date

Accepted: _____ _____

Contractor - Date

Approved: _____ _____

Owner - Jordan Valley Water Conservancy District Date

JORDAN VALLEY WATER CONSERVANCY DISTRICT

CONTRACTOR'S CERTIFICATE
OF
SUBSTANTIAL COMPLETION

OWNER ENGINEER

TO: Jordan Valley Water Conservancy District
8215 South 1300 West
P. O. Box 70
West Jordan, Utah 84088-0070

PROJECT: _____

ATTENTION: _____

FROM: _____
Firm or Corporation

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

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

The Contractor hereby releases the Owner and its agents from all claims of and liability to the Contractor for anything done or furnished for or relating to the work, as further provided in Article 14.08B of the General Conditions, except demands against the Owner for the remainder of progress payments retained to date, and unresolved written claims prior to this date.

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

SIGNATURE: _____

DATE: _____

JORDAN VALLEY WATER CONSERVANCY DISTRICT

CONTRACTOR'S CERTIFICATE
OF
FINAL COMPLETION

OWNER ENGINEER

TO: Jordan Valley Water Conservancy District
8215 South 1300 West
P. O. Box 70
West Jordan, Utah 84088-0070

PROJECT: _____

ATTENTION: Project Representative: _____

FROM: _____
Firm or Corporation

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

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

The Contract work is now complete in all parts and requirements, excepting the attached list of minor deficiencies and the reasons for each being incomplete to date, for which exemption from final payment requirements is requested in conformance to Article 14.09A of the General Conditions of our Contract (if no exemptions requested, write "none") _____. The work is now ready for your final inspection. The following items required from the Contractor prior to application for final payment (such as O & M Manuals, guarantees, record drawings, etc.) are submitted herewith, if any:

_____

_____

JORDAN VALLEY WATER CONSERVANCY DISTRICT

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

SIGNATURE: _____

DATE: _____

JORDAN VALLEY WATER CONSERVANCY DISTRICT

CONSENT OF SURETY FOR FINAL PAYMENT

PROJECT NAME: _____

LOCATION: _____

TYPE OF CONTRACT: _____

AMOUNT OF CONTRACT: _____

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

_____

_____

_____

on the Payment Bond of the following named Contractor:

_____

_____

_____

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

_____

_____

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

_____
(Name of Surety Company)

_____
(Signature of Authorized Representative)

_____
(Name of Authorized Representatives)

_____
(Title)

JORDAN VALLEY WATER CONSERVANCY DISTRICT

AFFIDAVIT OF PAYMENT

To All Whom It May Concern:

WHEREAS, the undersigned has been employed by the Jordan Valley Water Conservancy District to furnish labor and materials under a contract dated _____for the project entitled "11800 S 3257 W Booster Pump Station Add P7", in the County of Salt Lake, State of Utah, of which Jordan Valley Water Conservancy District is the Owner.

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

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

_____

Contractor (Name of sole ownership, corporation or partnership)

(affix corporate seal here)

_____

(Signature of Authorized Representative)

Title: _____

GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents 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.

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

Change Order - A document recommended by the ENGINEER, 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 - Information and Instructions, forms (including the Schedule of Prices and all required certificates and affidavits), Agreement, Performance Bond, Payment Bond, General Conditions, Supplemental General Conditions, Technical Specifications, Drawings and all Addenda and Change Orders executed pursuant to the provisions of the Contract Documents.

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

Contract Time - The number of successive Days stated in the Contract Documents for the 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.

Cost Proposal - The offer or proposal of the pipeline installation subcontractor to the CONTRACTOR to provide the work required under these Contract Documents.

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 ENGINEERS'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, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

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

Field Order - A written order issued by the ENGINEER which may or may not involve a change in the WORK.

Laws and Regulations; Laws or Regulations - Laws, rules, regulations, ordinances, codes, and/or orders promulgated by a lawfully constituted body authorized to issue such Laws and Regulations.

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 - The Jordan Valley Water Conservancy District.

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.

Project Representative - The authorized representative of the ENGINEER who is assigned to the site or any part thereof.

Proposer - Any person, firm or corporation submitting a proposal for the work.

Schedule of Prices - The offer or proposal of the CONTRACTOR setting forth the price or prices for the work to be performed.

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 at the site.

Substantial Completion - That state of construction when the WORK has progressed to the point where, in the opinion of the ENGINEER as evidenced by the Certificate 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 make 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 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 furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

GENERAL CONDITIONS

ARTICLE 2 - PRELIMINARY MATTERS

2.01 DELIVERY OF BONDS/INSURANCE CERTIFICATES

A. The CONTRACTOR shall deliver to the OWNER the Agreement, Bonds, Insurance Policies and 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 5 copies of the Contract Documents, together with 5 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 ENGINEER any conflict, error, or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from the ENGINEER before proceeding with any work affected thereby.

B. The CONTRACTOR shall submit to the ENGINEER for review those documents called for in each section of the Technical Specifications.

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 ENGINEER, and others as appropriate will meet to finalize the schedules submitted in accordance with the Technical Specifications.

GENERAL CONDITIONS

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, functionally complete, 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 ENGINEER in writing and before proceeding with the work affected thereby. The ENGINEER shall then make a written interpretation, clarification, or correction from the ENGINEER.

3.02 ORDER OF PRECEDENCE OF CONTRACT DOCUMENTS

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

1. Change Orders
2. Agreement
3. Addenda
4. Contractor's Bid (Bid Form)
5. Supplemental General Conditions
6. Notice Inviting Bids
7. Instructions to Bidders
8. General Conditions
9. Technical Specifications
10. Referenced Standard Specifications
11. Drawings

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 written consent.

GENERAL CONDITIONS

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 paragraph entitled "Physical Conditions" of the Supplementary General Conditions identifies exploration reports and subsurface conditions tests at the site that have been utilized by the ENGINEER 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 paragraph entitled "Physical Conditions" of the Supplementary General Conditions identifies 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 ENGINEER 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 ENGINEER 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 ENGINEER 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 differing 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 differing 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 ENGINEER will review the alleged differing site conditions, determine the necessity of obtaining additional explorations or tests with respect to verifying their existence and extent and advise the OWNER in writing of the ENGINEER's findings and conclusions.

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 or the ENGINEER by the owners of Underground Utilities or by others. Unless it is expressly provided in the Supplementary General Conditions and/or the Section entitled "Protection and Restoration of Existing Facilities" of the Technical Specifications, 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, the safeguard and protect the of 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 Contact 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 give written notice to the OWNER of that utility and the ENGINEER, specifying the location of the utility in question.

4.05 REFERENCE POINTS

A. The ENGINEER will provide one bench mark, 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 ENGINEER for alignment control. Unless otherwise specified in the Technical Specifications, the CONTRACTOR shall furnish all other lines, grades, and bench marks required for proper execution of the WORK.

B. The CONTRACTOR shall preserve all bench marks, 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.

GENERAL CONDITIONS

ARTICLE 5 - BONDS AND INSURANCE

5.01 PERFORMANCE AND OTHER BONDS

A. The CONTRACTOR shall furnish Performance and Payment Bonds, each in the amount set forth in the Supplementary General Conditions as security for the faithful performance and payment of all the CONTRACTOR's obligations under the Contract Documents. All insurance companies, sureties, and bond companies shall have an AM Best rating of A- or better, with a Financial Size Category of XII or better. Sureties shall also be listed on the Department of the Treasury's Circular 570, with an acceptable underwriting limitation limit. 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 ENGINEER 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.

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. All insurance companies, sureties, and bond companies shall have an AM Best rating of A- or better, with a Financial Size Category of XII or better. Sureties shall also be listed on the Department of the Treasury's Circular 570, with an acceptable underwriting limitation limit. 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 and ENGINEER 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. All insurance shall remain in effect until the ENGINEER issues the Notice of Completion and at all times thereafter when the CONTRACTOR may be correcting, removing, or replacing defective work in accordance with Paragraph 13.06 or completing punch list items required by the Notice of 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.

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; and (c) uninsured 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, and 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.

GENERAL CONDITIONS

ARTICLE 6 - CONTRACTOR'S 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 through the ENGINEER.

C. The CONTRACTOR's superintendent 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. When required in writing by the OWNER or ENGINEER, the CONTRACTOR or any subcontractor shall discharge any person who is, in the opinion of the OWNER or ENGINEER, incompetent, disorderly, or otherwise unsatisfactory and shall not again employ the discharged person on the WORK without the consent of the OWNER or ENGINEER. 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 the WORK, or property at the site or adjacent thereto, all work at the site shall be performed during regular working hours, and the CONTRACTOR will not permit overtime work or the performance of work on Saturday, Sunday or any legal holiday without the OWNER's written consent given after prior written notice

to the ENGINEER. 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 ENGINEER in writing. Additional compensation will be paid the CONTRACTOR for overtime work in the event extra work is ordered by the ENGINEER 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 by 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 ENGINEER, 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 ENGINEER for acceptance in accordance with the provisions for "Contractor Submittals" in the Technical Specifications.

6.04 SUBSTITUTES OR "OR-EQUAL" ITEMS

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or-equal” item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to ENGINEER for review under the circumstances described below:

1. “Or-Equal” Items: If in ENGINEER’s sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by ENGINEER as an “or-equal” item, in which case review and approval of the proposed item may, in ENGINEER’s sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph 6.04.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment ENGINEER determines that: (i) it is a least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;

b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Document.

2. Substitute Items

a. If in ENGINEER’s sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an “or-equal” item under paragraph 6.04.A.1, it will be considered a proposed substitute item.

b. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or

equipment proposed is essentially equivalent to that named and an acceptable substitute therefore. Requests for review of proposed substitute items of material or equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR.

c. The procedure for review by ENGINEER will be as set forth in paragraph 6.04.A.2.d, as supplemented in the Technical Specifications and as ENGINEER may decide is appropriate under the circumstances.

d. CONTRACTOR shall first make written application to ENGINEER for review of a proposed substitute item of material or equipment that CONTRACTOR seeks to furnish or use. The application shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not use of the proposed substitute item will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute item, and whether or not incorporation or use of the substitute item is subject to payment of any license fee or royalty. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute item. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item.

B. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in

ENGINEER's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph 6.04.A.2.

C. Engineer's Evaluation: ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.04.A and 6.04.B. ENGINEER will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized until ENGINEER's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." ENGINEER will advise CONTRACTOR in writing of any negative determination.

D. Special Guarantee: OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.

E. ENGINEER's Cost Reimbursement: ENGINEER will record time required by ENGINEER and ENGINEER's Consultants in evaluating substitute proposed or submitted by CONTRACTOR pursuant to paragraphs 6.04.A.2 and 6.04.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER approves a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluation each such proposed substitute.

F. CONTRACTOR's EXPENSE: CONTRACTOR shall provide all data in support of any proposed substitute or "or-equal" at CONTRACTOR's expense.

6.05 CONCERNING 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 federal, state, and local laws, ordinances, codes, orders, 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 law, ordinance, code, order, or regulations, the CONTRACTOR shall report the same in writing to the ENGINEER. The CONTRACTOR shall indemnify, defend and hold harmless the OWNER, the ENGINEER and their officers, agents, and employees against all claims and from violation of any law, ordinance, code, order, or regulation, whether by CONTRACTOR or by its employees or subcontractors. 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. Where an individual State act on occupational safety and health standards has been approved by Federal authority, then the provision of said State act shall control.

6.08 EQUAL OPPORTUNITY

A. The Contractor agrees to abide by: the provisions of Title VII of the Civil Rights Act of 1964 (42USC § § 2000e et seq.), which prohibits discrimination against any employee or applicant for employment on the basis of race, religion, color, or national origin; Executive Order No. 11246, as amended, which prohibits discrimination on the basis of sex; 45 CFR 90, which prohibits discrimination on the basis of age; Section 504 of the Rehabilitation Act of 1973, (42 USC § 794), which prohibits discrimination on the basis of handicap; Utah Executive Order dated June 30, 1989, which prohibits sexual harassment in the workplace; and the Americans with Disabilities Act (42 USC § § 12111 et seq.), which prohibits discrimination against qualified employees and applicants with a disability.

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 employees on the WORK and other persons and organizations who may be affected thereby.

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 duty shall be 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 Technical Specifications, the CONTRACTOR shall submit all shop drawings to the ENGINEER for review and approval in accordance with the approved schedule for shop drawings submittals specified in the Technical Specifications.

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

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.

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, 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 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 directly or indirectly from the negligence or carelessness of the CONTRACTOR or its 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, or by or on account of any act or omission of the CONTRACTOR or its agents;

2. Liability or claims arising directly or indirectly from or based on the violation of any law, ordinance, regulation, order, or decree, whether by the CONTRACTOR or its agents;

3. Liability or claims arising directly or indirectly from the use or manufacture by the CONTRACTOR, its agents, or the OWNER 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 directly or indirectly from the breach of any warranties, whether express or implied, made to the OWNER or any other parties by the CONTRACTOR or its agents;

5. Liabilities or claims arising directly or indirectly from the willful misconduct of the CONTRACTOR or its agents; and,

6. Liabilities or claims arising directly or indirectly from any breach of the obligations assumed herein by the CONTRACTOR.

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 ENGINEER, and shall be submitted to the ENGINEER at the conclusion of each work day.

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 Contact 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 ENGINEER 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 ENGINEER 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 latent or nonapparent defects and deficiencies in the other work, 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.

GENERAL CONDITIONS

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 COMMUNICATIONS

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

8.02 PAYMENTS

A. The OWNER shall make payments to the CONTRACTOR as provided in Paragraphs 14.05 and 14.09.

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 by the ENGINEER 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.

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.

GENERAL CONDITIONS

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 OWNER'S REPRESENTATIVE

A. The ENGINEER will be the OWNER's representative during the construction period. The duties, responsibilities and the limitations of authority of the ENGINEER as the OWNER's representative during construction are set forth in a separate agreement with the OWNER and 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 REPRESENTATION

A. The ENGINEER will furnish a Project Representative to observe and inspect the performance of the WORK. The Project Representative and/or other authorized agents of the Engineer shall serve as the chief Owner/Engineer contact(s) with the Contractor during the construction phase. All submittals shall be delivered to and communications between the Engineer and the Contractor shall be handled by the Project Representative and/or other authorized agents. The Project Representative shall be the chief authorized representative of the Owner and the Engineer at the site of the work in all on-site relations with the Contractor.

9.04 CLARIFICATIONS AND INTERPRETATIONS

A. The ENGINEER 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 ENGINEER 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 ENGINEER may authorize minor variation in the WORK as described in the Contact 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 parties are unable to agree as the amount or extent thereof, the CONTRACTOR may make a claim therefor as provided in Article 11 or 12.

9.06 REJECTION OF DEFECTIVE WORK

A. The ENGINEER is authorized to reject work which the ENGINEER 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 ENGINEER 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 Technical Specifications.

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

C. In connection with the ENGINEER's responsibilities with respect to Applications for Payment, see Article 14.

9.08 DECISIONS ON DISPUTES

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 ENGINEER in writing with a request for formal decision in accordance with this paragraph. The ENGINEER 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 ENGINEER promptly (but in no event later than 30 days) after the occurrence of the event. Written supporting data will be submitted to the ENGINEER with the written claim unless the ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim.

B. When reviewing the claim or dispute, the ENGINEER 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 ENGINEER's 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. Neither the ENGINEER's authority to act pursuant to its agreement with the OWNER, nor the description of that authority under this Article 9, nor any other description of the ENGINEER's responsibility in the Contract Documents, nor any decision made by the ENGINEER in good faith either to exercise or not exercise its authority, shall give rise to any duty or responsibility on the part of the ENGINEER to the CONTRACTOR, any Subcontractor, any Supplier, any surety or any other person or organization performing any part of the WORK.

B. 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 judgement of the ENGINEER 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 ENGINEER any duty or authority to supervise or direct the performance of the WORK or any duty or authority to undertake responsibility contrary to the provisions of its agreement with the OWNER.

C. The ENGINEER will not be responsible for the CONTRACTOR's means, methods, techniques, sequences, or procedures of construction not specified in the Contact Documents or the safety precautions and programs incident thereto.

D. The ENGINEER will not 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.

GENERAL CONDITIONS

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 ENGINEER. 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 or 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 Contact 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 Contact Time which are agreed to by the parties; or

4. Any other changes agreed to by the parties.

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. Changes in the quantity of all bid items established in the Contract Documents, regardless of whether the changes are more or less than 25 percent and at the unit price established in the Contract Documents or adjusted otherwise, shall be documented by Change Orders.

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.

GENERAL CONDITIONS

ARTICLE 11 - CHANGE OF CONTRACT PRICE

11.01 GENERAL

A. The Contact 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 Contact Price shall be based on written notice delivered by the CONTRACTOR to the ENGINEER 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 ENGINEER 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 ENGINEER in accordance with Paragraph 9.08A. No claim for an adjustment in the Contact Price will be valid if not submitted in accordance with this Paragraph 11.01B.

C. The value of any work covered by a Change Order or of any claim for an increase or decrease in the Contact 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. By 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 ENGINEER 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.

At the beginning of the extra work and as later requested by the ENGINEER, the CONTRACTOR shall furnish the ENGINEER 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 ENGINEER. 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 ENGINEER 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 Supplementary General Conditions. 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. If it is deemed necessary by the CONTRACTOR to use equipment not listed in the Supplementary General Conditions an equitable rental rate for the equipment will be established by the ENGINEER. The CONTRACTOR may furnish cost data which might assist the ENGINEER in the establishing the rental rate.

1. All equipment shall, in the opinion of the ENGINEER, 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 ENGINEER, 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 ENGINEER in making estimates for payment for special services:

1. When the ENGINEER 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 termination of market values by the ENGINEER, 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 ENGINEER, 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:

ACTUAL NECESSARY COST 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 the subcontractor, the allowance specified herein shall be applied to the labor, materials, and equipment costs of the subcontractor, to which the CONTRACTOR may add 5 percent of the subcontractor's total cost for the extra work. Regardless of the number of hierarchical tiers of subcontractors, the 5 percent increase above the subcontractor's total cost which includes the allowances for overhead and profit specified herein may be applied one time only for each separate work transaction.

GENERAL CONDITIONS

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 ENGINEER 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 ENGINEER 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. All claims for adjustment in the Contract Time shall be determined by the ENGINEER in accordance with Paragraph 9.08 if the OWNER 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 12.01A.

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 ENGINEER 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 15.01 (a) or for whatever other reasons including the stoppage of work by the ENGINEER for the CONTRACTOR's failure to comply with any order issued by the ENGINEER.

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 paragraph entitled "Inclement weather delays" of 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 time named in the Contract Documents for the completion of the WORK, 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 ENGINEER in writing of the causes of delay within 15 calendar days from the beginning of any such delay. The ENGINEER 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, accidents, failure on the part of the CONTRACTOR to carry out the provisions of the Contract 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. In the event that Contract completion is delayed beyond the Contract Time named in the Specifications 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 and ENGINEER 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, to offset the expected delay. The CONTRACTOR shall notify the ENGINEER, 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 acting through the ENGINEER, and his findings thereon shall be based on the ENGINEER'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 reason of changes made under the provisions of Article 10 or changed conditions as provided under Article 4.03, or by failure of the OWNER to acquire or clear right-of-way as provided under Article 15.01, or by any act of the ENGINEER or of the OWNER, not contemplated by the Contract, 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, except, that if the WORK is increased as a result of changes, the OWNER, at his sole discretion, may grant an adjustment in the number of calendar days for completion of the Contract. In the event of such delay, the CONTRACTOR shall notify the ENGINEER in writing of the causes of delay within 15 calendar days from the beginning of any such delay.

GENERAL CONDITIONS

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

13.01 WARRANTY, GUARANTEE AND MAINTENANCE 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. 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 Engineer's Notice of 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 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 ENGINEER 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 or the ENGINEER's acceptance of a Supplier of materials or equipment proposed as a substitution 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 ENGINEER will make, or have made, such inspections and test as the ENGINEER deems necessary to see that the WORK is being accomplished in accordance with the requirements of 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 or the OWNER-ENGINEER Agreement, 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 ENGINEER, as well as the cost of subsequent re-inspection and retesting. Neither observations by the ENGINEER 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 ENGINEER's written authorization, it must, if requested by the ENGINEER, be uncovered for testing, inspection, and observation. The uncovering shall be at the CONTRACTOR's expense unless the CONTRACTOR timely notified the ENGINEER of the CONTRACTOR's intention to cover the same and the ENGINEER failed to act with reasonable promptness in response to the notice.

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

G. If the ENGINEER considers it necessary or advisable that covered work be observed, inspected or tested by the ENGINEER or others, the ENGINEER 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 ENGINEER's direction and furnish all necessary labor, material, and equipment. If found 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 ENGINEER, the CONTRACTOR shall promptly correct all defective work, whether or not fabricated, installed, or completed, or, if the

work has been rejected by the ENGINEER, 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.

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 Contact Documents with respect to the WORK, and the OWNER shall be entitled to an appropriate decrease in the Contract Price.

GENERAL CONDITIONS

ARTICLE 14 - PAYMENTS TO CONTRACTOR, LIQUIDATED DAMAGES AND COMPLETION

14.01 SCHEDULE OF VALUES (LUMP SUM PRICE BREAKDOWN)

A. The schedule of values or lump sum price breakdown established as provided in the Technical Specifications shall serve as the basis for progress payments and will be incorporated into the form of Application for Payment included in the Contract Documents.

14.02 UNIT PRICE BID SCHEDULE

A. Progress payments for unit price work 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 ENGINEER 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 Value of Materials at the Site which have not yet been incorporated in the WORK, and less a deductive adjustment for materials installed which were not previously incorporated in the WORK, but for which payment was allowed under the provisions of payment for Materials Stored at the Site but not yet 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 withhold and retain 5% of each approved progress payment to the CONTRACTOR. The total retention proceeds withheld shall not exceed 5% of the total construction price. All retention proceeds shall be placed by the OWNER in an interest-bearing account. The interest accrued shall be for the benefit of the CONTRACTOR and its subcontractors, and it shall be paid after the WORK has been completed and accepted by the OWNER. CONTRACTOR shall ensure that any interest accrued on the

retainage is distributed by the CONTRACTOR to its subcontractors on a pro rata basis.

E. Any retention proceeds withheld, and any accrued interest, shall be released by the OWNER pursuant to an Application for Payment from the CONTRACTOR within 45 days from the later of:

1. the date the OWNER receives the final Application for Payment from the CONTRACTOR;

2. the date that a certificate of occupancy or final acceptance notice is issued to:

   (a) the Contractor who obtained the building permit from the building inspector or from a public agency;

   (b) the OWNER; or

   (c) the ENGINEER.

3. the date the CONTRACTOR accepts final payment for the Work; or

4. the date that a public agency or building inspector having authority to issue its own certificate of occupancy does not issue the certificate but permits partial or complete occupancy of a newly constructed or remodeled building; provided, however, that if only partial occupancy of a building is permitted, any retention proceeds withheld and retained, and any accrued interest, shall be partially released in direct proportion to the value of the part of the building occupied.

Each Application for Payment from the CONTRACTOR shall include documentation of lien releases or waivers.

F. Notwithstanding any other provision in this Article to the contrary,

1. If the CONTRACTOR is in default or breach of the terms and conditions of the Contract Documents, the OWNER may withhold from payment to the CONTRACTOR for so long as reasonably necessary an amount necessary to cure the breach or default of the CONTRACTOR; or

2. If the WORK or a portion of the WORK has been substantially completed, the OWNER may retain until completion up to twice the

fair market value of the WORK of the CONTRACTOR that has not been completed:

(a) in accordance with the Contract Documents; or

(b) in the absence of applicable provisions in the Contract Documents to generally accepted craft standards.

3. If the OWNER refuses payment under subparagraphs (F)(i) or (ii), it shall describe in writing within 45 days of withholding such amounts what portion of the WORK was not completed according to the standards specified in the Contract Documents.

G. The CONTRACTOR shall distribute retention proceeds as outlined below:

1. Except as provided in Paragraph 14.03.G.2, below, if the CONTRACTOR receives retention proceeds, it shall pay each of its subcontractors from whom retention has been withheld each subcontractor's share of the retention received within ten days from the day that all or any portion of the retention proceeds is received from the OWNER.

2. Notwithstanding Paragraph 14.03.G.1, above, if a retention payment received by the CONTRACTOR is specifically designated for a particular subcontractor, payment of the retention shall be made to the designated subcontractor.

H. 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 $5,000 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 in these General Conditions 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 ENGINEER 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 ENGINEER's reasons for refusing to recommend payment. In the later case, the CONTRACTOR may make the necessary corrections and resubmit the Application. Thirty 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.

B. The OWNER may refuse to make payment of the full amount recommended by the ENGINEER 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 (with a copy to the ENGINEER) 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 ENGINEER 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. Upon the OWNER's acceptance of these recommendations, the ENGINEER's aforesaid recommendation will be binding on the OWNER and the CONTRACTOR until final payment.

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 LIQUIDATED DAMAGES

A. The CONTRACTOR shall pay to the OWNER the amount specified in the Supplemental 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 time or times agreed upon. The periods for which these damages shall be paid shall be the number of Days from the agreed date or 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 ENGINEER certifies Substantial Completion of WORK or specified parts of the WORK 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 Supplemental 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. Said damages are not in lieu of but in addition to other actual or consequential damages to which the OWNER may be entitled.

C. 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, and the CONTRACTOR has delivered to the ENGINEER 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, the CONTRACTOR may notify the OWNER and the ENGINEER in writing that the WORK is substantially complete and request that the ENGINEER prepare a Certificate of Substantial Completion. Within a reasonable time thereafter, the OWNER, the CONTRACTOR, and the ENGINEER shall make an inspection of the WORK to determine the status of completion. If the ENGINEER does not consider the WORK substantially complete, the ENGINEER will notify the OWNER and CONTRACTOR in writing giving the reasons therefor. If the ENGINEER considers the WORK substantially complete, the ENGINEER will prepare and deliver to the OWNER for its execution the Certificate of Substantial Completion signed by the ENGINEER and CONTRACTOR, which shall fix the date of Substantial Completion.

B. The Certificate 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 Certificate of Substantial Completion, the ENGINEER 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 ENGINEER's 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 Certificate of Substantial Completion has been issued this certification must occur within 45 days of that date), the ENGINEER will make a final inspection with the OWNER and the CONTRACTOR. If the OWNER and ENGINEER do not consider the WORK complete, the ENGINEER will notify the OWNER and 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 ENGINEER and OWNER consider 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 ENGINEER 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 ENGINEER's Notice of 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 ENGINEER and delivered to the ENGINEER all required additions and modifications to 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 ENGINEER 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 or ENGINEER 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 ENGINEER's observation of the WORK during construction and final inspection, and the ENGINEER's review of the final application for payment and accompanying documentation, all as required by the Contract Documents, the ENGINEER is satisfied that the WORK has been completed and the CONTRACTOR has fulfilled all of his obligations under the Contract Documents, the ENGINEER 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 ENGINEER will give written notice to the OWNER and the CONTRACTOR that the WORK is acceptable by executing the ENGINEER's Notice of Completion. Otherwise, the ENGINEER 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 ENGINEER's filing of the Notice of Completion, the OWNER will make final payment including all deducted retainage (except as noted below) 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 damages, as applicable.

2. All amounts retained by the OWNER under Paragraph 14.03(F).

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 ENGINEER, nor the issuance of a Certificate 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 Certificate of Substantial Completion.

GENERAL CONDITIONS

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 SUSPENSION OF WORK BY OWNER

A. The OWNER acting through the ENGINEER 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 ENGINEER of written notice to proceed. Whenever the OWNER temporarily suspends work for any conditions enumerated in this Article 15.01 A, 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 the written order suspending the work and shall be terminated upon receipt by the Contractor of the written order terminating the suspension.

C. 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 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 ENGINEER for the CONTRACTOR's failure to comply with any order issued by the ENGINEER.

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 ENGINEER'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 engineer, 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 Contact 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 ENGINEER 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 or the Contract Documents and within 60 days after presentation to the OWNER by the CONTRACTOR of a request therefor, 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.

GENERAL CONDITIONS

ARTICLE 16 - MISCELLANEOUS

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 ASBESTOS

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

SUPPLEMENTAL GENERAL CONDITIONS

ARTICLE 17- GENERAL

17.01 GENERAL

1. These Supplemental General Conditions amend or supplement the General Conditions of the Contract and any other provisions of the Contract Documents as indicated herein. All provisions which are not so amended or supplemented remain in full force and effect.

2. The terms used in these Supplemental General Conditions which are defined in the General Conditions of the Contract have the meanings assigned to them in the General Conditions of the Contract herein.

17.02 SUPPLEMENTAL DEFINITIONS

1. ENGINEER

The "Engineer" is

Jordan Valley Water Conservancy District
Kevin Rubow, Staff Engineer
Telephone: (801) 565-4300
Email: kevinr@jvwcd.org
8215 South 1300 West
West Jordan, UT 84088

17.03 TESTING COSTS

1. Paragraph 13.03 of the General Conditions is amended as follows: the CONTRACTOR shall pay all testing costs. The Owner reserves the right to have additional tests performed by a testing organization selected by the OWNER and at the OWNER’s expense.

SUPPLEMENTAL GENERAL CONDITIONS

ARTICLE 18 - AMOUNTS OF LIQUIDATED DAMAGES, BONDS AND INSURANCE

18.01 AMOUNT OF LIQUIDATED DAMAGES

A. As provided in Article 14.07 of the General Conditions, the Contractor shall pay to the Owner as liquidated damages the amount of $1,000 for each calendar day's delay beyond the Contract Time for substantial completion. The Contractor shall pay to the Owner as liquidated damages the amount of $200 for each calendar day's delay beyond 45 calendar days from the date of substantial Completion until the Engineer issues the Notice of Final Completion.

18.02 PERFORMANCE AND OTHER BOND AMOUNTS

A. 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.

18.03 INSURANCE AMOUNTS

The limits of liability for the insurance required by Paragraph 5.02 of the General Conditions shall provide for not less than the following amounts or greater where required by Laws and Regulations:

A. Workers' Compensation under Paragraph 5.02B.1 of the General Conditions:

1. State: Utah — Statutory

B. Comprehensive General Liability: (under Paragraph 5.02B.2 of the General Conditions):

1. Bodily Injury (including completed operations and products liability):

$ 500,000 — Each Occurrence
$ 1,000,000 — Annual Aggregate

Property Damage:

$ 500,000 — Each Occurrence
$ 1,000,000 — Annual Aggregate
or a combined single limit of — $1,000,000

2. Property Damage liability insurance including, Explosion, Collapse and Underground coverages, where applicable.

3. Personal Injury, with employment exclusion deleted

$ 1,000,000 Annual Aggregate

C. Comprehensive Automobile Liability: (Under Paragraph 5.02B.3 of the General Conditions:)

1. Bodily Injury

$ 500,000 Each Person
$ 1,000,000 Each Occurrence

2. Property Damage:

$ 500,000 Each Occurrence

or combined single limit of $1,000,000

D. Builders Risk: Not required.

SUPPLEMENTAL GENERAL CONDITIONS

ARTICLE 19 - PHYSICAL CONDITIONS AND WEATHER DELAYS

19.01 INCLEMENT WEATHER DELAYS

A. The Contractor's construction schedule shall be based upon the inclusion of at least five (5) day(s) of inclement weather delays. Reference Article 12, paragraph 12.02 of the General Conditions for additional requirements.

SUPPLEMENTAL GENERAL CONDITIONS

ARTICLE 20 - SUBCONTRACT LIMITATIONS

20.01 SUBCONTRACT LIMITATIONS

A. In addition to the provisions of Paragraph 6.05 of the General Conditions, the CONTRACTOR shall perform not less than 20 percent of the WORK with its own forces (i.e., without subcontracting). The 20 percent requirement shall be understood to refer to the WORK, the value of which totals not less than 20 percent of the Contract Price.

ARTICLE 21 - MISCELLANEOUS

21.01 PATENTS AND COPYRIGHTS

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.

SPECIFICATIONS

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work covered by contract documents

B. Agreement

C. Work sequence

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Work covered by contract documents comprises of furnishing and installing one culinary water pump with associated valves and pipe fittings, one 1250 horsepower motor for the pump, one 4160 Volt soft starter for the motor, one 4000 kVA transformer, and HVAC upgrades, all within an existing structure. Include all work shown in the Contract Documents.

B. Location of the work is 3257 W Winter Creek Cir, South Jordan, Utah.

C. All equipment to be installed along with necessary rigging shall fit through existing building doors and roof hatches.

1.03 AGREEMENT

A. Construct Work under single Agreement.

1.04 WORK SEQUENCE

A. Time is of the essence. The Contractor shall submit data sheets, as outlined in the Submittal Procedures section of the specifications, for all long lead equipment items upon receiving a Notice to Proceed. If any of the equipment delivery time exceeds the project schedule, the Engineer and Owner shall be notified immediately.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01 20 00
MEASUREMENT AND PAYMENT

PART 1

1.01 SECTION INCLUDES

A. Scope.

B. Application for Payment.

C. Lump Sum Items.

1.02 SCOPE

Payment for items in the Bid Schedule, as further specified herein, shall include all compensation to be received by the Contractor for required labor, products, manufacturing, tools, equipment, supplies, transportation, services and incidentals; erection, application or installation of the Work being described in the Contract Documents including overhead and profit, and safety requirements. No separate payment will be made for an item that is not specifically set forth in the Bid Schedule, and all costs therefore shall be included in the price named in the Bid Schedule for the various appurtenant items of Work.

1.03 APPLICATION FOR PAYMENT

Application of Payment shall be as outlined in the General Conditions.

1.04 Lump Sum Items

A. No separate measurement of quantities will be made for those items of Work performed on a lump sum basis, but the item will be constructed, complete, as shown on the Drawings and as described in the Specifications.

B. Bid prices for lump sum items represent the total cost to the Owner. Such price shall constitute full compensation for furnishing and placing of materials required to complete the item, and for all labor, equipment, tools, and incidentals needed to complete the Work in conformity with the plans and specifications.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures.
B. Construction Progress Schedules
C. Shop Drawings.
D. Samples
E. Test reports
F. Certificates.
G. Manufacturer's instructions.
H. Manufacturer's field reports.
I. Engineer's duties.

1.02 SUBMITTAL PROCEDURES

A. Deliver submittals to:

Kevin Rubow
Email: KevinR@jvwcd.org
Jordan Valley Water
Conservancy District
8215 South 1300 West
West Jordan, Utah 84088

Drawings, instruction manuals, and other submittals shall be in English language.

B. Shop Drawings and manufacturers' information submitted shall be accompanied by completed copies of the "Shop Drawings Transmittal Form." Submit number of copies as specified.

C. Sequentially number the transmittal forms. Revise submittals with original number and a sequential alphabetic suffix.

D. Do not include submittals for more than one section of specifications on the Shop Drawing Transmittal form (disregard if inapplicable).

E. A brief description under "Title" should clearly identify the specific application of the equipment or material covered by the Shop Drawing, utilizing where possible the same title used in Drawings and Specifications. Identify Project, Contractor, Subcontractor, and supplier; pertinent drawing and detail number, and specification section number, as appropriate.

F. Information under the heading "Contractor's Transmittal" shall be completed by Contractor prior to submittal. Information under "Engineer's/Architect's Action" will be completed by Engineer/Architect.

G. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of

information is in accordance with the requirements of the Work and Contract Documents.

H. Schedule submittals to expedite the Project and deliver to Engineer at business address. Coordinate submission of related items.

I. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.

J. Notify Engineer in writing, at time of submission, of any deviations in submittals from requirements of Contract Documents. Any such deviations permitted by Engineer may require modifications of Contract Documents.

K. Provide space for Contractor and Architect/Engineer review stamps. When revised for resubmission, identify all changes made since previous submission.

L. Submittals containing language imposing duties on others (such as verification of dimensions or supply of related information) inconsistent with the contract language shall be null and void.

M. Shop drawings shall not be used as media for inquiries for information or for verification of information that must be supplied by others to Contractor. Inquiries or verification of information shall be made by separate Contractor submittal using Request For Information (RFI) process.

N. Begin no fabrication or Work which requires submittals until return of submittals by Engineer with Engineer stamp, as either "Reviewed" or Reviewed as Noted."

O. Distribute copies of reviewed submittals that carry Engineer stamp as either "Reviewed" or "Reviewed as Noted" as appropriate. Instruct parties to promptly report any inability to comply with requirements.

P. Submittals not requested will not be recognized nor processed.

1.03 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedules within 20 days after date of Notice to Proceed. After review, resubmit required revised data within ten days.

B. Submit revised Progress Schedules with every second Application for Payment.

C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.

D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

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

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

and duration.

G. indicate estimated percentage of completion for each item of Work at each submission.

H. Provide separate schedule of submittal dates for Shop Drawings, Product Data, and Samples, including dates reviewed submittals will be required from Engineer. Indicate decision dates for selection of finishes.

I. Revisions to schedules:
1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
3. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.

1.04 SHOP DRAWINGS

A. Submit to Engineer for review for the limited purpose of checking for conformance to information given and the design concept expressed in the Contract Documents. Produce copies and distribute in accordance with article "Submittal Procedures" and for record documents purposes described in the General Conditions.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sheet size: 8-1/2" x 11" minimum; 24" x 36" Maximum.

D. Make submittals to Engineer promptly in accordance with approved schedule, and in such sequence as to cause no delay in Work or in work of any other contractor.

E. Shop Drawings may be submitted in electronic format.
1. Submit electronic copy on Email.
2. Text documents shall be submitted in .pdf.
3. Drawings shall be submitted in .pdf format

F. Number of submittals required:
1. Shop Drawings: Submit number of opaque reproductions which Contractor, Owner and/or approving agency(ies) requires.

G. Submittals shall contain:
1. Date of submission and dates of any previous submissions.
2. Project title and number.
3. Contract identification.
4. Names of:
   a. Contractor.
   b. Supplier.
   c. Manufacturer.
   d. Identification of product, with Specification section number and article number.
   e. Field dimensions, clearly identified as such.
   f. Relation to adjacent or critical features of Work or materials.
   g. Applicable standards, such as ASTM or Federal Specification numbers.

h. Identification of deviations from Contract Documents.
i. Identification of revisions on resubmittals.
j. An 3" x 3" blank space for Contractor and Engineer stamps.
k. Indication of Contractor's approval, initialed or signed, with wording substantially as follows:

"Contractor represents to Owner and Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria materials, catalog numbers, and similar data, or assumes full responsibility for doing so and has reviewed or coordinated each Shop Drawing or Sample with requirements of Work and Contract Documents."

l. If Contract Documents include performance specifications stating required results which can be verified as meeting stipulated criteria, so that further design by Contractor prior to fabrication is necessary, Shop Drawings shall be submitted to Engineer for approval before fabrication.

m. Shop Drawing Transmittal Form is bound herein. Electronic version of this form is also available and may be obtained from the Engineer. Contractor shall reproduce any additional copies required and use in accordance with instructions given with Transmittal Form. Contractor shall submit 2 copies of Transmittal Form for initial submittals and resubmittals.

n. Resubmission requirements: Make any corrections or changes in submittals required by Engineer and resubmit until stamped as either "Reviewed" or "Reviewed as Noted" by Engineer. Text and depictions changed on Shop Drawings shall be back-circled (clouded). Engineer will assume that portions of Shop Drawings not back-circled have not been changed by Contractor from previous submission. Indicate revision number and date in document revision block.

1.05 SAMPLES

A. Submit to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Produce duplicates and distribute in accordance with article "Submittal Procedures" and for record documents purposes described in the General Conditions.

B. Samples For selection as specified in product sections:
   1. Submit to Engineer for aesthetic, color, or finish selection.
   2. Submit samples of finishes, textures, and patterns for Engineer selection.
   3. After review, produce duplicates and distribute in accordance with article "Submittal Procedures' and for record documents purposes described in the General Conditions.

C. Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

D. Include identification on each sample, with full Project information.

E. Reviewed samples which may be used in the Work are indicated in individual specification sections.

F. Samples will not be used for testing purposes unless specifically stated in the specification section.

1.06 TEST REPORTS

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

1.07 CERTIFICATES

A. When specified in individual specification sections, submit certification by the manufacturer, installation/application subcontractor, or the Contractor to Engineer, in quantities specified for Product Data.

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

C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

1.08 MANUFACTURER'S INSTRUCTIONS

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

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

1.09 MANUFACTURER'S FIELD REPORTS

A. Submit reports for the Engineer's benefit as contract administrator or for the Owner.

B. Submit report in duplicate within 30 days of observation to Engineer for information.

C. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the Contract Documents.

1.10 ENGINEER DUTIES

A. Review required submittals with reasonable promptness and in accord with schedule, only for general conformance to design concept of Project and compliance with information given in Contract Documents. Review shall not extend to means, methods, sequences, techniques, or procedures of construction or to safety precautions or program incident thereto. Review of a separate item as such will not indicate approval of assembly in which item functions.

B. Affix stamp and initials or signature, and indicate requirements for resubmittal, or review of Submittal. Engineer's action on submittals is classified as follows:

1. **Reviewed:** Submittal has been reviewed and appears to be in conformance to design concept of Project and Contract Documents. Contractor may proceed with fabrication of work in submittal.
2. **Reviewed As Noted:** Submittal has been reviewed and appears to be in conformance to design concept of Project and Contract Documents, except as noted by Engineer. Contractor may proceed with fabrication of work in submittal with modifications and corrections as indicated by Engineer.

3. **Resubmit:** Submittal has been reviewed and appears not to be in conformance to design concept of Project or with Contract Documents. Contractor shall not proceed with fabrication of work in submittal, but instead shall make any corrections required by Engineer and resubmit for review.
4. **Returned without Review:** Submittal is being returned without having been reviewed because: 1) not required by Contract Documents; 2) grossly incomplete; 3) indicates no attempt at conformance to Contract Documents; 4) cannot be reproduced; 5) lacks Contractor's completed approval stamp; or 6) lacks design professional's seal when required by law or Contract Documents. if submittal is required by Contract Documents, Contractor shall not proceed with Work as detailed in submittal, but instead shall correct defects and resubmit for review.
5. **For Information Only:** Submittal has not been reviewed but is being retained for informational purposes only.

C. Return 1 copy of submittals to Contractor. Contractor shall make additional copies as required.

D. Engineer's review of submittals shall not relieve Contractor from responsibility for any variation from Contract Documents unless Contractor has, in writing, called Engineer's attention to such variation at time of submission, and Engineer has given written concurrence pursuant to Contract Documents to specific variation, nor shall any concurrence by Engineer relieve Contractor from responsibility for errors or omissions in submittals.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01 43 33
MANUFACTURER'S FIELD SERVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Service engineer responsibilities.

1.02 SERVICE ENGINEER RESPONSIBILITIES

A. Contractor shall provide qualified Service Engineer(s), as necessary to:
   1. Supervise assembly of equipment
   2. Inspect equipment after it is installed to assure that all details of installation are correct and that equipment is prepared for operation in accordance with manufacturer's instructions and recommendations.
   3. Check connections to equipment and adjust, or supervise adjustment of, control and indicating devices after equipment has been installed and connected.
   4. Fully instruct Owner's operating personnel in operation and maintenance of equipment.
   5. Provide Engineer with duplicate copies of final alignment and clearance measurements on all rotating or reciprocating equipment. Measurements shall clearly identify each piece of equipment.
   6. Supervise start-up operation of equipment and necessary adjustments.

B. Presence of Service Engineer will in no way relieve Contractor of any responsibility assumed under Agreement.

C. Work and abilities of Service Engineer shall be subject to review of Engineer. If Engineer determines that any Service Engineer is not properly qualified, Contractor shall replace Service Engineer upon written notification by Engineer.

D. Service Engineer shall report to Resident Project Representative while at site and shall submit a written report on results of trip to site to Resident Project Representative.

E. Service Engineer's time spent at site shall be at no additional cost to the Owner and if any of his trips to site are required to make corrections to equipment supplied under Agreement resulting from defective design, material or workmanship used in manufacture of equipment, such time and trips will be at Contractor's expense and will not be counted against number of working days or trips specified, nor will adjustment prices apply.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01 74 23
FINAL CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposal requirements.
B. Materials.
C. Cleaning during construction.
D. Dust control
E. Final cleaning.

1.02 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal requirements to comply with codes, ordinances, regulations, and antipollution laws.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of surface material to be cleaned.

C. Use cleaning materials only on surface recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 CLEANING DURING CONSTRUCTION

A. Execute periodic cleaning to keep Work, site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.

B. Provide on-site containers for collection of waste materials, debris, and rubbish.

C. Remove waste materials, debris, and rubbish from site periodically and dispose of at legal disposal areas away from site.

3.02 DUST CONTROL

A. Clean interior spaces prior to start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

3.03 FINAL CLEANING

A. Employ skilled workers for final cleaning.

B. Remove grease, mastic, adhesives, dust, dirt stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces, as well as all tools, appliances, construction equipment and machinery, and surplus materials.

C. Wash and shine glazing and mirrors.

D. Polish glossy surfaces to clear shine.

E. Ventilating systems:
1. Clean permanent filters and replace disposable filters if units were operated during construction.
2. Clean ducts, blowers, and coils if units were operated without filters during construction.

F. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds to leave site ready for occupancy by Owner. Restore those portions of site not designated for alteration by Contract Documents to their condition as of beginning of Work.

G. Prior to final completion, or Owner occupancy, Contractor shall conduct inspection of sight-exposed interior and exterior surfaces, and **all** work areas, to verify that entire area is clean.

END OF SECTION

SECTION 01 78 23
OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operating and maintenance data requirements.
B. Form of submittals.
C. Content of manual.
D. Manual for equipment and systems.
E. Submittal schedule.
F. Instruction of Owner's personnel.

1.02 OPERATING AND MAINTENANCE DATA REQUIREMENTS

A. Operating and maintenance data shall be in English language.
B. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Agreement.
C. Prepare operating and maintenance data as specified in this section and as referenced in other pertinent sections of Specifications.
D. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

1.03 FORM OF SUBMITTALS

A. Prepare data in form of an instructional manual for use by Owner's personnel.

B. Format
1. Size 8-1/2" x11".
2. Paper: 20 lb. minimum, white, for typed pages.
3. Text: Manufacturer's printed data, or neatly typewritten.
4. Drawings:
   a. Provide reinforced punched binder tab. Bind in with text.
   b. Fold larger drawings to size of text pages.
5. Provide fly-leaf for each separate product, or each piece of operating equipment.
   a. Provide typed description of product, and major component parts of equipment.
   b. Provide indexed tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS." List:
   a. Title of Project.
   b. Identity of separate structure as applicable.
   c. Identity of general subject matter covered in manual.
7. Binders:
   a. Commercial quality 3-ring binders with durable and cleanable plastic covers.
   b. Maximum ring size: 3".
   c. When multiple binders are used, correlate data into related consistent groupings.

1.04 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.
1. Contractor, name of responsible principal, address, and telephone number.
2. List of each product required to be included, indexed to content of volume.
3. List, with each product, name, address, and telephone number of:

a. Subcontractor or installer.
b. Maintenance contractor, as appropriate.
c. Identify area of responsibility of each.
d. Local source of supply for parts and replacement and list of recommended spare parts.

4. Identify each product by product name and other identifying symbols as set forth in Contract Documents, including nameplate information and shop order numbers for each item of equipment furnished.

B. Product data:
1. Include only those sheets which are pertinent to specific product.
2. Annotate each sheet to:
a. Clearly identify specific product or part installed.
b. Clearly identify data applicable to installation.
c. Delete references to inapplicable information.

C. Drawings:
1. Supplement product data with Drawings as necessary to clearly illustrate:
a. Relations of component parts of equipment and systems.
b. Control and flow diagrams.
2. Do not use Project record documents as maintenance Drawings.

D. Written text, as required to supplement product data for particular installation.
1. Organize in consistent format under separate headings for different procedures.
2. Provide logical sequence of instructions for each procedure.

E. Copy of each warranty, Bond, and service contract issued.

1. Provide information sheet for Owner's personnel, giving:
a. Proper procedures in event of failure.
b. Instances which might affect validity of warranties or Bonds.

1.05 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit 2 copies of complete manual in final form and submit 1 copy electronically in pdf format.

B. Contents, for each unit of equipment and system, as appropriate:
1. Description of unit and component parts:
a. Function, normal operating characteristics, and limiting conditions.
b. Performance curves, engineering data, and tests.
c. Complete nomenclature and commercial number of replaceable parts.
2. Operating procedures:
a. Startup, break-in, routine, and normal operating instructions.
b. Regulation, control, stopping, shutdown, and emergency instructions.
c. Summer and winter operating instructions.
d. Special operating instructions.

3. Maintenance procedures:
   a. Routine operations.
   b. Guide to "trouble-shooting."
   c. Disassembly, repair, and reassembly.
   d. Alignment, adjusting, and checking.
4. Servicing and lubrication schedule, including list of lubricants required.
5. Manufacturer's printed operating and maintenance instructions.
6. Description of sequence of operation by control manufacturer.
7. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
   a. Predicted life of parts subject to wear.
   b. Items recommended to be stocked as spare parts.
8. As-installed control diagrams by controls manufacturer.
9. Chart of valve tag numbers, with location and function of each valve.
10. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
11. Other data as required under pertinent sections of Specifications.

C. Content, for each electrical and electronic system, as appropriate.
   1. Description of system and component parts:
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, and tests.
      c. Complete nomenclature and commercial number of replacement parts.
   2. As-installed color-coded wiring diagrams.
   3. Operating procedures:
      a. Routine and normal operating instructions.
      b. Sequences required.
      c. Special operating instructions.
   4. Maintenance procedures:
      a. Routine operations.
      b. Guide to "trouble-shooting."
      c. Disassembly, repair, and assembly.
      d. Adjustment and checking.

   5. Manufacturers printed operating and maintenance instructions.
   6. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
   7. Other data as required under pertinent sections of Specifications.

D. Prepare and include additional data when need when such data becomes apparent during instruction of Owner's personnel.
E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.07 SUBMITTAL SCHEDULE

A. Draft
   1. Submit 2 copies to Engineer for review. Engineer will review draft and return 1 copy with comments.
B. Submit 1 copy of completed data in final form 15 days prior to final inspection or acceptance. Copy will be returned after final inspection or acceptance, with comments.
C. Submit specified copies of approved data in final form 10 days after final inspection or acceptance.

1.08 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Manual for equipment and systems shall constitute basis of instruction. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 05 05 20
BOLTS, WASHERS, ANCHORS, AND EYEBOLTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes materials and installation of anchor bolts, connecting bolts, washers, drilled anchors, epoxy anchors, eyebolts, and stainless steel fasteners.

1.02 RELATED SECTIONS

A. Section 40 20 01 — General Requirements for Steel Piping.

B. Section 40 07 64 — Pipe Hangers

1.03 DESIGN CRITERIA

A. Structural Connections: AISC Specification for Structural Steel Buildings (June 22, 2010).

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00

B. Submit manufacturer's catalog data and ICB0 reports for bolts, washers, and concrete anchors. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 MATERIALS

2.01 ANCHOR BOLTS

A. Steel anchor bolts shall conform to ASTM A 307, Grade A, B, or C.

2.02 CONNECTION BOLTS

A. Steel connection bolts shall conform to ASTM A 307

B. Provide self-locking nuts or lock washers and plain nuts where shown in drawings.

C. Provide galvanized bolts where shown in drawings. Galvanizing of bolts, nuts, and washers shall be by the hot-dipped process.

2.03 STAINLESS STEEL BOLTS

A. Stainless steel bolts shall be ASTM A193, Grade B8M or ASTM F593, Type 304. Nuts shall be ASTM A194, Grade 8M or ASTM F594, Type 304. Use ASTM A194 nuts with ASTM A193 bolts; use ASTM F 594 nuts with ASTM F593 bolts. Provide washer for each nut and bolt head. Washers shall be of the same material as the nuts.

2.04 HARDENED STEEL WASHERS

A. Washers for American Standard beams and channels shall be square or rectangular, tapered in thickness, smooth, and conforming to ASTM F436.

2.05 PLAIN UNHARDENED STEEL AND STAINLESS STEEL WASHERS

A. Washers shall comply with ASTM F844. Stainless steel washers shall be Type 304. Provide clipped washers where space limitations necessitate.

2.06 DRILLED ANCHORS

A. Unless otherwise indicated in the drawings, drilled anchors shall be Type 303 or 304 stainless steel wedge anchors as manufactured by ITW Ramset/Redhead or equal.

B. Where indicated in the drawings, drilled anchors shall be Type 304 stainless steel heavy-duty wedge anchors suitable for dynamic loading. Anchors shall be HSL heavy-duty wedge anchor by Hilti, Power-Bolt by Rawlplug Company, or equal.

2.07 EPOXY ANCHORS

A. Epoxy anchors in concrete shall be Type 304 stainless steel threaded rod adhesive anchors. Epoxy adhesive shall comply with ASTM C881, Type IV, Grade 3, Class B or C. Adhesive shall be Rawl Power-Fast, Hilti HSE 2421, Simpson Epoxy-tie with SET epoxy, or equal.

PART 3 EXECUTION

3.01 STORAGE OF MATERIALS

A. Store material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 GALVANIZING

A. Zinc coating for bolts, anchor bolts, and threaded parts shall be in accordance with ASTM A153

3.03 INSTALLING CONNECTION BOLTS

A. Use steel bolts to connect structural steel members. Use stainless steel bolts to connect structural aluminum members.

B. Install ASTM A325 bolts per the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

C. Install washers per AISC Specification for ASD.

D. Bolt holes in structural members shall be 1/16 inch in diameter larger than bolt size. Measure cast-in-place bolt locations in the field before drilling companion holes in structural steel beam or assembly.

E. Bolts shall be of the length that will extend entirely through but not more than 1/4 inch beyond the nuts. Draw bolt heads and nuts tight against the work. Tap bolt heads with a hammer while the nut is being tightened.

3.04 INSTALLING CONNECTION (ANCHOR) BOLTS

A. Minimum depth of embedment of drilled mechanical anchors shall be as recommended by the manufacturer, but no less than that shown in the drawings.
B. Minimum depth of embedment of epoxy anchors shall be as recommended by the manufacturer, but no less than that shown in the drawings.
C. Prepare holes for drilled and epoxy anchors in accordance with the anchor manufacturer's recommendations prior to installation.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART I GENERAL

1.01 SECTION INCLUDES

A. On-site surface preparation and painting.

1.02 RELATED SECTIONS

A. Coating repair for existing finishes.

1.03 SUBMITTALS

A. Schedule of products proposed for each system.

B. Product data sheets, if other than products specified in schedule.

C. Duplicate 6" x 8" (150 mm x 200 mm) samples of paint and stain colors when requested by Engineer. When possible, apply finishes on identical type materials to which they will be applied on job. Identify each sample as to finish type, formula, color name and number, and gloss.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, color designation and instructions for mixing and/or reducing.

B. Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 45°F (7°C) in well ventilated area.

C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Ensure surface temperatures and the surrounding air temperature is above 45°F (7°C) before applying finishes. Minimum application temperatures for latex paints are 45°F (7°C) for interior work and 50°F (10°C) for exterior work. Minimum application temperature for varnish finish is 65°F (18°C).

B. Do no exterior painting while surfaces are damp or during rainy or frosty weather.

C. Do no exterior spray painting while the wind velocity is above 13 mph (20 km/h).

D. Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 45°F (7°C) for 24 hours before, during and 48 hours after application of finishes.

E. Provide adequate lighting on surfaces to be finished.

1.06 HEALTH AND SAFETY REQUIREMENTS

A. Work shall comply with applicable federal, state, and local laws and regulations including analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

B. Worker exposures: Exposure of workers to chemical substances shall not exceed limits as established by American Conference of Governmental Industrial Hygienists: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, ACG1H-02 or as required by a more stringent applicable regulation.

C. Toxic compounds: Toxic compounds having ineffective physiological properties, such as odor or irritation levels, shall not be used unless approved by the Owner.

D. Training: Workers having access to affected work area shall be informed of contents of manufacturer's current printed product description, Material Safety Data Sheets (MSDS) and technical data sheets for each coating system and shall be informed of potential health and safety hazard and protective controls associated with materials used on Project. Affected work area is one that may receive mists and odors from painting operations. Workers involved in preparation, painting and clean-up shall be trained in safe handling and application, and exposure limit, for each material which worker will use in Project. Personnel having a need to use respirators and masks shall be instructed in use and maintenance of such equipment.

E. Provide paints for interior use that contain no mercurial mildewcide or insecticide. Provide paint containing not more than 0.06% lead.

F. Provide documentation stating that paints proposed for use meet Volatile Organic Compound (VOC) regulations of local air pollution control districts having jurisdiction over geographical area in which Project is located.

1.07 EXTRA STOCK

A. Leave on premises, where directed by Engineer, not less than 1 quart of each color and type used.

B. Containers shall be tightly sealed and clearly labeled for identification.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Benjamin Moore Paints.

B. ICI Paints (Devoe/Dulux).

C. Pittsburg Paints.

D. Sherwin-Williams Co.

E. Materials and colors referenced in this Section are as manufactured by Sherwin Williams Co., unless noted otherwise.

2.02 MATERIALS

A. Paint accessory materials: Linseed oil, shellac, turpentine and other materials not specifically indicated herein but required to achieve finishes specified of high quality and approved manufacturer.

B. Paints: Ready-mixed, except field catalyzed coatings. Pigments fully ground maintaining soft paste consistency, capable of readily and uniformly dispersing to complete homogeneous mixture.

C. Paints to have good flowing and brushing properties and be capable of drying or curing free of streaks or sags.

D. Dry mil thickness of paint shall comply with manufacturer's recommendations for materials specified for prevailing substrates and Project conditions.

E. Paints containing lead in excess of 0.06% by weight of total nonvolatile content (calculated as lead metal) shall not be used.

F. Paints containing zinc chromate or strontium chromate pigments shall not be used.

G. VOC content: Paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards and shall conform to restrictions of local air pollution control authority.

PART 3 EXECUTION

3.01 INSPECTION

A. Thoroughly examine surfaces scheduled to be painted prior to commencement of Work. Report in writing to Engineer, any condition that may potentially affect proper application. Do not commence until such defects have been corrected.

B. Correct defects and deficiencies in surfaces that may adversely affect work of this Section.

3.02 PROTECTION

A. Adequately protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.

B. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.

C. Place cotton waste, cloths, and material that may constitute a fire hazard in closed metal containers and remove daily from site.

D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be carefully stored, cleaned, and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

3.03 PREPARATION

A. Remove mildew, by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry completely.

B. Aluminum surfaces: Remove surface contamination by steam, high-pressure water, or solvent washing. Apply etching primer or acid etch. Apply paint immediately if acid etching.

C. Asphalt, creosote, or bituminous surfaces: Remove dirt, oil, grease, and sand if necessary to provide adhesion key. Apply compatible sealer or primer.

D. Canvas and cotton insulated surfaces: Remove dirt, grease, and oil.

E. Copper surfaces requiring paint finish: Remove contamination by steam, high-pressure water, or solvent washing. Apply vinyl etch primer or acid etch. Apply paint immediately if acid etching.

F. Copper surfaces required to be oxidized: Remove contamination. Apply oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for correct effect. Once attained, rinse surfaces well with clear water and allow to dry.

G. Gypsum board surfaces: Remove contamination and repair defects, if any.

H. Galvanized surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching type primer.

I. Zinc coated surfaces: Remove surface contamination and oils and prepare for priming in accordance with metal manufacturer's recommendations.

J. Concrete and concrete masonry:
   1. Remove dirt, loose mortar, scale, powder, and other foreign matter. Remove oil and grease with solution of trisodium phosphate, rinse well and allow to thoroughly dry.
   2. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after being thoroughly wetted with water. Allow to thoroughly dry.

K. Plaster surfaces: Fill hairline cracks, small holes, and imperfections with patching plaster. Smooth off to match adjacent surfaces. Wash and neutralize high alkali surfaces where they occur.

L. Iron and steel surfaces:
   1. Cleaning methods: Conform to applicable requirements of SSPC and NACE:
      a. Solvent cleaning: SSPC-SP1.
      b. Power tool cleaning: SSPC-SP3.
      c. Commercial blast cleaning: SSPC-SP6 or NACE 3.
      d. Power tool cleaning to bare metal: SSPC-SP11.
   2. Blast cleaning requirements: Non-submerged shall be SSPC-SP6 or SSPC-11 for areas where abrasive blast is prohibited.
   3. Cleaning for other field painting: SSPC-SP3.
   4. Removal of materials such as grease and oil: SSPC-SP1. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime surfaces to indicate defects, if any. Paint after defects have been remedied.
   5. Surface irregularities from blasting shall be approximately 25% of total paint system dry mil thickness.
   6. Sand and scrape shop primed steel surfaces to remove loose primer and rust. Feather out edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime steel including shop primed steels.

M. Wood surfaces: Wipe off dust and grit from miscellaneous wood items and millwork prior to priming. Spot coat knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried and sand between coats.

N. Prepare surfaces to be finished in conformance to recommendations of finish manufacturer.

3.04 APPLICATION

A. Apply each coat at proper consistency. Materials shall be evenly spread and applied smoothly without runs or sags, by skilled workers. Do painting under conditions suitable to production of high quality work. Follow manufacturer's directions on container label.

B. Sand lightly between coats to achieve smooth finish on wood or metal surfaces.

C. Do not apply finishes on surfaces that are not sufficiently dry.

D. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by manufacturer.

E. Where clear finishes are specified, ensure tint fillers match wood. Work fillers well into grain before set. Wipe excess from surface.

F. Back-prime exterior woodwork to receive paint finish.

G. Back-prime interior and exterior woodwork, which is to receive stain and/or varnish finish, with gloss varnish reduced 25% with mineral spirits.

H. Prime top and bottom edges of metal doors when they are to be painted.

I. Prime top and bottom edges of wood doors with gloss varnish when they are to receive stain or clear finish.

J. Where interior or exterior wood or metal are primed in mill or shop, material shall be that specified for such surfaces and shall be used in accordance with manufacturer's directions for first or prime coat. In such case, no prime coat will be required on job, except for touch-up.

3.05 MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to mechanical sections with respect to painting and finishing requirements for color coding, identification banding of equipment and piping.

B. Do not paint galvanized surfaces.

C. Do not paint electrical conduit, fittings and enclosures. Enclosures shall have factory applied finish only.

D. Remove grilles, covers, and access panels for mechanical and electrical systems from location and paint separately.

E. Finish paint primed equipment to color selected.

F. In finished areas of building, prime and paint bare pipes, hangers, brackets, collars and supports, except where items are plated or covered with prefinished coating. Color and texture to match adjacent surfaces unless otherwise directed.

G. Replace identification markings on mechanical or electrical equipment when painted over or spattered.

H. Color code equipment and piping in accordance with requirements indicated. Color banding and identification (flow arrows, naming, numbering, etc.)

3.06 CLEANING

A. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered.

B. During progress of work, keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Upon completion of work, leave premises neat and clean.

3.07 SURFACES EXCLUDED FROM PAINTING

A. Surfaces not requiring painting:
   1. Surfaces above suspended ceilings.
   2. Surfaces concealed inside mechanical and electrical chases.

B. Surfaces on which painting is prohibited:
   1. Sprinkler heads.

2. Fire detection elements.
3. Anodized aluminum surfaces.
4. Glass and mirror surfaces.
5. Chrome and stainless steel hardware items.
6. Suspended ceiling panels or suspension grid.
7. Plumbing fixtures.
8. Electrical fixtures or wiring devices.
9. Floor finishes, unless specified otherwise.
10. Wall base materials.
11. Fire extinguisher cabinets.
12. Exterior brick.
13. Door and window hardware items.
14. Factory finished items, unless specified otherwise.

3.08 PAINT SYSTEMS SCHEDULE

A. Drywall surfaces, interior.
   1. Primer, drywall: 1 coat "Prep-Rite 200" latex wall primer B28W200.
   2. Finish coats: 2 coats "Pro-Mar 200" latex "Eg-Shel" enamel B20W200.

B. Metals, interior.
   1. Primer* and touch-up on shop-primed surfaces*, on ferrous metals: "Pro-Cryl" universal metal primer B66_310.
   2. Primer, galvanized metal and aluminum: "Pro-Cryl" universal metal primer B66_310.
   3. Primer shop-primed surfaces: "Pro-Cryl" universal metal primer 366_310.

C. Concrete floors, interior.
   1. Primer: 1 coat "Armorseal" 1000 HS series (reduce 1 pint/gallon).
   2. Finish coat: 1-2 coats "Armorseal" 1000 HS series with anti-slip aggregate if required.

END OF SECTION

SECTION 09 96 00
HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coating systems for water processing facilities.

1.02 RELATED SECTIONS

A. Section 09 90 00 – Painting and Coating.

B. Section 05 60 00 – Miscellaneous Metal Fabrications.

C. Section 40 20 01 – General Requirements for Steel Piping

D. Section 40 23 15 – Fabricated Steel Specials

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.

B. Samples: Submit manufacturer's color samples showing full range of standard colors.

C. Quality assurance:
   1. Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
   2. Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:
      a. Project name and location.
      b. Name of owner.
      c. Name of contractor.
      d. Name of engineer.
      e. Name of coating manufacturer.
      f. Approximate area of coatings applied.
      g. Date of completion.

D. Warranty: Submit manufacturer's standard warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer's qualifications:
   1. Specialize in manufacture of coatings with a minimum of 10 years successful experience.
   2. Able to demonstrate successful performance on comparable projects.
   3. Single-source responsibility: Coatings and coating application accessories shall be products of a single manufacturer.

B. Applicator's qualifications:
   1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.
   2. Applicator's personnel: Employ persons trained for application of specified

coatings.

C. Mock-Ups: Prepare 2' x 2' mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application as required by the Engineer. Obtain Engineer's approval of mock-ups. Retain mock-ups to establish intended standards by which coating systems will be judged.

D. Preapplication meeting: Convene preapplication meeting 2 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Engineer, applicator, and manufacturer's representative. Review the following:
   1. Environmental requirements.
   2. Protection of surfaces not scheduled to be coated.
   3. Surface preparation.
   4. Application.
   5. Disinfection.
   6. Repair.
   7. Field quality control.
   8. Cleaning.
   9. Protection of coating systems.
   10. One-year inspection.
   11. Coordination with other work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:
   1. Coating or material name.
   2. Manufacturer.
   3. Color name and number.
   4. Batch or lot number.
   5. Date of manufacture.
   6. Mixing and thinning instructions.

B. Storage:
   1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
   2. Keep containers sealed until ready for use.
   3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Weather:
   1. Air and surface temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
   2. Surface temperature: Minimum of 5°F (3°C) above dew point.
   3. Relative humidity: Prepare surfaces and apply and cure coatings within

relative humidity range in accordance with manufacturer's instructions.

4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.

B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWA D102.

C. Dust and contaminants:
1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Carbonline.

B. DuPont.

C. Pittsburg Paints.

D. Sherwin Williams Company.

E. Tnemec Company, Incorporated.

F. Madison Chemical

G. Materials and colors referenced in this Section are as manufactured by Tnemec Company, Incorporated, 6800 Corporate Drive, Kansas City, Missouri 65120-1372. Toll free, 800.863.6321. Telephone, 816.483.3400. Facsimile, 816.483.3969. Web site www.tnemec.corn. Represented by Protective Coatings Intermountain, LLC, telephone 801.282.2327.

2.02 COATING SYSTEMS FOR STEEL - STRUCTURAL, TANKS, PIPE, AND EQUIPMENT

A. All coatings in contact with potable water must be ANS1/NSF 61 approved, Series N140 Pota Pox or equivalent. Two (2) coats at 4.0 to 6.0 mils. Dry Film Thickness (OFT) 8.0 - 12.0 mils.

B. System 2 - Interior Exposed:
1. Type: Aromatic/Epoxy.
2. Surface preparation: SSPC-SP 6, 1.5 mil blast profile.
3. Primer: Series N66 Hi-Build Epoxoline II*: OFT 2.0 to 3.0 mils.
4. Intermediate coat: Series N66 Hi-Build Epoxoline II. OFT 2.0 to 3.0 mils.
5. Finish coat: Series N66 Hi-Build Epoxolinell. DFT 2.0 to 3.0 mils.
6. Total OFT: 6.5 to 9.5 mils.
7. Finish color: As selected by Owner from manufacturer's standard colors or as indicated on Drawings.

2.03 COATING SYSTEMS FOR FACTORY PRIMED STEEL - DOORS, FRAMES, AND MISCELLANEOUS EQUIPMENT

A. System 6 - Exterior Exposed:
1. Type: Epoxy/Urethane.
2. Surface preparation: Clean and dry.
3. Primer: Factory primed.
4. Intermediate coat: Series 27 Typoxy. DFT 2.0 to 3.0 mils.
5. Finish coat: Series 73 Endure-Shield OFT 2.0 to 3.0 mils.
6. Total DFT: 4.0 to 6.0 mils.
7. Finish color: As selected by Owner from manufacturer's standard colors or as indicated on Drawings.

B. System 7 - Interior Exposed:
1. Type: Epoxy.
2. Surface preparation: Clean and dry.Primer: Factory primed.
3. Intermediate coat: Series 27 Typoxy. DFT 2.0 to 3.0 mils.
4. Finish coat: Series N69 Hi-Build Epoxoline II. DFT 3.0 to 4.0 mils.
5. Total DFT: 5.0 to 7.0 mils.
6. Finish color: As selected by Owner from manufacturer's standard colors or as indicated on Drawings.

2.04 COATING SYSTEMS FOR GALVANIZED STEEL AND NONFERROUS METAL - PIPE AND MISCELLANEOUS FABRICATIONS

A. System 8 - Exterior Exposed:
1. Type: Epoxy/Urethane.
2. Surface preparation: In accordance with manufacturer's instructions.
3. Primer: Series 1 N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
4. Finish coat: Series 73 Endura-Shield DFT 2.0 to 3.0 mils.
5. Total DFT: 4.0 to 6.0 mils.
6. Finish color: As selected by Owner from manufacturer's standard colors or as indicated on Drawings.

B. System 9 - Interior Exposed:
1. Type: Epoxy.
2. Surface preparation: In accordance with manufacturer's instructions.
3. Primer: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
4. Finish coat: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
5. Total DFT: 4.0 to 6.0 mils.
6. Finish color: As selected by Owner from manufacturer's standard colors or as indicated on Drawings.

C. System 10 - Immersion:
1. Type: Epoxy.
2. Surface preparation: SSPC-SP 1 followed by abrasive blast.
3. Primer: Series N69 Hi-Build Epoxoline II. DFT 3.0 to 5.0 mils.
4. Finish coat: Series N69 HI-Build Epoxoline II. DFT 4.0 to 6.0 mils.
5. Total DFT: 7.0 to 11.0 mils.
6. Finish color: As selected by Owner from manufacturer's standard colors or as indicated on Drawings.

2.05 COATING SYSTEMS FOR DUCTILE OR CAST IRON - PIPE, PUMPS, AND VALVES

A. System 11 - Exterior Exposed:
   1. Type: Epoxy/Urethane.
   2. Surface preparation: In accordance with manufacturer's instructions.
   3. Primer: Series N69 Hi-Build Epoxoline II. DFT 5.0 to 7.0 mils.
   4. Finish coat: Series 73 Endura-Shield DFT 2.0 to 3.0 mils.
   5. Total DFT: 7.0 to 10.0 mils.
   6. Finish color: As selected by Owner from manufacturer's standard colors or as indicated on Drawings.

B. System 13 - Interior Exposed:
   1. Type: Epoxy.
   2. Surface preparation: In accordance with manufacturer's instructions.
   3. Primer: Series N69 Hi-Build Epoxolinell. OFT 3.0 to 5.0 mils.
   4. Finish coat: Series N69 Hi-Build Epoxoline II. DFT 4.0 to 6.0 mils.
   5. Total DFT: 7.0 to 11.0 mils.
   6. Finish color: As selected by Owner from manufacturer's standard colors or as indicated on Drawings.

2.06 ACCESSORIES

A. Coating application accessories:
   1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
   2. Product of coating manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which coating systems are to be applied. Notify Engineer of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.02 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.

B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.03 APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.

C. Keep containers closed when not in use to avoid contamination.

D. Do not use mixed coatings beyond pot life limits.

E. Use application equipment, tools, pressure settings, and techniques in accordance with • manufacturer's instructions.

F. Uniformly apply coatings at spreading rate required to achieve specified DFT.

G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

H. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.04 DISINFECTION

A. Disinfection of water contact surfaces and filling of water storage tanks:

1. Do not disinfect water contact surfaces or fill water storage tanks until application of coating systems is complete, coatings have fully cured, and field quality control inspection is complete.
2. Allow number of days in accordance with manufacturer's instructions and as directed by Engineer for full cure of coating systems on water contact surfaces before flushing, disinfecting, or filling with water.
3. Disinfection: AWWA C652 or as directed by Engineer.

3.05 REPAIR

A. Materials and surfaces not scheduled to be coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.06 FIELD QUALITY CONTROL

A. Inspector's services:
1. Verify coatings and other materials are as specified.
2. Verify surface preparation and application are as specified.
3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gages.
4. Coating defects:
   a. Check coatings for film characteristics or defects that would adversely

affect performance or appearance of coating systems.

b. Check for holidays on interior steel immersion surfaces using holiday detector.

5. Report:
   a. Submit written reports describing inspections made and actions taken to correct nonconforming work.
   b. Report nonconforming work not corrected.
   c. Submit copies of report to Engineer and Contractor.

B. Manufacturer's field services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.07 CLEANING

A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.08 PROTECTION OF COATING SYSTEMS

A. Protect surfaces of coating systems from damage during construction.

3.09 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems. Inspection shall be attended by Owner, Contractor, Engineer, and manufacturer's representative. Repair deficiencies in coating systems as determined by Engineer in accordance with manufacturer's instructions.

B. Include color system to be used for identification of various materials contained in tanks and pipes. Refer to "Tnemec Color System Material Identification" in the Tnemec "Systems Guide to High Performance Coatings for Water & Wastewater Processing Facilities".

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures, general,

B. Final Reports,

C. Contractor responsibilities,

D. Preparation, Schedule of systems requiring testing, adjusting, and balancing services.

1.02 SYSTEM REQUIREMENTS

A Prepare each system for testing and balancing.

B. Cooperate with testing organization, provide access to equipment and systems. Operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.

C. Notify testing organization 14 days prior to time system will be ready for testing, adjusting, and balancing.

D. Perform specified services with Contractor's qualified personnel, or employ and pay for qualified organization to perform specified services.

E. Perform testing of control station equipment, balancing of distribution system, and adjustment of terminal devices for HVAC systems of Project.

F. Perform testing of hydronic systems, adjust and record liquid flow at each piece of equipment.

G. Provide instruments required for testing, adjusting, and balancing operations.

1. Make instruments available to Engineer to facilitate spot checks during testing.

2. Retain possession of instruments; remove from Site at completion of services.

H. Furnish material, tools, and labor required to perform start-up of each respective item of equipment, instrument, and system

I Provide information and assistance required, cooperate with test, adjust, and balance services.

J. Comply strictly with specified manufacturer's or Engineer's procedures in starting up specified systems.

1.03 CONTRACTOR SUBMITTALS

A Prior to start of Work, submit name of organization proposed to perform services. Designate managerial responsibilities for coordination of entire testing, adjusting, and balancing.

B. Submit documentation to confirm organization qualifications.

C. Submit 3 preliminary specimen copies of each of report forms proposed for use.

D. Fifteen days prior to Substantial Completion, submit 3 copies of final reports. Submit reports of testing, adjusting, and balancing which is postponed due to seasonal, climatic, occupancy, or other.

E. Schedule start-up with Engineer.

F. Contractor shall prepare instrument calibration reports in duplicate for each instrument and control loop. Include instrument calibration data and status of equipment Note any deficiencies yet to be corrected on instruments that are suitable for operation (e.g.) broken lenses, faulty local indicators on transmitters that can still perform correct output transmission) Contractor shall correct these deficiencies at earliest possible date. Copies shall be submitted for Resident Project Representative's review. Each calibration report shall be signed by Contractor's representative witnessing test
   1. Electrical systems test reports: Typewritten, listing equipment used, person or persons performing tests, date tested, circuits tested, and results of tests.
   2. Environmental test reports:
      A. Form of final reports:
         i. Each individual final reporting form must bear signature of person who recorded data and that of testing, adjusting, and balancing supervisor of reporting organization.
         ii. When more than 1 certified organization performs testing, adjusting, and balancing services, firm having managerial responsibility shall make submittals.
         iii. Identify instruments of types that were used, and last date of calibration of each.
         iv. Record and submit all data measured including air flow, liquid flows, pressure drops, motor loads and all other data requested in "Environmental Systems," this Section.

G. At completion of Work, Contractor shall submit to Owner certification that equipment has been commissioned and is in operating condition in accordance with Contract Documents.

H. Final Reports
   1. Organization having managerial responsibility shall make reports.
   2. Each form: Bear signature of recorder, and that of supervisor of reporting organization.
   3. Identify each instrument used and latest date of calibration of each.

1.04 QUALITY ASSURANCE

A. Provide testing organization services under provisions specified in Section 01 45 29.

B. Comply with procedural standards of certifying association under whose standards service will be performed.

C. Notify Engineer 5 days prior to beginning of operations.

D. Accurately record data for each step.

E. Comply with applicable procedures and standards of certification sponsoring association; either:

1. "National Standards for Field Measurements and Instrumentation, Total Systems Balance, Air Distribution-Hydronics Systems," by AABC, or "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems," by NEBB.

2. Perform services under direction of supervisor who is designated and qualified under certification requirements of sponsoring association.

3. Calibration and maintenance of instruments shall be in accordance with requirements of standards, and calibration histories for each instrument shall be available for examination.

4. Accuracy of measurements shall comply with requirements of standards.

1.05 JOB CONDITIONS

A. Prior to start of testing, adjusting, and balancing, verify that required "job conditions" are met:

1. Systems installation is complete and in full operation.

2. Outside conditions are within reasonable range relative to design condition.

3. Special equipment such as computers, laboratory equipment, and electronic equipment are in full operation.

1.06 COORDINATION

A. Coordinate services with Work of various trades to ensure rapid completion of services.

B. Promptly report to Engineer any deficiencies noted during performance of services.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide and maintain tools and test equipment in first-class condition and quantities sufficient to assure successful performance and completion of required Work.

B. Furnish and use materials in accordance with these Specifications. Materials shall be of first-class quality, free from defects or imperfections, of recent manufacture, unused and of classification and grade specified.

C. Test equipment shall have recent calibration checks by equipment manufacturer or authorized facility to assure accuracy of commissioning process.

D. Piping system joint leak testing compound: "Leak-Tek," or equal.

E. Anti-rust compound for packing gland threads and valve stems: "Moly-Cote" or "Fel-Pro."

PART 3 EXECUTION

3.01 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing. Retain possession of instruments and remove at completion of services.

B. Verify installation of system to be tested is complete and in continuous operation.

C. Verify ambient conditions and related facilities are in full operation.

3.02 MECHANICAL SYSTEMS

A. Bearings

1. Inspect for cleanliness; clean and remove foreign materials.
2. Replace defective bearings, and those that run roughly or noisily.
3. Verify ambient conditions and related facilities are in full operation.
4. Grease as necessary, and in accordance with manufacturer's recommendations.

B. Drives

1. Adjust tension in V-belt drives, and adjust varipitch sheaves and drives for proper equipment speed.
2. Adjust drives for alignment of sheaves and V-belts.
3. Clean; remove foreign materials before starting operation.

C. Motors

1. Check each motor for amperage comparison to nameplate value.

2. Correct conditions which produce excessive current flow, and which exist due to equipment malfunction.

D. Piping Systems

1. Tighten flanges after system has been placed in operation. Replace flange gaskets which show any sign of leakage after tightening.

2. Inspect screwed joints for leakage.

   a. Promptly remake each joint that appears to be faulty; do not wait for rust to form.

   b. Clean threads on both parts, apply compound, and remake joints.

3. After system has been placed in operation, clean strainers, dirt pockets, orifices, valves seats, and headers in fluid systems, to assure they are free of foreign materials.

4. Open air vents; remove operating elements. Clean thoroughly, replace internal parts and put back into operation.

5. Remove any rust, scale, and foreign materials from equipment and renew defaced surfaces.

6. Vent gasses trapped in any part of systems.

7. Check piping for leaks at every joint, and at every screwed, flanged, or welded connection.

3.03 ENVIRONMENTAL SYSTEMS

A Perform testing of central station equipment, balancing of distribution systems, and adjusting of terminal devices for:

1. Air handling units.

2. Exhaust fans.

3. Cooling water distribution systems.

B. Air Blancing:

1. Make measurements in accordance with recognized procedures and practices of certifying association.

2. Measure air volume discharged at each outlet and adjust air outlets to design air volumes within 10% over or under.

3. Adjust fan speeds and motor drives within drive limitations for required air volume. Set speed to provide air volume at farthest distance without excess static pressure.

4. Measure and adjust air supply and exhaust fan units to deliver design conditions at 100%.

5. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan.

C. Hydronic balancing:

1. Make measurements in accordance with recognized procedures and practices of certifying association.

2. Measure and adjust water flow for design conditions, within 10% over or under.

3. Check conditions at primary source equipment for performance of design conditions.

3.04 INSTRUMENTATION SYSTEMS

A Commission controls and instruments prior to start-up to assure in situ performance in accordance with specifications under simulated operating conditions. Contractor to determine initial start-up conditions.

B. Remove shipping stops from instruments before starting with procedures listed herein. Contractor shall have instruction manuals available, and shall install miscellaneous components such as charts, illumination, mercury, etc.. which have been supplied separately but are integral parts of equipment

C. If any doubt exists as to correct method for calibrating or checking calibration of instrument, manufacturer's printed recommendations shall be used.

D. Many instruments contain small supply pressure gages or output pressure gages. Calibration of these gages will not be required. However, if gage is found to be defective, instrument involved shall be immediately called to attention of Engineer and reporting of its condition confirmed in writing.

E. If any instrument cannot be properly adjusted, it shall be immediately called to attention of Engineer and report of its condition confirmed in writing.

F. Instrument check Verify data on nameplate with respect to conditions of range, operating temperature, specific gravity, and components as stated on unit specifications. Any discrepancies shall be immediately called to attention of Engineer and report of condition confirmed in writing.

G. Verify that control valve seats are free from foreign material, and are properly positioned for intended service.

H. Test procedures

1. Check handswitches, pushbuttons, and pilot lights.

2. Check interlocking circuits installed for conformance to schematic diagrams and "Sequence of Operation."

3. Perform Work of placing in initial operation equipment installed or wired under this contract, following instructions and recommendations of equipment manufacturers.

   a. After energizing and prior to start-up, check control circuits and programs for proper sequence of operation and interlocking functions.
   b. Wiring changes required as result of such checks shall be properly identified by changing terminal strip and/or wiring markers.

4. Contractor shall provide necessary construction labor to make equipment final adjustments that are required to place systems in good operating condition, and furnish labor to assist in solving instrument or control problems.

5. Contractor shall calibrate instruments and components in accordance with manufacturer's calibration data over full operational range, prove instruments to be within published specification, accuracy, and affix calibration sticker. Instruments shall be calibrated individually and where applicable, as system. Components which have adjustable features shall be carefully set for specific conditions and applications of this Project Each calibration sticker shall be signed by Contractor's representative witnessing test.

6. Calibration sticker shall contain the following information Equipment identification tag number, range of calibration, and date and name of person doing calibration.

7. Pressure gages: Shall be checked at 10%, 50%, and 90% of their ranges for linearity within Manufacturer's stated specifications.

8. Gages not meeting manufacturer's specifications shall be repaired or replaced.

END OF SECTION

SECTION 23 09 13
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. HVAC instrumentation for use with control system specified in Section 23 09 23.

1.02 RELATED SECTIONS

A Section 23 31 00

1.03 CONTRACTOR SUBMITTALS

A Specification Data Sheets for control components.

B. Complete instruction manual covering function and operation of control components.

1.04 QUALITY ASSURANCE

A. Manufacturer shall guarantee control device installed under this Specification to be free from defects in workmanship and material under normal use for a period of one year from date of acceptance of building by Owner.

B. Replace defective material or workmanship within guarantee period, immediately, without cost to Owner.

C. Control devices shall be by same manufacturer insofar as practicable. Control devices shall be provided by control system manufacturer unless noted otherwise.

PART 2 PRODUCTS

2.01 CONTROL VALVES

A. Two-way (water service):

1. Equal percentage throttling plugs.
2. Construction:
    a. 2” and smaller: ASTM B61 bronze body, screwed ends.
    b. 2-1/2” and larger: ASTM A536 ductile iron body, bronze trim, with micrometer handwheel adjustment.
3. Pressure class: 150 psig.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Size control apparatus to supply and/or operate and control devices served.

B. Install and balance control valves according to manufacturer's recommendations and system requirements.

END OF SECTION

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plumbing and HVAC system pumps, except where provided as integral part of manufactured piece of equipment, including:

1. In-line circulator

1.02 SUBMITTALS

A Shop Drawings including:
1. Pump curves.
2. Materials of construction.
3. Performance characteristics.
4. Data concerning physical dimensions.
5. Motor drive assemblies.
6. Bearings.
7. Impeller capacities.
8. Weights
9. Ratings.

1.03 DESIGN REQUIREMENTS

A Statically and dynamically balance rotating parts.

B. Construction shall permit complete servicing without breaking piping or motor connections.

C. Pumps shall operate at 1,750 rpm unless otherwise noted.

PART 2 PRODUCTS

2.01 IN-LINE CIRCULATING PUMP

A. Type: In-line circulating.

B. Casing: Bronze, rated for 175 psi working pressure.

C. Impeller: Bronze; plastic not permitted.

D. Shaft: Alloy steel with integral thrust collar and 2 oil-lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against stationary ceramic seat.

F. Trim shall be constructed of stainless steel.

G. Manufacturer: Bell & Gossett Series 80, or equal.

PART 3 EXECUTION

3.01 INSTALLATION GENERAL

A. Where pump connections and line sizes do not match, provide concentric reducers/increasers at pump connections in vertical and eccentric connections in horizontal.

B. Valves and piping specialties shall be full line size, not pump inlet or outlet size.

C. Decrease from line size with eccentric reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4" and over.

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are nonoverloading in parallel or individual operation, operate within 25% of midpoint of published maximum efficiency curve.

E. Access: Provide access space around pumps for service indicated, but in no case less than that recommended by manufacturer.

END OF SECTION

SECTION 23 73 00
CENTRAL STATION AIR HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular, indoor central station air handling unit.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittals.

B. Section 01 43 33 – Manufacturer’s Field Services.

C. Section 01 78 23 - Operating and Maintenance Data.

1.03 DESIGN CRITERIA

A Furnish units complete with fans, variable frequency drives, motors, drives, coils, drain pans, filter sections, and filter.

B. Configure units as indicated on Drawings and as scheduled.

C. Air handling unit total static pressure shall include static pressure loss of casing and components furnished within unit.

D. Motor furnished with fan shall not operate into motor service factor. Drive efficiency shall be considered in motor selection according to manufacturer's published recommendation, or in accordance with AMCA Publication 203, Appendix L.

E. Fans shall be statically and dynamically balanced and shall operate without objectionable noise or vibration throughout entire range of fan speed.

F. Design air handling unit to meet the requirements of ASHRAE 62.

G. Equivalent fan selections shall not increase motor horsepower, increase noise level, increase tip speed by more than 10%, or increase inlet or outlet air velocity by more than 20%, from that of unit specified.

1.04 SUBMITTALS

A Product Data:

1. Catalog data showing selection and options.
2. Manufacturer's Installation Instructions.
3. Fan curves showing cfm, static pressure and rpm, brake horsepower for operating range of 10% above and below design condition.
4. Manufacturer's operation and maintenance data.
5. Spare parts list.

B. Shop Drawings including:

1. Dimension drawings.
2. Fan curves.
3. Sound ratings.

4. Material of construction.
5. Weights.
6. Tag numbers.
7. Vibration isolation.
8. Motor data.

C. Operation and maintenance manuals

1.04 QUALITY ASSURANCE

A Insofar as practicable, provide air handling units of same manufacturer throughout.

B. Provide fans within the scope of AHRI Standard 430 shall be certified in accordance with AHRI Standard 430.

C. Provide filter media with UL Class I or Class II rating, as required by local authorities.

D. Units shall be UL and C-UL Listed.

E. Materials shall meet requirements of NFPA 90A and 90B.

F. Flame smoke ratings:
1. Flame spread: 25 or less.
2. Fuel contributed: 50 or less.
3. Smoked developed: 50 or less.

G. Comply with AMCA standards for testing and rating fans, and testing louvers, dampers, and shutters.

H. Comply with SMACNA duct construction standards for air handling units.

I. Materials exposed to output of UVC emitter shall be compatible with UVC emitter output.

J. Indoor air handling units will be shipped stretch-wrapped to protect unit from in-transit rain and debris, per ASHRAE 62.1 recommendations.

1.05 JOB CONDITIONS

A Do not operate fans for any purpose, temporary or permanent, until ductwork is clean, filters are in place, and bearings are lubricated.

1.06 COORDINATION

A Coordinate with other work, including ductwork, wiring, controls, and piping to interface installation of air handling units with other work.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A Indoor units:
1. Trane.
2. Or approved equal.

2.02 CASINGS

A Panels:
1. Mount equipment and support exterior reinforced steel panels from structural steel frame. Weld or bolt and seal seams. Removal of side panels shall not affect structural integrity of unit.
2. Construction: All unit panels shall be 2" solid, double-wall construction to facilitate cleaning of unit interior. Unit panels shall be provided with a mid-span, no-through-metal, internal thermal break.
3. Casing thermal performance shall be such that under 55°F supply air temperature and design conditions on the exterior of the unit of 81°F dry bulb and 73°F wet bulb, condensation shall not form on the casing exterior.
4. Casings shall be suitable for pressures scheduled The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.00 times design static pressure. Maximum design static shall not exceed +8 inches w.g. in all positive pressure sections and -8 inches w.g. in all negative pressure sections, vibration free with no oil-canning.
5. Provide closed-cell foam gasketing between individual modules of air handling units.
6. Insulation: Panel insulation shall provide a minimum thermal resistance (R) value of 13 ft^2-h-ºF/Btu throughout the entire unit. Insulation shall completely fill the panel cavities in all directions so that no voids exist and settling of insulation is prevented. Panel insulation shall comply with NFPA 90A.

B Access Door Construction:
1. Access doors shall be 2" double wall construction. Interior and exterior door panels shall be of the same construction as the interior and exterior wall panels respectively.
2. All doors shall be provided with a thermal break construction of door panel and door frame. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.
3. Surface mounted handles shall be provided to allow quick access to the interior of the functional section and to prevent through cabinet penetrations that could likely weaken the casing leakage and thermal performance. Handle hardware shall be designed to prevent unintended closure.
4. Access doors shall be hinged and removable for quick easy access. Hinges shall be interchangeable with the door handle hardware to allow for alternating

door swing in the field to minimize access interference due to unforeseen job site obstructions. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.

5. Door hinges shall be galvanized.
6. All doors shall be a minimum of 60" high when sufficient height is available, or the maximum height allowed by the unit height

C Finish:

1. Indoor unit: All exterior and interior indoor AHU panels will be made of galvanized steel.

D Unit Base: Manufacturer to provide a full perimeter integral base frame for either ceiling suspension of units or to support and raise all sections of the unit for proper trapping. Indoor unit base frame will either be bolted construction or welded construction with a base height of 6-inches. Contractor will be responsible for providing a housekeeping pad when unit base frame is not of sufficient height to properly trap unit. Unit base frames shall be constructed of galvanized steel. Unit base height to be included in total height required for proper trap height.

E Drain pans:

1. Fabricate from single piece of galvanized steel with welded corners.
2. Provide under cooling coils and entire fan section and shall be of sufficient size to collect all condensate produced from the coil.
3. Insulate casing drain pans with minimum of 1/2" formed in place insulation.
4. Slope in 2 directions. Drain pan shall drain dry to meet the requirements ASHRAE 62.1.
5. The outlet shall be the lowest point on the pan; and shall be of sufficient diameter to preclude drain pan overflow under normally expected operating conditions. All drain pans connections shall have a threaded connection, extending a minimum of 2-1/2" beyond the unit base, and shall be made from the same material as the drain pan.

2.03 FAN

A The fan type shall be provided as required for stable operation and optimum energy efficiency.

B The fan shall be a double-width, double-inlet, multiblade-type, forward-curved (FC) fan.

C The fan shall be equipped with self-aligning, antifriction bearings with an L-50 life of 200,000 hours as calculated per ANSI/AFBMA Standard 9. For any bearing requiring relubrication, the grease line shall be extended to the fan support bracket on the drive side.

D The fan shall be statically and dynamically balanced at the factory as a complete fan assembly (fan wheel, motor, drive, and belts). The fan shaft shall not exceed

75 percent of its first critical speed at any cataloged speed.

E Fan wheels shall be keyed to the fan shaft to prevent slipping. The fan shafts shall be solid steel. The fan section shall be provided with an access door on the drive side of the fan.

F Fans that are selected with inverter balancing shall first be dynamically balanced at design RPM. The fans then will be checked in the factory from 25% to 100% of design RPM to insure they are operating within vibration tolerance specifications, and that there are no resonant frequency issues throughout this operating range. Inverter balancing that requires lockout frequencies inputted into a variable frequency drive to in order to bypass resonant frequencies shall not be acceptable. If supplied in this manner by the unit manufacturer, the contractor will be responsible for rebalancing in the field after unit installation. Fans selected with inverter balancing shall have a maintenance free grounding assembly installed on the fan motor to discharge both static and induced shaft currents to ground.

G Drive Service Factor: The drives shall be constant speed with fixed-pitch sheaves. The drives shall be selected at a minimum 50 percent larger than the motor brake horsepower (1.5 service factor).

H Vibration isolators:

1. The fan and motor assembly (on sizes 10 to 120) shall be internally isolated from the unit casing with 2-inch (50.8 mm) deflection spring isolators, furnished and installed by the unit manufacturer.
2. The isolation system shall be designed to resist loads produced by external forces.

I Motors:

1. Fan motor size and location indicated or scheduled.
2. The fan section shall have motor leads extended to a factory-installed NEMA external junction box to facilitate field supplied starter or VFD wiring and to maintain air leakage integrity of the casing.
3. The motor shall be mounted integral to the isolated fan assembly and furnished by the unit manufacturer. The motor is mounted inside the unit casing on an adjustable base to permit adjustment of drive belt tension (not applicable for direct drive plenum fans). The motor shall meet or exceed all NEMA Standards Publication MG 1 requirements and comply with NEMA Premium efficiency levels when applicable except for fractional horsepower motors which are not covered by the NEMA classification. The motor shall be T-frame, squirrel cage with size, type, and electrical characteristics as shown on the equipment schedule.

2.04 FILTERS

A Flat filter boxes:

1. Arrangement:
    a. Flat. Provided as part of mixing box.
    b. Limit filter velocity, based on gross area, to maximum 500 ft/min.
    c. Provide access doors both sides.
2. Filter:
    a. Provide 4" thick pleated media filter made with 100% synthetic fibers.
    b. Minimum Efficiency Reporting Value (MERV) 8 rating tested in accordance with ASHRAE Standard 52.2.
    c. Filters shall be capable of operating up to 625 fpm face velocity without loss of filter efficiency and holding capacity.
    d. Provide clean filters at final acceptance by Owner.
    e. Provide 2 spare sets of filters to Owner for each filter section at final acceptance by Owner.
    f. Filter size shall match existing filter dimensions of AHU-1 and AHU-2, for compatibility.

2.05 COILS

A Comply with requirements of Section 23 82 16.

B Coils shall be equal to sizes and capacities scheduled.

C Coils mounted in casing shall be accessible for service and shall be removable from each side of unit without dismantling entire unit. See drawings for required coil connections.

D Provide sealing collars to prevent leakage where coil connections penetrate unit casing or end panel.

E The coil section shall be provided complete with coil and coil holding frame.

F The coils shall be installed such that headers and return bends are enclosed by unit casings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install air handling units in accordance with manufacturer's installation instructions.

B. Filter section shall be accessible for filter replacement.

C. Floor units: Mount on concrete equipment bases.

D. Install coils to be easily removable.

E. Extend insulated condensate drain piping from drip pan to floor drain, minimum 1-1/4" diameter.

F. Provide trap in condensate drain line. Depth of trap shall be equal to fan static pressure plus 3”.

G. Provide positive equipment ground for air handling unit components.

H. Lifting Instructions:

1. The air handling units must be rigged, lifted, and installed in strict accordance with the Installation, Operation, and Maintenance manual (CLCH-SVX07G-EN). The units are also to be installed in strict accordance with the specifications. Units may be shipped fully assembled or disassembled to the minimum functional section size in accordance with shipping and job site requirements.

2. Indoor units shall be shipped on an integral base frame for the purpose of mounting units to a housekeeping pad and providing additional height to properly trap condensate from the unit.

3. Units to be shipped with the necessary number of lift points for safe installation. All lifting lugs are to be utilized during lift. The lift points will be designed to accept standard rigging devices and be removable after installation.

3.02 TESTING

A. Upon completion of installation of air handling units, start-up and operate equipment to demonstrate capability and compliance with Specifications.

B. Provide manufacturer's field services for start-up as listed in Section 01 43 33.

C. Where required, field correct malfunctioning units. Retest to demonstrate compliance.

D. Except as otherwise indicated, test air handling unit in accordance with ARI Standard 410.

END OF SECTION

SECTION 23 82 16
COILS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chilled water coils.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittals.

B. Section 01 78 23 - Operating and Maintenance Data.

1.03 DESIGN CRITERIA

A Coil is designed with aluminum or copper plate fins and copper tubes. Coil has airflow arrow and nameplate attached to coil casing.

B. Air handling unit shall be furnished with two sperate cooling coil sections with connections being made on the left-hand side and right-hand side of the unit.

C. All material or equipment in contact with the cooling water shall be NSF/ANSI 61 and NSF/ANSI 372 compliant.

1.04 SUBMITTALS

A Product Data:
1. Data concerning dimensions, capacities, materials of construction, ratings, weights, and appropriate identification.
2. Manufacturer's Installation Instructions.
3. Manufacturer's descriptive literature, operating instructions, and maintenance and repair data.
4. Spare parts list.
5. Operation and maintenance manuals.

1.05 QUALITY ASSURANCE

A Certify coil capacities, pressure drops, and selection procedures in accordance with ARI Standard 410.

B Coil shall be fabricated by the air handling manufacture to maintain consistence in quality and reliability.

PART 2 PRODUCTS

2.01 AIR HANDLER WATER COILS

A Characteristics:
1. Type “W” chilled water coil.
2. A single-row serpentine coil, with 5/8” OD cooper tubing. Tubes shall have a wall thickness of 0.035”.
3. Coil is proof tested at a minimum of 300 psig and leak tested to 200 psig, air pressure under water. Suitable for working pressures up to 200 psig.

4. Cleanable-type, removable coil for complete access for mechanical cleaning. Coil.
5. Coils are to be a split coil system. Nominal coil height to be 51” with a finned length of 36”.

B Fins:
1. Aluminum fins.
2. Fins have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes.

C Coil Casing:
1. Coil casing and supports are manufactured with galvanized steel. Provide rigid top and bottom channels.
2. Allow for expansion and contraction of finned tube section.

D Turbulators: Silicon bronze, spring turbulators are fitted in tubes for increased heat transfer at lower water tube velocities.

PART 3 EXECUTION

3.01 INSTALLATION

A. Support coil sections on steel channel or double-angle frames and secure to casing.

B. Arrange supports for cooling coils to avoid piercing or short-circuiting drip pans.

C. Bolt casings to other section, ductwork, or unit casings.

D. Install airtight seal between coil and duct or unit cabinets.

E. Make connections to coils, including valves, air vents, unions, and connections from drip pans.

F. Install isolation valve on supply line and balancing valve on return line from each water coil.

G. Protect coils so fins and flanges are not damaged.

H. Replace loose or damaged fins.

I. Level serpentine coils and install cleanable tube coils and steam coils with 1:50 pitch.

J. Comb out bent fins.

K. Cooling coils: Pipe condensate pan to nearest drain with trap.

END OF SECTION

SECTION 26 00 00
ELECTRICAL GENERAL CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

A. The General Conditions of these Specifications shall form a part and be included under this section of the Specifications. The Contractor shall provide all supervision, labor, material, equipment, machinery and any other items necessary to complete the electrical systems. All items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items of equipment as indicated on the Drawings, and as required for complete systems.

1.02 WORK UNDER THIS DIVISION

A. It shall be noted that this Section of the Specifications includes:

1. A - GENERAL
2. B - ELECTRICAL REQUIREMENTS

1.03 CODES, RULES, PERMITS, FEES

A. The Contractor shall give all necessary notices, obtain all permits and pay all government and state sales taxes, fees, and other costs, including utility connections or extensions, in connection with his work; file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment of the work.

B. All materials furnished and all work installed shall comply with the current adopted Edition of the National Electrical Code, with the requirements of local utility companies, and with the requirements of all governmental departments having jurisdiction.

C. All material and equipment for the electrical portion of the system shall bear the approval label, or shall be listed by Underwriter's Laboratories, Incorporated or another Nationally Recognized Testing Laboratory (NRTL) approved by OSHA and the local electrical inspector.

1.04 INTENT

A. It is the intention of these specifications and drawings to call for finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete and ready for use."

1.05 SURVEYS AND MEASUREMENTS

A. The Contractor shall base all measurements, both horizontal and vertical from established benchmarks. All work shall agree with these established lines and levels. Verify all measurements at site and check correctness of same as related

to the work.

B. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Engineer, through the General Contractor, and shall not proceed with his work until he has received instructions from the Engineer.

1.06 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the contract. The engineering drawings and details shall be examined for exact locations of fixtures and equipment. Where they are not definitely located, this information shall be obtained from the Engineer.

B. The Contractor shall follow drawings in laying out work, and check drawings of other trades to verify spaces in which work will be installed.

1.07 "OR EQUAL"

A. Wherever the words “or equal" or “equal to” or “equivalent” are used in connection with any specified material, it is to be understood that such words mean any material or work of any kind claimed to be an equal in quality to the work or material specified, but does not require prior written approval by the Engineer.

B. Wherever the words "approved equal" or "prior approved equivalent" are used in connection with any specified material, it is to be understood that such words mean any material or work of any kind claimed to be an equal in quality to the work or material specified and shall be so approved in writing by the Engineer.

C. It is further understood that no material or work shall be presented to the Engineer as work or material equal to that specified with the full understanding on the part of the manufacturers and agents for the so called "equal" material, and the full understanding on the part of the Contractor, that the Engineer is to use his own judgment in the matter, that his decision is final, and that in the event of an adverse condition, no claim of any sort shall be made against the Owner or Engineer.

1.08 SHOP DRAWINGS

A. The Contractor shall submit for approval, detailed shop drawings of all equipment and all material required to complete the project, and no material or equipment may be delivered to the job site or installed until the Contractor has in his possession the approved shop drawings for the particular material or equipment. The shop drawings shall be completed as described by Specification Section 01 33 00 – Submittal Procedures.

1.09 EQUIPMENT DEVIATIONS

A. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the

structure, partitions, foundations, piping, wiring, or any other part of the mechanical, electrical, or structural layout, all such redesign and all new drawings and detailing required therefore shall be prepared by the Contractor at his own expense and approved by the Engineer.

B. Where such approved deviation requires a different quantity and arrangement of wiring, conduit, and equipment from that specified or indicated on the drawings, the Contractor shall furnish and install any such controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system at no additional cost to the Owner.

1.10 COOPERATION WITH OTHER TRADES

A. This Contractor shall give full cooperation to other trades and shall furnish in writing to the Contractor, with copies to the Engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. Where the work of the Contractor will be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If the Contractor installs his work before coordinating with other trades or so as to cause any interference with work of other trades, he shall make the necessary changes in his work to correct the condition without extra charge.

C. The Contractor shall furnish to other trades, as required, all necessary shop details for the proper installation of work and for the purpose of coordinating adjacent work.

D. Refer to other Divisions of the Specifications for equipment furnished by others and work required thereof by the Contractor.

1.11 PROTECTION

A. The Contractor shall protect all work and material from damage by his work or workmen and shall be liable for all damage thus caused.

B. The Contractor shall be responsible for work and equipment until finally inspected, tested, and accepted; he shall protect work against theft, injury or damage; and shall carefully store material and equipment received on site, which is not immediately installed. He shall close open ends of work with temporary covers or plugs during storage and construction to prevent entry of obstructing material.

1.12 SCAFFOLDING, RIGGING, HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any electrical equipment and electrical apparatus furnished. Remove same from premises when no longer required.

1.13 MATERIAL AND WORKMANSHIP

A. All materials and apparatus required for the work, except as specifically specified otherwise, shall be new of first-class quality, and shall be furnished, delivered, erected, connected, and finished in every detail, and shall be so selected and arranged as to fit properly into the available spaces. Where no specific kind or quality of material is given, a first-class standard article as approved by the Engineer shall be furnished.

B. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation or work, together with all skilled workmen, helpers, and labor required to unload, transfer, erect, connect up, adjust, start, operate, and test each system. The job superintendent shall be a Master Electrician licensed in the State that the work is being performed.

C. Unless otherwise specifically indicated on the plans or specifications, all equipment and materials shall be installed with the approval of the Engineer in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

1.14 APPLICABLE STANDARDS

A. Provide work in accordance with applicable rules, codes, ordinances and regulations of local, state, federal governments, and other authorities having lawful jurisdiction. Conform to the latest editions and supplements of codes, standards, and recommended practices.

B. Drawings and specifications indicate minimum construction standards. Should any work indicated be substandard to any ordinances, lower codes, rules or regulations bearing on work, the Contractor shall promptly notify the Engineer in writing, through the General Contractor, of any necessary changes to be adjusted. However, if Contractor provides any work knowing it to be contrary to any ordinances, laws, rules and regulations, he shall thereby have assumed full responsibility and bear all costs involved for correction and compliance. In any instance where the specifications call for materials for construction of a better quality or larger size than required by codes, provisions of these specifications shall take precedence. Codes shall govern in case of direct conflict between codes, plans and specifications.

1. SAFETY CODES:
    a. National Electrical Safety Code Handbook H30-National Bureau of Standards
    b. Occupational Safety and Health Standard (OSHA) - Department of Labor
2. NATIONAL FIRE CODES:
    a. NFPA 70 - NATIONAL ELECTRIC CODE, current adopted Edition.
3. UNDERWRITERS LABORATORIES, INC.
    a. UL 508A Standard
    b. All applicable UL standards as referenced in other section.
4. Third Party Certification

a. All equipment not bearing a UL listing shall be provided with a third-party certification stamped by registered Professional Engineer licensed in the state of which the work is being performed.

5. The Projects Location Applicable STATE ELECTRICAL BOARD
   a. Laws, Rules, Wiring Standards, and all applicable local state standards.

1.15 TESTS AND OPERATION RECORDS

A. General: Test all equipment installed under this specification and demonstrate its proper operation to the Engineer. No equipment shall be tested or operated for any other purpose, such as checking motor rotation, until it has been fully lubricated in accordance with manufacturer's instructions and, if it is a centrifugal pump, until it has been connected to piping systems and supplied with sufficient water so that it will not run dry.

1. Any defects in workmanship, material, equipment or any grounds or short circuits shall be corrected by the Contractor before final acceptance.
2. Submit a searchable electronic copy or a minimum of three (3) copies of data noted below to Engineer prior to final inspection.
3. Maintain a marked set of drawings to record all deviations made from routes, locations, circuiting, etc. shown on contract drawings. Prior to final inspection submit one new set of project drawings with deviations and changes clearly indicated.

B. Testing: The entire electrical system shall be tested by Contractor in presence of the Engineer. Every local switch, panelboard, service breaker, safety switch, and circuit breaker shall be operated under load conditions. Every fixture and equipment tested and operated. Test shall include any tests specified in any part of this section.

1. Contractor shall measure resistance of electrical system with a "Megger" from busses of main switch to ground with main breaker open, and bonding jumper between neutral and ground temporarily removed. Values are to be determined with all panelboards, motor controls and switch circuits open. If any value measured is less than 100,000 ohms, each feeder shall be measured and must exceed those set forth in Article 110 of National Electrical Code, before they shall be accepted. Typewritten test results shall be furnished to the Engineer.

C. Recording and Distribution

1. Record nameplate horsepower, amperes, volts, phase, efficiency, service factor and other necessary data on motors, and other electrical equipment furnished and/or connected under this contract.
2. Record motor starter catalog number, size and rating and/or catalog number of thermal overload units installed in all motor starters furnished and/or connected under this contract. See motor starter specifications for instructions for proper sizing of thermal overload units.
3. Record ampere per phase at normal or near normal loading of each item of equipment furnished and/or connected.

4. Record voltage and ampere per phase readings taken at service entrance equipment after completion of project with operation at normal electrical load.
5. Record all VFD settings, solid-state motor controller settings, electronic overload relay settings, relay settings, device settings, and related electronic equipment setting.
6. Record all instrumentation and device calibration settings.
7. Distribute copies of all recorded information to the Engineer along with the project O&M manuals.

1.16 DEMONSTRATION OF COMPLETED ELECTRICAL SYSTEMS

A. General: Upon completion of entire electrical systems, Contractor shall demonstrate to Engineer's satisfaction that all installed electrical systems are in perfect operating condition, that they perform all power and control functions intended and that they are installed in strict accordance with project drawings and specifications.

B. Materials: Contractor shall provide all necessary testing equipment, tools, materials, dummy loads, etc., required to properly demonstrate performance.

1.17 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Provide O/M manuals per Specification Section 01 78 23 – Operation and Maintenance Data.

PART 2 ELECTRICAL REQUIREMENTS

2.01 BASIC MATERIALS

A. General: Material and equipment installed under this contract shall be new, unused, and without damage. Physical size of equivalent or substitute equipment shall not be larger than space provided including space required for access and maintenance of equipment.

END OF SECTION

SECTION 26 05 05
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 3 EXECUTION

2.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Engineer before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

2.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Obtain permission from Owner at least 96 hours before partially or completely disabling system.

2.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

2.04 CLEANING AND REPAIR

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. See Section 01 74 23 - Final Cleaning for additional requirements.

C. Clean and repair existing materials and equipment that remain or that are to be reused.

END OF SECTION

SECTION 26 05 10
LARGE MOTORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Medium-voltage, 3-phase, induction, squirrel cage electric motor rated 1250HP.

1.02 RELATED SECTIONS

1.03 SYSTEM DESCRIPTION

A. The motor shall be furnished as a package with the Vertical Turbine Can Pump specified in Section 44 42 56.

B. Motors shall be rated to continuously supply power at rated load, and capable of supplying short-term overload condition calculated by multiplying rated horsepower of motor by service factor at rated voltage and frequency.

C. Motor rated load at rated power factor shall exceed driven equipment load by 15% unless otherwise agreed by Owner.

D. Motors shall not exceed temperature rise specified when supplying power at nameplate rated horsepower of motor.

E. Location is indoors..

F. Site elevation is 4560 feet.

G. Maximum ambient temperature is 104°F.

1.04 SUBMITTALS

A. Submit:

1. Completed Data Sheets.
2. Motor list identifying equipment by name, horsepower or kW rating, voltage requirements, and number of phases.
3. List of recommended start-up parts, spare parts, and maintenance tools.
4. Recommended long term and short-term storage requirements and procedures.
5. Warranty data.

B. Shop Drawings:

1. Complete and updated Data Sheets.
2. Certified detailed drawings showing dimensions, anchor locations, weight, lifting points, center of gravity, enclosure construction, and layout of accessories.
3. Interconnection wiring drawings with terminal points clearly labeled.
4. Interface coordination details.
5. Lube oil fittings.

C. Product Data:

1. List of instruments and accessories, model number, and operating ranges.
2. Motor curves showing starting current and power factor at 80%, 90%, and 100% terminal voltage.
3. Motor torque versus speed curves at 80%, 90%, and 100% voltage.
4. Motor load versus efficiency curves.
5. Torque versus speed curve for driven equipment.
6. Motor hot and cold thermal damage curves.

D. Quality assurance data: Certified shop test reports.

E. Operation and maintenance manuals. Provide at a minimum:

1. General description and technical data.
2. List of instruments and accessories supplied, listing manufacturer, model number, operating ranges, and equipment tag numbers.
3. Receiving, storage, installation, and testing instructions.
4. Operating and maintenance procedures.
5. Complete set of reviewed drawings that require no further action.
6. Completed Data Sheets modified to include field installation conditions.
7. Complete documentation of inspections and tests performed, including logs, curves, and certificates. Documentation shall note any replacement of equipment or components that failed during testing.
8. Recommended spare parts list that includes bearings.
9. Lubrication recommendations.
10. Bearing temperature limits.
11. Winding temperature limits.
12. Installation field reports.

1.05 QUALITY ASSURANCE

A. Manufacturer's qualifications:

1. Manufacturer shall manufacture motor and major motor components and shall be ISO certified.
2. Manufacturer shall have produced similar equipment for minimum period of 10 years.

B. Regulatory requirements:

1. Motors shall be in accordance with applicable requirements of ANSI C50.41, NEMA MG-1, NFPA 70, and UL 1004.
2. Standards of foreign organizations shall not be used.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Coordinate transportation with requirements of pertinent authorities.

B. Ship equipment to job Site, or to drive equipment supplier assembly facility, for installation.

C. During delivery and storage, handle motors carefully to prevent damage, denting, or scoring.

D. Store motors and components in clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage in accordance with manufacturer's instructions.

1.07 TEMPORARY POWER

A. Motors furnished with space heaters shall have heaters connected to temporary source of power capable of being monitored.

B. Maintain temporary power until motors are installed in final position and normal power source is permanently energized.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACT URERS

A. U.S. Motors

B. General Electric.

C. Siemens.

D. Prior Approved Equal

2.02 ENCLOSURE

A. Furnish motors with lifting eyes so lifting slings do not become entangled in any apparatus mounted on motor.

B. Materials potentially exposed to process fluids or corrosive atmospheres shall be Type 316L stainless steel or other corrosion-resistant material specifically selected for expected environment.

C. Do not use copper or copper alloy for air coolers.

D. Bolts and nuts exposed to environment shall be Type 316L stainless steel.

2.03 VOLTAGE AND FREQUENCY

A. Nominal voltage: 4160 Volts, three phase.

B. Nominal frequency: 60 Hz.

C. Motor shall be designed and rated for use on Adjustable Frequency Drive (AFD) power system and shall be inverter duty.

D. Motors shall be capable of rated output at 75% of nominal voltage and frequency for 1-minute without overheating.

E. When starting, locked rotor current shall not exceed that defined by "Locked Rotor Code Letter" specified. Locked-rotor currents during low voltage starting shall not exceed 750% of motor full load current.

F. Motor shall be suitable for at least 2 consecutive hot starts with motor initially at ambient conditions. Motor shall be capable of 1 start with motor at rated operating temperature without causing degradation to motor.

2.04 CHARACTERISTICS

A. Motor nameplate horsepower shall cover full range of driven equipment load.

B. 1790 nominal RPM at 60 Hz power:

C. 1.15 Service Factor.

D. Motor shall be sufficient to start and operate connected loads at designated speeds in installed environment, and within operating sequence without exceeding nameplate ratings.

E. Ratings shall include allowance for altitude and maximum temperatures as required by site conditions.

F. Temperature rise shall not exceed temperature for motors with class of insulation as specified on Data Sheets, at standard ambient conditions and elevation.

G. Temperature rise shall not be exceeded when tested under fully rated nameplate values at standard ambient conditions and elevation.

H. Equip vertical motors coupled to vertical turbine pumps with spark-resistant, non-reversing ratchets, and bolted couplings.

I. Design vertical in-line pump motors to withstand up-or-down thrust loads that may occur during pump startup or operation.

2.05 MOTOR FRAME

A. Motor frames shall be fabricated of heavy-duty cast steel or plate steel weldments with stator assembly firmly anchored to frame.

B. Provide case drip shields.

C. Motor frame, end brackets, fan covers, drip shields, and bearing housing shall be corrosion-resistant, with motor supporting feet case as integral part of frame.

D. Provide motors with stainless steel drains and plugs. Locate drain holes at low point of motor in mounted position.

E. Drill and tap two 3/8", 16-pitch bolt holes for use as ground connections.

1. Vertical frames: Junction box side and opposite of junction box side.

2.06 BASE

A. Base shall be capable of supporting heaviest weight for motor rating without bending, flexing, or vibrating.

2.07 STATOR ASSEMBLY

A. Maintain assembly in alignment and hold under compression with through bolts and end rings. Use only high-grade material, consistent with operating efficiency.

B. Stator assembly shall be firmly anchored to frame.

C. Windings shall be copper.

D. Insulation:

1. Vacuum pressure impregnation (VPI). Windings shall undergo minimum of 2 VPI and bake cycles.

E. Resistance temperature detectors (RTD) shall be platinum rated 100 ohms at 0°C.

1. Provide 2 per phase in stator windings, evenly spaced apart.
2. RTD leads shall be insulated, stranded, copper wire extended and terminated on terminal blocks in accessibly mounted junction box.

2.08 ROTOR AND SHAFT ASSEMBLIES

A. Machine motor shaft from corrosion-resistant forged steel or cold-rolled steel bar stock; capable of transmitting torque produced by motor.

B. Rotor bars and end rings shall be of copper or copper alloy.

C. Rotor shall be epoxy-coated.

D. Motor rotating components shall be dynamically balanced (at rated speed) after mounting on shaft. Motor vibration shall not exceed peak-to-peak amplitude values given in NEMA MG-1 standards when measured in accordance with those standards. In addition, magnitude of vibration values for running speed and 120 Hz vibrations shall not exceed 0.5 mil peak-to-peak or less in any plane.

E. Dynamically balance motors by one of following means:

1. Drilling out parent metal in such a manner that structural strength of rotor is not weakened.
2. Use of balance washers securely pinned in place.
3. Chiseling, sawing, or use of solder or similar deposit materials to achieve balance is not acceptable.

2.09 BEARINGS

A. Anti-friction type bearings shall have minimum rated life L10 100,000 hour rating with a median life no less than 50% of L10 life, as defined by AFBMA. Reliability of each bearing shall be greater than 90%.

B. Provide bearings sized to carry all imposed loads with minimum design safety factor of 2.0.

C. Bearings shall be vacuum-degassed steel, motor quality.

D. Construct and provide bearing and bearing housing with seals to prevent dirt or moisture from entering motor. Provide interior bearing caps to prevent lubricant from entering motor.

E. Bearing supports: Integral to case as part of motor end bell. Ensure proper bearing alignment and air gap spacing.

F. Design bearings so as not to be damaged by axial rotor movement during motor startup or shutdown.

G. Provide double-shielded bearings using high-temperature greases on motors for air cooler fan applications.

H. Bearings for motors driving vertical pumps, including in-line pumps, shall be designed to carry 200% of maximum thrust, up and down, which pump may develop during starting or stopping or while operating at any capacity on rated performance curve. Minimum continuous up-thrust capacity shall be equal to 30% of down-thrust at rated capacity. Thrust bearings for in-line pump motors shall be at upper end of motor.

I. Equip each bearing with platinum RTDs rated 100 ohms at 0°C, one per bearing. Wire and terminate RTD leads on terminal blocks in a common externally mounted junction box.

2.10 LUBRICATION SYSTEM

A. Bearing housing shall have extra large oil reservoirs to serve as settling chambers.

B. Fit each bearing housing with either constant-level, sight-feed oil or a sight gage mounted on housing, marked with proper oil level.

C. Oil system shall have sufficient surge capacity to absorb, without overflowing, oil returned from bearings when motor is stopped.

D. Fit bearing housings with fill and drain openings, stingers, equalizers, vents, and other devices to prevent loss of lubricant.

E. Inlet lines shall be not less than 1/2" diameter.

2.11 MOTOR FANS

A. Key fans to motor shaft. Slip-fitted with setscrews not acceptable.

B. Provide stainless steel hardware.

2.12 SPACE HEATERS

A. Mount low surface-temperature space heaters on inside of motor frame.

B. When operating at 110% of rated voltage and ambient temperature, sheath temperature shall not exceed 200°C. Heaters shall be de-energized while motor is in operation.

C. Space heaters shall be rated and designed to operate at 120 Volts AC.

D. Space heaters shall automatically maintain temperature inside motor at 5°C above ambient.

E. Route space heater power leads to dedicated terminal box near RTD terminal box.

2.13 MOTOR TERMINAL BOXES

A. Equip each motor with corrosion-resistant terminal boxes.

1. Provide main terminal box for motor power lead terminations.
2. Provide separate control terminal box for termination of space heaters and RTD leads, providing separation of voltage as required by NEC.

3. Terminate instrumentation in low-voltage instrument terminal box separate from main box. Mount instrument terminal box near control terminal box.

B. Size motor main terminal box to allow for bending radius and stiffness of motor supply cables as specified in Section 26 18 38, and for terminating grounding conductor. At a minimum, size main terminal box at least one size larger than listed in NEMA MG-1.

C. Provide grounding lugs inside main terminal box to accommodate incoming earth conductors. Size lugs in accordance with NEC.

D. Motor leads shall have brass, stainless steel ferrules embossed with appropriate lead number, or leads imprinted with lead number.

E. Motor lead connections shall be tinned.

F. Main terminal boxes shall have required bushings, standoff insulators, insulation barriers, and hardware for completing line connections.

G. Terminal boxes shall be weatherproof and dust-tight and fitted with neoprene gaskets.

H. Provide motor lead seal and separator gasket between motor frame and terminal box.

I. Provide motor lead terminal boxes with threaded hub for 3” conduit.

J. Motor lead insulation shall be oil-resistant.

2.14 NOISE AND VIBRATION

A. Equipment shall not exceed sound pressure levels of 85dBA at 3' from equipment surface in accordance with NEMA MG-1.

B. Vibration limits shall meet requirements of NEMA MG-1.

C. Provide vibration monitoring instrument: Metrix model 440-SR-2140-0220 only. 24 VDC operating voltage, relay output, 0.2-3.0 inches/second range, internal transducer, 20 second power-up timed inhibit.

D. Design to keep torsional and rotational natural frequencies of vibration at least 25% above or below motor rated speed ranges to avoid resonant vibration over operating speed range of motor and driven equipment.

2.15 IDENTIFICATION AND TAGGING

A. Provide motor with stainless steel nameplates attached with stainless steel screws or pins in locations clearly visible and readable without requiring unsafe condition.

B. Nameplate shall contain standard information in accordance with NEMA MG 1 and following additional information:

1. Serial number and year of manufacture.
2. Type of bearing lubricant and specification number.

3. Arrow indicating direction of rotation for main lead connections.
4. Bearing type and manufacturer's part number.

C. Starting duty nameplate, including following information:

1. Start(s) with motor at maximum ambient temperature.
2. Start(s) with motor at rated operating temperature.
3. Hours with motor shutdown before re-start.

D. Motor power and space heater circuits shall be derived from different sources.

2.16 SOURCE QUALITY CONTROL

A. Perform following routine and typical tests complying with NEMA MG-1 and tests specified in Data Sheets:

1. Full load current, locked rotor current, and power measurements.
2. Vibration test in accordance with NEMA MG 1.
3. Locked-rotor current measurement.
4. Full load heat run.
5. Power factor at full load, 3/4 load, 1/2 load, and under locked rotor conditions.
6. Percent slip at rated load.
7. Vibration measurements.
8. Machine noise level test in accordance with IEEE 85.
9. Breakdown torque calculation, and pullout and starting torque measurements.
10. Efficiency and power factor measurements for 1/2, 3/4, and full-rated loads in accordance with IEEE 112, Test Method B.
11. Current balance measurement.
12. Winding resistance measurement, before and after heat run.

B. In event that motor fails tests, additional tests will be witnessed at discretion of Owner at no additional cost to Owner.

C. Test results shall be tabulated, submitted, and accepted by Engineer prior to shipment.

D. Defects and defective equipment revealed or noted during testing will be corrected prior to shipment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Installation will require the use of a crane to lower the motor through a building roof hatch. Temporary removal of the conductor termination enclosure may be required to fit through the hatch.

END OF SECTION

SECTION 26 05 13
MEDIUM VOLTAGE CABLE

PART 1 GENERAL

1.01 SUMMARY

A. Related Documents:

1. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes:

1. Single conductor, medium voltage power cable.
2. Cable Grounding.
3. Medium voltage cable splicing and terminations.
4. Testing of medium voltage cable, splices and terminations.

C. Related Sections:

1. Section 260500 - Electrical General Conditions
2. Section 260534 - Conduit
3. Section 261200 - Padmount Distribution Transformers
4. Section 261300 - Medium Voltage Switchgear

1.02 REFERENCES

A. General:

1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
3. The latest edition of NFPA 70, National Electric Code (NEC).

B. AEIC CS8

C. ICEA Publication No. S-93-639/NEMA WC74

D. ICEA Publication No. S-97-682

E. ICEA Publication No. T-29-520

F. IEEE 48 - Test Procedures and Requirements for High-Voltage Alternating Current Cable Terminations.

G. IEEE 1202 / CSA FT4

H. NEMA WC 8 - Ethylene Propylene Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

I. NETA – National Electrical Testing Association

J. Underwriters' Laboratories, Inc. (UL 1072).

K. UL 1685 (Sizes 1/0 AWG and larger) UL Flame Exposure Test

L. UL Listed as Type MV-105 for use in accordance with NEC, UL File # E90501

M. SUBMITTALS

1. Submit in accordance with Specification Section 01 33 00 - Submittal Procedures.
2. The manufacturer's Shop Drawings shall include the following information:
   a. Diameter of cable.
   b. Weight of cable in pound per foot.
   c. Complete description of cable, insulation production compound code number.
   d. Trade name.
   e. Written warranty.
   f. Recommend splicing and termination methods.
   g. Recommended bending radius.
   h. Maximum length of cable on standard reel.
   i. Lead Time.
3. Calculations: The Contractor shall provide pulling tension and sidewall pressure calculations for pulling in both directions of each cable pull. Include drawings of actual duct layouts indicating duct lengths, size and material and bend radius and degrees of arc between pulling points.
4. Product literature and samples of materials for circuit labeling.

N. QUALITY ASSURANCE

1. Manufacturer's Qualifications: Company experienced in manufacturing Products specified in this Section with minimum of 10 years.
2. Cable Splicer Qualifications:
   a. Workers' Competency: Submit high voltage cable splicer certification of competency and experience 30 days before splices or terminations are made in high voltage cables. Splicer experience during the immediate past three years shall include performance in splicing and terminating cables of the types and classification being provided under this contract.
   b. A notarized listing of relevant projects completed by the proposed splicer during the past three years and completed formal training must be submitted to demonstrate qualifications.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. 15 kV - General Cable with Concentric Neutral

B. 5kV - General Cable Spec 6155

C. Kerite Equals

D. Okonite Equals

E. Southwire Equals

F. Prior Approved Equals

2.02 CABLE SYSTEM

A. This Specification describes requirements for 5kV and 15kV Class (133 percent Insulation level) shielded power cable for use in power distribution. Cable provided must be single conductor, jacketed, and insulated with a high quality, heat, moisture, impact, ozone, and corona resistant thermosetting (ethylene propylene) rubber that shall be suitable for use in wet or dry locations in conduit, underground duct systems, direct burial, and aerial installations.

B. Conductors:

1. Conductors shall be annealed bare copper compact Class B Stranded.

C. Strand Shield:

1. Extruded thermoset semi-conducting polymeric stress control layer over conductor. Material shall be compounded in the cable manufacturer's facility using clean room technology.
2. Thickness: Per ICEA S-93-639 / NEMA WC74 and ICEA S-97-682

D. Insulation (15kV):

1. Insulation shall be an ethylene propylene rubber (EPR) compound rated at 105 deg C for normal operation.
2. The average insulation thickness shall be not less than 220 mils; the minimum thickness at any point shall not be less than 90 percent of the specified average thickness.

E. Insulation (5kV):

1. Insulation shall be an ethylene propylene rubber (EPR) compound rated at 105 deg C for normal operation.
2. The average insulation thickness shall be not less than 115 mils; the minimum thickness at any point shall not be less than 90 percent of the specified average thickness.

F. Insulation Shielding:

1. Extruded thermoset semi-conducting polymeric layer, free stripping from the insulation. Material shall be compounded in the cable manufacturer's facility using clean room technology.
2. Thickness: Per ICEA S-93-639 / NEMA WC74 and ICEA S-97-682

G. Metallic Tape Shield

1. The metallic tape shield shall be constructed of 5 mil annealed Copper with a minimum 25% overlap.

H. Overall Jacket:

1. Low Friction Black Flame Retardant Polyvinyl Chloride (FR-PVC) jacket shall be applied directly over the metallic tape shield.
2. The overall jacket shall be free stripping from the shielding tape.

I. Electrical and Physical Tests:

1. Qualification tests in compliance with Section B, AEIC CS6-79 are required for each shielded cable furnished.

2. All materials used in construction of the cables shall be tested in compliance with the application paragraphs of ICEA S-68-516.
3. All completed cables shall successfully pass the following tests prescribed in ICEA publication S-68-516:
    a. Par. 6.5 - Aging.
    b. Par. 6.27 - Voltage.
    c. Par. 6.28 - Insulation Resistance.
    d. Par. 6.29 - Partial Discharge Extinction (Corona) Level.
    e. Par. 6.23 - Discharge Residence.
4. Test methods and frequency of tests shall be as prescribed in Part 6 ICEA S-68-516.

J. Cable Identification: The following information shall be indicated, by means of a surface legend printed in compatible ink of contrasting color, at intervals not to exceed 24 inches (600 mm) over the entire length of the cable:

1. Manufacturer
2. Conductor size
3. Conductor Type
4. Insulation Thickness
5. Insulation Material:
6. Voltage Class:
7. Insulation Level
8. Date of manufacture. (Month & Year)
9. Sequential Footage Marks

K. Reel Identification: Each reel shall have printed on the reel or a weatherproof (metal or plastic) tag firmly attached indicating:

1. Manufacturer's name.
2. Conductor material.
3. Conductor size.
4. Insulation type and thickness.
5. Jacket thickness.
6. Temperature rating.
7. Length of cable.
8. Manufacturer's type.
9. Voltage class.
10. Purchaser' s purchase order number and item number.
11. Cable weight.
12. Reel weight.
13. Shielded or non-shielded.
14. Date of manufacture.

L. Shipment: The cable shall be shipped in continuous lengths as specified by the Contractor. The shipment shall be made on carefully inspected nonreturnable reels if possible. Cable ends shall be securely fastened to the reel using polypropylene rope ties. Metal ties shall not be used. Cable ends shall be completely sealed against moisture and contaminants. The cable on the reel shall be protected with ply board or tekboard lagging held securely in place with

steel banding.

M. Conductor and Shield Continuity: Each length of completed cable shall be tested for conductor and shield continuity.

N. Cable Terminations

1. Silicon Rubber Termination:
   a. Description: All terminations used shall be compatible with the MV cable used and be suitable for the application in which it will be used. Terminations shall be of the cold shrink type and be constructed of silicone rubber specifically formulated as a high track resistant material with hydrophobicity to ensure a long life expectancy. All terminations shall meet or exceed IEEE 48 requirements.
   b. Ratings:
      1) Voltage Rating: 5 kV or 15 kV as applicable to the application
      2) Insulation Level: 133%
      3) BIL Level: 95kV
      4) Conductor Size: As Indicated on the Drawings
      5) Cable and Shield Type: As Specified herein
      6) Conductor Material Copper
      7) Termination Location: As indicated on the Drawings
   c. Use Areas Requirements
      1) Interior Locations: A termination intended for use where it is protected from solar radiation and precipitation and not subject to periodic condensation, or other excessive humidity. These areas are primarily isolated to area that contain air conditioning and heating.
         (a) Termination shall be of the tubular or skirted type. The Contractor shall verify requirements with the equipment manufacture that this termination is intended to be used on.
      2) Exterior Locations: A termination intended for use where it is not protected from the direct exposure to either solar radiation or precipitation.
         (a) Termination shall be of the skirted type. The Contractor shall verify requirements with the equipment manufacture that this termination is intended to be used on.
   d. Manufacturers:
      1) 3M Cold Shrink QT-III
      2) Cooper Power Systems
      3) Prior Approved Equal

O. Loadbreak Elbows - 15kV

1. Description:
   a. The loadbreak elbows shall be submersible rated, fully shielded, and be ideal for connecting underground cable to transformers, switchgear, sectionalizing cabinets and junctions where indicated. All load break elbows used shall be compatible with the MV cable used and be suitable for the application in which it will be used. All

load break elbows used shall be provided with a test point, ground strap suitable to be used with cables which have a tape shield, and integral jacket seal.

b. The loadbreak elbows shall meet the electrical, mechanical, and dimensional requirements of IEEE Std 386 and shall be designed to be fully interchangeable with other major manufacturers currently complying with IEEE Std 386.

2. Ratings:
   a. Voltage Class: 15 kV
   b. Max Phase to Phase Voltage: 14.4 kV
   c. Max Phase to Ground Voltage: 8.3 kV
   d. AC 1 Minute Withstand: 34 kV
   e. DC 15 Minute Withstand: 34 kV
   f. BIL and Bull Wave Crest: 95 kV
   g. Minimum Corona Voltage Level: 11 kV
   h. Continuous Current (rms): 200A
   i. Switching Current: 10 make/break operations at rated continuous current and at the rated Max Phase to Phase Voltage.
   j. Fault Closure: 10kA rms symmetrical at the rated Max Phase to Phase Voltage for a minimum of 0.17 seconds after 10 switching operations.
   k. Short Time: 10kA rms symmetrical for 0.17 seconds, 3.5kA rms symmetrical for 3.0 seconds.

3. Manufacturers:
   a. Cooper Power Systems LE215 Series
   b. 3M Equal to the Cooper Power System device noted above
   c. Prior Approved Equal

MAXIMUM DISCHARGE VOLTAGE (KV CREST) 8/20 MICROSECONDS CURRENT WAVE							
DUTY CYCLE VOLTAGE RATING (KV)	MCOV (KV)	EQUIV. FRONT-OF-WAVE CREST (KV CREST)	1.5 KA	3 KA	5 KA	10 KA	20 KA
3	2.55	11	9	9.7	10.7	11.4	13
6	5.1	22	18	19.4	20.8	22.7	26
9	7.65	31.7	26	28	30	32.8	37.4
10	8.4	33	27	29.1	31.2	34.1	38.9
12	10.2	41.5	33.9	36.6	39.2	42.9	48.9
15	12.7	51.8	42.4	45.7	49	53.6	61.1
18	15.3	62.2	50.9	54.9	58.8	64.3	73.4

2.03 CONDUCTOR/CABLE LABELS (MEDIUM VOLTAGE CIRCUITS ONLY)

A. Description: Cable circuit labels shall be constructed of PVC, with black lettering on a colored substrate which matches the respective Phase. Provide a polyethylene holder, attached to the cable by two nylon self-locking ties. At a minimum each cable shall be labeled as follows:

1. For conductors entering a transformer, switchgear, manhole, sectionalizing cabinet, generator, motor or any other like equipment each cable shall be labeled as follows:
   a. "CIRCUIT # AND PHASE (PHASE A, B, C, OR NEUTRAL) - FROM (EQUIPMENT NAME), (CABLE LENGTH IN FEET)
2. For conductors exiting a transformer, switchgear, manhole, sectionalizing cabinet, generator, motor or any other like equipment each cable shall be labeled as follows:
   a. "CIRCUIT # AND PHASE (PHASE A, B, C, OR NEUTRAL) - TO (EQUIPMENT NAME), (CABLE LENGTH IN FEET)
3. The Contractor shall install a cable label which indicates the identical information contained on the conductor jacket as well as the circuit # as found on the Drawings if the information found on the conductor jacket is not visible once it enters a piece of equipment. This tag shall be laminated and secured to the cable via a nylon self-locking tie.

PART 3 EXECUTION

3.01 MEDIUM VOLTAGE CABLE INSTALLATION

A. Carefully protect cable from mechanical damage. Provide suitable mechanical protection for reels.

B. Pull cable directly from reels into the ducts. It may not be laid on the ground or otherwise handled for cutting or sorting. Pulling lubricant, UL listed and compatible with the cable being pulled, as manufactured by IDEAL or equal shall be generously applied. Pulling tension (lbs.) not to exceed 0.008 times the circular mil cross sectional area of the conductor or as recommended by the equipment manufacturer. Cables shall not be pulled through more than one intermediate manhole on one pull. Cable ends shall be sealed against moisture after pulling. Pull ropes shall be nonmetallic to prevent cutting of duct materials.

3.02 MEDIUM VOLTAGE CABLE TESTING

A. Following cable installation and end terminations being completed, but not connected to equipment, the Contractor shall notify the Engineer when the installation is available for testing.

B. Each conductor shall be individually tested with other conductors grounded. Shields shall be grounded.

C. A dc high potential shall be applied in at least 8 equal increments until a maximum voltage is reached as recommended by the cable manufacturer. Dc leakage current shall be recorded at each step, allowing stabilization time for system charging current decay. A graphic plot shall be made of leakage current (x axis) versus voltage (y axis) at each increment.

D. The tested conductor shall be raised to the maximum test voltage and held for fifteen minutes. Readings of leakage current (y axis) versus time (x axis) shall be recorded and plotted at thirty second intervals for the first two minutes and then at each minute thereafter.

E. A shield continuity test shall be performed by the ohmmeter method. The ohmic value shall be recorded.

END OF SECTION

SECTION 26 05 19
POWER AND INSTRUMENTATION CABLE - LESS THAN 600V

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnish and install all conductors to accomplish the circuiting, control and power distribution as shown on the Drawings.

B. Related Work:

1. Section 26 05 34 - Conduit
2. Section 26 05 53 - Identification For Electrical Systems

1.02 REFERENCE STANDARDS:

A. U.L. 486A - Wire connectors

B. NEMA WC5-1973

C. NEMA WC30-1976

D. NFPA 70 (National Electrical Code)

E. NFPA 79

1.03 DELIVERY, STORAGE, AND HANDLING:

A. Deliver conductors to project on standard coils or reels and suitably protected from weather and damage during storage and handling.

PART 2 PRODUCTS

2.01 CONDUCTORS

A. Type P1 - 600V Rated General Purpose Single Conductor Cable

1. Construction:
   a. No. 14 AWG and larger: Stranded Copper, (THHN/THWN-2). Solid conductors will not be permitted.
   b. All conductors shall contain factory color coded insulation in all standard colors to match the voltage level used.
   c. Sequential footage markers shall be factory installed on the insulation jacket.
   d. Aluminum conductors not permitted.
2. Feeder Conductors:
   a. 98 percent conductivity copper, 600 volt insulation.
3. Branch Circuit Conductors:
   a. 98 percent conductivity copper, 600 volt insulation.
   b. Conductors smaller than No. 14 AWG not permitted except in control panel.
4. Project Use Areas:
   a. All general use indoor building circuiting.

5. Manufacturer:
    a. Service Wire Co.
    b. Okonite Co.
    c. Southwire
    d. Belden
    e. Alpha Wire

B. Type S2 - Signal Cable - 3 Conductor - Shielded/Twisted

1. Construction
    a. 3-condcutor, twisted, 100% shield coverage, 18 AWG, stranded (7 x 26) tinned copper conductors.
    b. 300V minimum insulation rating
    c. 90 deg C PVC primary insulation
    d. Conductors shall be shielded with a .35 x 5 mil (min.), 100% coverage, aluminum or copper mylar tape shield, or equal with an 18 gauge strand copper drain wire.
2. Ratings/Listings:
    a. UL Temperature Rating: 75 deg C Dry, 90 deg C wet
    b. ICEA S-73-532, S-61-402
3. Project Use Areas:
    a. Motor RTD Circuits
4. Manufactures:
    a. Service Wire Co.
    b. Okonite Co.
    c. Southwire
    d. Belden
    e. Alpha Wire
    f. Or Equal

C. Type D4 - Cat 6 Ethernet Cable

1. EIA/TIA Category 6, 4-pair, 22 gauge, FEP Teflon plenum rated premise wiring cable.
2. Category 6 cables shall all be terminated in eight-conductor TIA-568-B CAT6, RJ-45 compliant snagless modular connectors. Refer to Section 40 95 13 for module type.
3. Project Use Areas:
    a. Network circuiting as defined on the Drawings.
4. Manufactures:
    a. Belden
    b. Mohawk/CDT
    c. Approved Equal

2.02 CORD CONNECTOR GRIPS

A. Manufacturer: Killark “Z” series or equal

B. Type: Aluminum cord connector, stainless steel mesh grips, straight or 90° as required in eliminating sharp cable bending radii.

C. Use: To support all cables/cords from the enclosure at their point of use and/or wherever cables/cords enter or leave the bottom of conduit risers (above grade). Required for all cord connections to motors or enclosures.

2.03 BOLTED, PRESSURE TYPE CONNECTORS

A. Manufacturer: Burndy or equal

B. Use: Connecting conductors to busbars, suitable for copper and aluminum conductors.

C. Size: As required for conductor.

2.04 SOLDERLESS CONNECTORS

A. Manufacturer: 3M "Scotchlok" or equal

B. Type: Twiston, spring tension.

C. Use: With copper conductors only.

PART 3 EXECUTION

3.01 INSTALLATION

A. All conductors shall be installed within conduit or approved raceway unless noted otherwise on drawings.

B. Draw conductors into conduit only after conduit system is complete. Install in a manner so as not to injure insulation.

C. Use stranded, copper conductors only. Solid conductors are not acceptable.

D. Make splices on branch circuit conductors with solderless stapleless, mechanical wire connectors.

E. Tighten bolted, pressure type connectors to manufacturer's recommendations.

F. No. 10 AWG and smaller shall be stranded copper for all motor and control circuits. Branch circuits for lighting and convenience outlets shall be solid copper.

G. All branch circuit homeruns greater than 50 feet shall be #10 minimum.

H. Make splices and terminations in control panel by using bolted, pressure type connections. Install according to manufacturer's recommendations.

I. Provide strain relief cord connectors and stainless steel mesh on all cords entering motor termination boxes, junction boxes or conduits.

J. Use factory color coded conductors with separate color for each phase and neutral conductor by integral pigmentation for all conductor sizes.

K. Use following codes:

CONDUCTOR SYSTEM VOLTAGE-120/208, THREE PHASE

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Equipment Ground	Green

CONDUCTOR SYSTEM VOLTAGE-277/480, THREE PHASE

Phase A	Brown
Phase B	Orange
Phase C	Yellow
Neutral	Gray
Equipment Ground	Green

L. Lace or clip groups of feeder conductors in control panel, pull boxes, and wireways.

M. Use wiring pulling lubricant for pulling No. 4 AWG and larger wire.

N. Splice only in accessible junction or outlet boxes.

3.02 CABLE INSTALLATION CERTIFICATIONS

A. Installations and terminations of Ethernet network cabling shall be performed by BICSI Installer 2 certified installers with INSTC and INSTF certifications.

B. Contractor shall submit installer certification to project engineer prior to installation of any network cabling.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnish and install a complete grounding system for all electrical equipment at the facility.

B. Related Work:

1. Section 26 05 19 - Power And Instrumentation Cable - Less Than 600V
2. Section 26 05 34 - Conduit
3. Section 26 12 00 - Padmounted Distribution Transformers

1.02 DESCRIPTION OF SYSTEM

A. Bond electrical equipment, control panels, panelboards, etc. to the metallic conduit system through conduit connectors or bonding jumpers, as required, to provide effective electrical continuity.

1.03 QUALITY ASSURANCE

A. NFPA - 70, Article 250.

PART 2 PRODUCTS

2.01 GROUNDING CONDUCTORS

A. Copper, with green identification as specified in Section 260519.

2.02 GROUND CLAMPS (CONCEALED)

A. Compression type grounding which meets IEEE 837.

B. Manufacturer: Panduit StructuredGround

2.03 GROUND FITTINGS AND LUGS (EXPOSED)

A. Manufacturer: Equal to Burndy Company

2.04 GROUND LUG

A. Located in electrical equipment as indicated on the Drawings.

PART 3 EXECUTION

3.01 POWER SYSTEM GROUNDING

A. Main Service

B. Provide a properly sized copper grounding conductor in all branch circuit and feeder conduits. Size the conductor according to Table 250-122 of the National Electric Code. Connect the grounding connector to grounding points (grounding

bars, ground studs, etc.) in all electrical enclosures, electrical equipment, junction boxes and outlet boxes.

C. Ground and bond in accordance with National Electric Code, Article 250.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 26 05 34 - Conduit: Additional support and attachment requirements for conduits.

D. Section 26 05 37 - Boxes: Additional support and attachment requirements for boxes.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

D. MFMA-4 - Metal Framing Standards Publication 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment, and other potential conflicts installed under other sections or

by others.

5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as

required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.

4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Indoor Dry Locations: Use hot dipped galvanized materials unless otherwise indicated on the Drawings.
    b. Outdoor and Damp or Wet Indoor Locations: Use 304 stainless steel unless otherwise indicated on the Drawings.
    c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel, malleable iron, or 304 stainless steel as noted on the Drawings for each area.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2 inch diameter.
    b. Busway Supports: 1/2 inch diameter.
    c. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
    d. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
    e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.

F. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use expansion anchors or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Steel: Use beam clamps, machine bolts, or welded threaded studs.
6. Plastic and lead anchors are not permitted.
7. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Owner.

H. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

END OF SECTION

SECTION 26 05 34
CONDUIT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnish and install a complete conduit system for all conductors. Low voltage control conductors and fiber optic cabling shall be installed within a conduit as well.

B. Related Work:

1. Section 26 05 19 - Power And Instrumentation Cable - Less Than 600V
2. Section 26 05 37 - Boxes
3. Section 26 05 53 - Identification For Electrical Systems

1.02 REFERENCE STANDARDS:

A. U.L. 6 - Rigid metal conduit.

B. U.L. 360 - Liquid-tight flexible steel conduit.

1.03 DELIVERY, STORAGE AND HANDLING:

A. Store in a dry area, protected from the weather.

PART 2 PRODUCTS

2.01 RIGID METAL CONDUIT

A. Manufacturer: Equal to the Wheatland Steel Company

B. Type: Steel heavy wall, galvanized unless noted otherwise on Drawings.

C. Minimum trade size is 3/4-inch; other sizes as required by NEC based on quantity of conductors.

2.02 FLEXIBLE METAL CONDUIT (LIQUID-TIGHT)

A. Manufacturer: Equal to Alflex

B. Type: Steel

C. Weatherproof covering

PART 3 EXECUTION

3.01 INSTALLATION

A. Size conduits as shown on the Drawings or as required by National Electrical Code (whichever is larger) for number and size of conductors installed.

B. Minimum trade size for home runs is 3/4-inch.

C. Contractor shall not exceed 270 degrees of bend in any single conduit run without an additional pull point unless otherwise noted in drawings.

D. All raceways shall have an equipment ground conductor installed. The raceway shall not be utilized as an EGC.

E. Support all conduits from structural system, independent of ductwork, ceiling system supports and main runners. Do not support conduit from conduit.

F. Cut conduit joints square and ream smooth. Make bends with an approved bender or utilize standard conduit elbows.

G. Contractor shall core drill floors where floor penetrations are required. See the Drawings for specific requirements pertaining to non-destructive testing requirements.

H. Keep an air gap between conduit and finished wall surfaces to reduce the potential of moisture induced corrosion. Route all conduits parallel to and at right angles to building lines. Conduits mounted directly in contact with wall surface will not be acceptable.

I. Tie wires to hang or strap conduits not permitted.

J. Route conduit continuous from outlet to outlet, outlet to cabinets, outlet to pull or junction boxes. Secure conduit to all boxes using sealing-type locknuts and bushings or Myers Hubs in such manner that each system is electrically continuous throughout.

K. Surface mount conduit in all areas, unless noted otherwise. All conduits and outlet boxes on the building exterior shall be flush mounted where possible. If not, install conduits within the building and then penetrate the wall directly into the back of light/outlet/etc. Intent is to eliminate/minimize the usage of surface mounted conduit on the exterior face of the building.

L. Cap ends of conduit to prevent entrance of foreign materials during construction.

M. Provide watertight installation where conduits pass through roof, wall, or waterproofing membranes.

N. Conduit systems must be installed complete before conductors are pulled in.

O. Fill conduits which can admit air to or release air from air plenums through the connecting conduit system with sealing compound.

P. All conduit bodies shall be of the malleable iron type. LR and LL style conduit bodies are not permitted to be installed without approval from the Engineer.

3.02 RIGID METAL CONDUIT

A. <u>Metallic:</u>

1. Rigid Metal Conduit is required for all exposed conduits unless otherwise noted on the Drawings.

3.03 FLEXIBLE METAL CONDUIT (LFMC):

A. Use rain tight flexible metal conduit with rain tight fittings for final connections to motors (nonhazardous areas), and fixed control devices (nonhazardous areas) that do not come with factory installed cords. Minimum trade size is 1/2-inch.

B. Length shall be limited to trade size: 3/4" or less = 36"; 1" or larger = 48" unless a longer length is required and approved by the Engineer. Minimum 12". Use permitted only to avoid transmission of vibration or noise and where flexibility to entry is required. All other uses shall be approved by engineer.

C. Engineer reserves the right to request re-work of all flexible metal conduit exceeding lengths exceeding specified or installed where not permitted in 3.04 C above.

END OF SECTION

SECTION 26 05 37
BOXES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnish and install all outlet boxes, junction boxes and pull boxes required to accomplish device and equipment installation, wire pulling shown on the Drawings and to comply with National Electric Code requirements for conduit and conductor installation.

B. Related Work:

1. Section 26 05 19 - Power And Instrumentation Cable - Less Than 600V
2. Section 26 05 34 - Conduit

1.02 SHOP DRAWINGS AND PRODUCT DATA:

A. Submit in accordance with Specification Section 01 33 00 – Submittal Procedures.

1.03 WORK INSTALLED BUT FURNISHED BY OTHERS:

A. Back boxes for selected items of equipment are furnished by the equipment supplier. Refer to individual Specification Sections for mounting, size, etc.

1.04 REFERENCE STANDARDS:

A. U.L.

B. NEMA

1.05 DELIVERY, STORAGE AND HANDLING:

A. Store materials in a dry area, protected from the weather.

PART 2 PRODUCTS

2.01 PULL BOXES

A. Manufacturer: Hoffman or Equal

B. Type: Metal hot-dipped galvanized construction, conforming to National Electric Code, with screw on or hinged cover, unless specifically noted otherwise on drawings.

C. NEMA 12 unless otherwise noted on the Drawings.

D. Overlapping covers with flush head cover retaining screws, prime coated for flush mounted pull boxes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not use sectional or handy boxes.

B. Protect outlet boxes from entrance of foreign materials, including paint, during the construction period.

C. Pull boxes and junction boxes are not indicated on Drawings except for special requirements. Install pull boxes or junction boxes as required to facilitate pulling wire. Size pull boxes and junction boxes as required by National Electric Code.

D. All conduits entering pull boxes shall have the conduit ID as shown on the cable and conduit schedule clearly labeled on the interior and exterior of the pull box using a Brady manufactured printable label or equal.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Equipment to be identified includes transformers, switchgear, and all wires and terminations.

PART 2 PRODUCTS

2.01 INSTRUCTION SIGNS

A. Plastic sandwich-type acrylic based construction of contrasting colors equal to Rowmark. Engraving through top layer exposes inner layer.

B. Color: Black with white letters.

C. Letters: 1/8-inch height, standard block type.

D. Punched or drilled for mechanical fasteners. Fasteners shall be self tapping stainless steel screws with nuts and flat lock washers.

2.02 EQUIPMENT IDENTIFICATION LABELS

A. Self-adhered, engraved, laminated acrylic or melamine label.

B. Color: Black with white letters.

C. Letters: 3/8-inch minimum height, standard block type.

D. Punched or drilled for mechanical fasteners. Fasteners shall be self tapping stainless steel screws with nuts and flat lock washers.

2.03 WIRE MARKERS

A. All wires requiring circuit indication shall be permanently fastened type written. No hand written labels shall be acceptable.

B. Wire markers shall be Shrink Tube type as specified below.

C. Shrink Tubing type wire markers:

1. All shrink tube type markers shall be type written with circuit indication.
2. 3:1 heat-shrinking type
3. Resistant to chemicals, grease, oil and cleaning agents.
4. Material shall be Polyolefin with smudge-proof finish.
5. Material shall be cold resistant and flame-retardant
6. Temperature range: -67 to 275 degrees Fahrenheit.
7. Manufacturer: Brady or equal

D. Special Requirements pertaining to the RTU Control Panel

1. The Contractor shall field identify all wires being installed to the RTU Control Panel.
2. The Contractor shall turn over all required wire labels as specified above to the Owner for installation by the Owner.
3. The Owner will be completing all wire terminations within the RTU Control Panel.

2.04 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated. Weather resistant, non-fading, metal backed or baked enamel signs to be used for outdoor installations.

2.05 POWER SOURCE LABELS FOR EQUIPMENT AND DEVICES

A. Self-adhered label, installed on the front cover, door, or other access to equipment and devices unless otherwise indicated. Weather resistant, non-fading, metal backed or baked enamel signs to be used for outdoor installations.

B. Self adhesive labels, shall be Brady or equal.

C. Apply to all panels, junction boxes, receptacle faceplates, switch faceplates, front covers, doors, or other access to equipment unless otherwise indicated. See Part 3 for Execution.

2.06 CABLE AND CONDUIT IDENTIFICATION

A. Each cable or conduit shall be identified using a permanent identification system consisting of a round 304 stainless steel engraved tag secured to the cable or conduit 6" from entry at both ends. Install tag in suitable location readable from normally accessed side.

B. The following information shall be provided on each conduit label:

1. Line #1 - Conduit ID found on the Cable and Conduit Schedule (where applicable)

PART 3 EXECUTION

3.01 INSTALLATION

A. Identify with black acrylic based placard with white engraved letters mounted with drive pins or other approved fasteners.

3.02 EQUIPMENT LABELING

A. Label per NEC Article 408.4 (A) & (B) and with the following information: Equipment name, voltage, phase, and amperage/type of main.

B. Provide each panelboard with an updated neatly typed directory, with clear plastic cover, of circuits describing loads served.

C. All markings are to be plainly visible, fit over the insulation of the conductor and begin 1/8” from where the insulation begins.

D. Wire markers shall be provided by the Contractor and placed on both ends of all wires prior to termination.

E. All wiring shall be checked for circuit completeness to verify correct circuiting, identification and labeling at the terminals. Terminal markings and wire markings shall match “record schematics” as provided by Control Integrator.

F. Hand lettering of identification not permitted. Completely remove temporary labels used during construction and repaint surface if required.

3.03 POWER SOURCE LABELS FOR EQUIPMENT AND DEVICES

A. Provide a mechanically fastened power source label at all equipment and devices with the following information:

1. EXAMPLE: LPA-11 or LPA-13,15 or DPA-1,3,5.

B. All equipment and devices such as panels, junction boxes, receptacle faceplates, switch faceplates, front covers, doors, or other access to equipment shall include an adhesive backed label that indicates the power source for said equipment.

3.04 CONDUIT AND CIRCUIT LABELING AT POINT OF ENTRY TO LARGE ENCLOSURES

A. Label all conduits and circuits at the point of entry to large enclosures (control panels, pull boxes, junction boxes, motor control centers, etc.) with the conduit/circuit number from the Cable and Conduit Schedule.

B. Labeling shall be done on the interior of the enclosure or on the floor near each conduit/circuit, or on the conduit itself in some cases. All conduits/circuits that enter enclosures shall be labeled.

C. Labeling with a permanent marker shall be in addition to any circuit tags installed around the cables themselves.

3.05 GROUNDED (NEUTRAL) CONDUCTOR IDENTIFICATION

A. Follow NEC 200.6. In addition to the part (D) identification requirements for the grounded conductor when different systems are in close proximity - Example: Non-Emergency UPS and Utility power sharing a common junction box or multi-channel raceway. Where broken, to prevent crossing of grounded/neutral conductors, the non-utility system's neutral wires shall all have wire markers identifying it as the system to which it belongs.

END OF SECTION

SECTION 26 12 00
PADMOUNTED DISTRIBUTION TRANSFORMERS

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the padmounted transformer(s) as specified herein and as shown on the Drawings.

1.02 RELATED SECTIONS

A. Section 26 05 19 - Power And Instrumentation Cable - Less Than 600V

1.03 REFERENCES

A. The padmounted transformer(s) and all components shall be designed, manufactured, and tested in accordance with the latest applicable NEMA (NEMA 210), IEEE and ANSI standards (ANSI C57).

1.04 SUBMITTALS – FOR REVIEW/APPROVAL

A. See Section 01 33 00 - Submittal Procedures for additional requirements.

B. The following information shall be submitted to the Engineer:

1. Front view elevation or outline drawing and weight
2. Nameplate diagram
3. Conduit entry/exit locations
4. Ratings (on nameplate) including:
    a. kVA
    b. Primary and secondary voltage
    c. Taps
    d. Basic Impulse level
    e. Impedance
        1) Product data sheets
5. Where applicable, the following additional information shall be submitted to the Engineer:
    a. Busway connection
    b. Specified accessories

1.05 SUBMITTALS – FOR CONSTRUCTION

A. See Section 01 33 00 - Submittal Procedures and Section 01 78 23 - Operating and Maintenance Data for additional requirements.

B. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
2. Wiring diagrams
3. Production test reports
4. Installation information
5. Seismic certification as specified

1.06 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.07 REGULATORY REQUIREMENTS

1.08 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.09 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

1.10 FIELD MEASUREMENTS

A. Measure primary and secondary voltages and make appropriate tap adjustments.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cooper

B. ABB

C. Square-D

D. Prior Approved Equal

E. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if preapproved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS

A. The ratings of each transformer shall be as follows or as shown on the drawings:

1. Transformer T-2:
   a. kVA Rating: 4,000 kVA ONAN
   b. Impedance: 5.6 +- 7.5 %

c. HV: 12,470 kV, Wye
d. HVBIL: 95 kV
e. HV de-energized Taps: 4 +/- 2 - 2-1/2% full capacity
f. LV: 4160 V, Wye
g. LV BIL: 60 kV
h. HV Connection Type: Deadfront, High Voltage Bushings Well and Insert
i. LV Connection Type: Livefront, Porcelain Bushing with 4-Hole Spades
j. Maximum allowable dimensions shall be approximately 92" wide x 109" Deep with a pad opening of 89" wide x 21" deep.
k. Minimum Allowable Efficiency at 50% Loading: 99.46%
l. Provide distribution class livefront style surge arrestors on the 4160V side of this transformer. Surge arrestors shall be equal to the UltraSIL Polymer-Housed Evolution series as manufactured by Cooper.
m. **Leadtime/Delivery Requirements: The specified transformer shall be delivered to the jobsite no later than May 15th, 2022.**

2.03 CONSTRUCTION

A. The unit shall be mineral oil filled and shall be in accordance with the latest edition of the NEC. High fire point fluids shall be Factory Mutual and UL approved.

B. The transformer shall carry its continuous rating with average winding temperature rise by resistance that shall not exceed 65 degrees C, based on average ambient of 30 degrees C over 24 hours with a maximum of 40 degrees C.

C. The transformer shall be designed to meet the sound level standards for liquid transformers as defined in NEMA and ANSI.

D. The transformer shall be included with Seismic Zone 4 Anchoring.

E. High voltage and low voltage windings shall be copper. Insulation between layers of the windings shall be by thermally set insulating paper or equal.

F. The main transformer tank and attached components shall be designed to withstand pressures greater than the required operating design value without permanent deformation. Construction shall consist of carbon steel reinforced with external, internal or sidewall braces. All seams and joints shall be continuously welded.

G. The assembly shall be individually welded and receive a quality control pressurized check for leaks. The entire tank assembly shall receive a similar leak test before tanking. A final six hour leak test shall be performed.

H. The transformer(s) shall be compartmental type, self cooled and tamper resistant for mounting on a pad. The unit shall restrict the entry of water (other than flood water) into the compartments so as not to impair its operation. There shall be no exposed screws, bolts or other fastening devices which are externally removable.

I. The transformer(s) shall consist of a transformer tank and full height, bolt-on high and low voltage cable terminating compartments located side-by-side separated by a rigid metal barrier. Each compartment shall have separate doors, designed to provide access to the high voltage compartment only after the low voltage has been opened. There shall be at least one additional fastening device accessible only after the low voltage door has been opened, which must be removed to open the high voltage door. Doors shall be mounted flush with the cabinet frame. The low voltage door shall have a handle operated, three point latching mechanism designed to be secured with a single padlock. A hex head or penta-head bolt shall be incorporated into the low voltage door latching mechanism. Both high and low voltage doors shall be incorporated into the low voltage door latching mechanism. Both high and low voltage doors shall be equipped with stainless steel hinges and door stops to secure them in the open position.

J. Compartment sills, doors and covers shall be removable to facilitate cable pulling and installation. The high voltage door shall be on the left with the low voltage door on the right. Compartments shall be designed for cable entry from below.

K. Transformer(s) shall be supplied with a welded or bolted main tank cover and be of a sealed tank construction designed to withstand a pressure of 7 Psig without permanent distortion. The tank cover shall be designed to shed water and be supplied with a tamper resistant access handhole sized to allow access to internal bushing and switch connections. Transformers supplied with “less flammable” fluids shall be manufactured to withstand 12 Psig without rupture. The transformer shall remain effectively sealed for a top oil temperature of -5 degrees C to 105 degrees C. When necessary, to meet the temperature rise rating specified, cooling panels shall be provided.

L. The transformer manufacturer shall certify that the transformer is non-PCB containing less than 1 part per million detectable PCBs. Nonflammable transformer liquids including askarel and insulating liquids containing tetrachloroethylene, perchloroethylene, chlorine compounds, or halogenated compounds are not acceptable and shall not be provided.

M. When high voltage taps are specified above, full capacity taps shall be provided with a tap changing mechanism designed for de-energized operation. The tap changer operator shall be located within one of the compartments.

N. The coil windings shall be designed to reduce losses and manufactured with the conductor material as specified above. All insulating materials shall be rated for 120 degrees C class.

O. For grounded wye to grounded wye application, the core assembly shall be a 5 legged, distributed gap, wound core, designed to meet NEMA TR-1 sound levels measured per ANSI standards. For ratings above 2500 kVA, a stacked core design may be utilized.

P. The core material shall be high grade, grain oriented, non-aging silicon core steel with high magnetic permeability, low hysteresis, and eddy current losses.

Magnetic flux densities are to be kept well below saturation to allow for a minimum of 10 percent overvoltage excitation. The cores shall be properly annealed to reduce stresses induced during the manufacturing processes and reduce core losses.

Q. The core frame shall be designed to provide maximum support of the core and coil assembly. The core frame shall be welded or bolted to ensure maximum short circuit strength.

R. The core and coil assembly shall be designed and manufactured to meet the short circuit requirements of ANSI C57.12.90. The core and coil assembly shall be baked in an oven prior to tanking to “set” the epoxy coating on the insulating paper and remove moisture from the insulation prior to vacuum filling.

S. Transformer shall be vacuum filled with the appropriate fluid as indicated above. The process shall be of sufficient vacuum and duration to ensure that the core and coil assembly is free of moisture prior to filling the tank.

2.04 STANDARD FEATURES

A. Transformer features and accessories shall include:

1. UL Listed
2. Include a Steel Divider Plate
3. Include a Removable Sill
4. Include a Ground Pad
5. Include a Ground Strap and Pad for HO/XO
6. Include Parking Stands
7. Include a High Security Cabinet with Penta head Door Bolts
8. Tap Changer
9. Dial type thermometer
10. Liquid level gauge
11. Pressure vacuum gauge
12. Drain valve with sample valve
13. Automatic Pressure relief valve
14. Non-PCB label
15. High voltage warning label
16. Shock and arc flash warning label
17. Upper fill/filter press connection or valve
18. Nitrogen Blanket
19. Provide dust tight weatherproof insulating caps to adequately protect all unused bushing wells from moisture and debris.

2.05 FINISH

A. Transformer units shall include suitable outdoor or indoor paint finish. The paint shall be applied using an electrostatically deposited dry powder system to a minimum of three (3) mils average thickness. Units shall be painted padmount green, Munsell No.7GY3.29/1.5.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest applicable ANSI and NEMA standards.

1. Resistance measurements of all windings on the rated voltage connection
2. Ratio tests on the rated voltage connection and on all tap connections
3. Polarity and phase relation tests on the rated voltage connections
4. No load loss at rated voltage on the rated voltage connection
5. Exciting current at rated voltage on the rated voltage connection
6. Impedance and load loss at rated current on the rated voltage connection
7. Applied potential test
8. Induced potential tests

B. The manufacturer shall provide three (3) certified copies of factory test reports to the Engineer upon request.

C. The following special factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest applicable ANSI and NEMA standards.

1. Temperature test(s) shall be made on all units. Tests shall not be required when there is available a record of a temperature test on an essentially duplicate unit.
2. ANSI impulse test on all primary windings.

3.02 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. All necessary hardware to secure the assembly in place shall be provided by the contractor.

C. The Contractor shall provide cable supports in all pad-mount distribution transformers to effectively remove the cable weight from the transformer spade/bushing connections. This shall apply to both the primary and secondary cables.

3.03 FIELD ADJUSTMENTS

A. Adjust taps to deliver appropriate secondary voltage.

3.04 FIELD TESTING

A. Measure primary and secondary voltages for proper tap settings.

B. Megger primary and secondary windings

END OF SECTION

SECTION 26 18 38
MEDIUM-VOLTAGE MOTOR CONTROL CENTER

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the medium voltage motor starters as specified herein and as shown on the contract drawings.

1.02 RELATED SECTIONS

A. Section 26 05 13 – Medium-Voltage Cables

1.03 REFERENCES

A. Medium voltage motor starters shall be designed, manufactured, assembled, and tested in accordance with the following standards:

1. ANSI/NEMA ICS 3 – Medium Voltage Controllers
2. UL 347 – Medium Voltage AC Contactors, Controllers and Control Centers
3. CSA C22.2 No. 14 – Industrial control equipment
4. CSA C22.2 No. 253 – Medium Voltage AC Contactors, Controllers and Control Centers

1.04 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer in accordance with section 01 33 00 - Submittal Procedures:

1. Master drawing index
2. Front view elevation
3. Floor plan
4. Top view
5. Schematic diagram
6. Nameplate schedule
7. Component list
8. Conduit entry/exit locations
9. Single-line and 3-line diagrams
10. Assembly ratings including:
    a. Short-circuit current rating
    b. Voltage
    c. Continuous current
    d. Basic impulse level
11. Major component ratings including:
    a. Short-circuit current rating
    b. Voltage
    c. Continuous current
    d. Interrupting ratings
12. Cable terminal sizes
13. Descriptive bulletins
14. Product data sheets

B. Where applicable, the following additional information shall be submitted to the Engineer:

1. Busway connection
2. Connection details between close-coupled assemblies
3. Composite floor plan of close-coupled assemblies
4. Key interlock scheme drawing and sequence of operations

1.05 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04 above and shall incorporate all changes made during the manufacturing process
2. Wiring diagrams
3. Certified production test reports
4. Installation information, including equipment anchorage provisions
5. Seismic certification as specified
6. Recommended priced spare parts list

1.06 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic tested equipment as follows:

1. The equipment shall be suitable for installation within a Seismic Zone 4 (0.5g maximum ground acceleration)
2. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.
   a. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
   b. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.07 REQUIREMENTS

A. Equipment shall be provided with the following special labels: U.L. and cUL.

B. All components and material shall be new and of the latest field-proven design and in current production. Obsolete components or components scheduled for

immediate discontinuation shall not be used.

1.08 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Each assembly shall be split into shipping groups for handling as indicated on the drawings or per the manufacturer's recommendations. Shipping groups shall be designed to be shipped by truck, rail, or ship. Shipping groups shall be bolted to skids. Accessories shall be packaged and shipped separately. Each shipping group shall be equipped with lifting eyes for handling solely by crane.

1.09 OPERATION AND MAINTENANCE MANUALS

A. Submit manufacturer's data in accordance with Section 01 78 23 - Operation and Maintenance Data for operation and maintenance data for repairing, cleaning, testing requirements and parts list.

PART 1 PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufactures - Base Bid

1. Benshaw

B. Approved Manufactures under Alternate No.2

1. Siemens
2. Schneider Electric
3. Eaton
4. GE
5. Motortronics
6. Prior Approved Equal

C. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS

A. The assembly ratings shall be as follows:

1. Nominal System Voltage: 4160VAC, 3 Phase, 60 Hz
2. System Grounding: Grounded Wye
3. Main Cross Bus Continuous Current: 800A
4. Interrupting Rating: 350 MVA
5. BIL: 60 kV

2.03 INCOMING TERMINATION ENCLOSURE

A. The incoming termination enclosure shall be provided with the following:

1. **Required Dimension: 92.5"H x 24"W x 36"D**
2. Landing Pad for all incoming cables as defined on the Drawings.
3. Grounding Balls
4. 800A Insulated Bus with Splice Kit
5. Space Heater
6. Infrared Viewing Windows
7. Tin Plated Copper Ground Bus
8. Stainless Steel Gland Plate
9. Bottom Cable Entry
10. NEMA 3R Enclosure
11. Provide CTs, PTs, and a customer power monitor as specified on Drawing E5.

2.04 MCC BUS

A. When starters are grouped together in a lineup, the horizontal main bus shall be located in its own separate, 24-inch high enclosure and isolated from the starters. To allow for ease of maintenance or extension of lineups without disassembling starters, the main bus shall be front, top, and side accessible.

B. Starters shall be connected by an insulated vertical bus.

C. All bus bars shall be tin-plated copper. Bus shall be rated at 800A continuous current.

D. All bus bars shall utilize bolted bus joints using a minimum of two bolts.

E. Provide a 1/4 x 2-inch ground bus throughout the entire lineup.

F. Bus bars shall be braced to withstand short circuit currents with a minimum of 50KAIC.

2.05 BUS INSULATION SYSTEM

A. All bus shall be supported utilizing a high strength and high creep support providing 10.5 inch of creep distance between phases and ground. The molded fins shall be constructed of high track resistant cycloaliphatic epoxy.

B. All standoff insulators on switches and fuse mountings shall be cycloaliphatic epoxy.

2.06 WIRING/TERMINATIONS

A. All control wire shall be UL/CSA approved.

B. Standard control wire shall be 14GA, stranded, tin-plated, red, dual-rated type XLPE (UL 3173) 125 degrees C, SIS 90 degrees C.

C. Current transformer circuits shall utilize #12 wire with the same characteristics as above. Provide shorting blocks for all current transformers.

D. All terminations shall be performed using compression screw type terminals.

E. Wire markers shall be a “sleeve” type.

F. “Clamping-collar” type terminals shall be used to terminate control wiring. Current transformer circuits shall be provided with ring-type terminals where applicable.

G. Bus bar with standard NEMA two or four-hole pattern shall be supplied for input and output connection of external power wiring and shall be conveniently located, clearly numbered, and identified.

H. Control wire terminal blocks for external wiring terminations shall be located in a separate control or low voltage compartment. Termination blocks shall be compression screw type, designed to accommodate stripped insulation bare wire ends, and shall accept a minimum of two No. 14 AWG wires.

I. Connection points for inputs and outputs of different voltage levels shall be segregated to reduce possibility of electrical noise.

J. Where wiring is run through sheet metal or any barrier, bushings, grommets or other mechanical protection around the sheet or barrier opening shall be provided.

K. All internal wiring shall be terminated with no more than two (2) conductors per terminal point.

L. The RVSS shall have an internal mechanical ground connection suitable for terminating a stranded copper ground conductor of the same size as the incoming phase conductors. Ground connections shall be near the incoming and outgoing power cable termination points and control wiring connections.

2.07 STARTERS

A. The starters shall be designed to accommodate motors of the size and type as shown on the drawings.

B. The starters shall be non-reversing to accommodate the following motor type:

1. Induction Motor Solid-State Reduced Voltage Start (5kV and below only)

C. The following equipment shall be provided for the starter type indicated in Paragraph 2.07B.

a. Each induction motor Reduced Voltage Solid-State Starter shall include the following:
1) **Required Dimension: 92.5"H x 45"W x 30"D**
2) Medium Voltage Sections
(a) One – Fixed portion isolating switch with shutter mechanism rated at 400A.
3) One – Removable portion isolating switch with blown fuse indication.
4) Three – Bolt-in 5kV Class R Fuses
5) One -Bolt-in main vacuum contactor assembly rated at 400A.
6) 18 SCR, fiber-optic control power section rated at 600% for 30 seconds.
(a) Roll-out three-phase solid-state power stack assembly

7) One - control circuit transformer 750 VA @ 4.16 kV
   (a) Two - control circuit primary fuses
   (b) One - control circuit secondary fuse
   (c) One - run test circuit
   (d) Four - electrical interlocks
8) One – Zero sequence ground fault current transformer
9) Operator Panel, Instruments, Displays, and Indicating Lights
   (a) Provide a door-mounted drive backlit English language LCD keypad for operator interface. LEDs shall indicate the operating mode of the drive.
   (b) The electronic operator keypad (EOI) display shall:
      (1) be in English, by menu format for configurable program capabilities.
      (2) contains LED's to indicate "Local / Remote" operation, "Ready / Run" light. All alarms or faults shall be in easy to read English format and shall define a fault.
      (3) have control functions and only allow remote run command of the motor.
      (4) Local Start / Stop Push Button, Drive Reset Pushbutton.
      (5) have full access to all parameters and variables.
   (c) Local "START" and local "LOCAL/REMOTE" switch wiring connections will only be inputs to the external PLC panel. These switches will not start the pump motor directly. Only a command from the external PLC panel will start the pump motor. This is required because an electrically operated valve must be opened before starting the pump motor or serious damage may occur.
   (d) The operator keypad shall be used to read and write parameter data, to present operational information, to produce fault and device indication, to show alarms, to allow metering of parameters, and provide Ethernet connectivity to the RVSS software programming tool on the Owner's PC.
   (e) The operator keypad shall include a level of security lock-out capability.
   (f) The electronic operator keypad shall have monitor function to provide drive and motor load conditions.
   (g) Meters, displays, and keypads shall be accessible and visible from the front without opening the enclosure.
10) Low Voltage Compartment and Door
   (a) Slide-out panel
   (b) One - set of control relays
   (c) One – Set of control circuit terminal blocks with 15% spare capacity
   (d) Provide an ESTOP pushbutton.

(e) Provide terminals for remote reset
(f) Provide a reset pushbutton
(g) Door mounted soft-start keypad / display with metering.
(h) Provide a Ethernet Communication Module as well as an Industrial, Managed, 8-port Ethernet switch.
(i) Provide an 8-channel RTD Module
(j) Provide a Manual/Off/Auto selector switch
(k) Provide the following Push-To-Test style LED Pilot Lights:
    (1) White - Ready
    (2) Green - Running
    (3) White - Controlled Locally
    (4) Amber - Controlled Remotely
    (5) Red - Tripped
    (6) Amber - Alarm
(l) The specified customer meter shall have the Human Machine Interface installed on the door of the low voltage compartment as noted on Drawing E5.

11) Provide Infrared Viewing Windows
12) Provide a tin-platted copper bus.
13) Provide space heaters as required
14) Provide Stainless Steel Gland Plate
15) Cable exit shall be from the bottom
16) Provide Grounding Balls
17) The control board shall be mounted for ease of testing, service, and replacement. It shall have quick disconnect plug-in connectors for all connections. The logic board shall be identical for all ampere ratings and voltage classes and shall be conformal coated to protect environmental concerns.
18) The integral paralleling run bypass contactor shall energize when the motor reaches 90% of full speed and close/open under one (1) times motor current.
19) The solid-state power stack assembly shall be mounted on a roll-out truck for ease of maintenance. When the truck is removed, the load cables shall be easily moved to the line side stabs to allow full voltage starting in emergency situations.
20) The following control function adjustments on the device keypad are required:
    (a) Selectable Torque Ramp Start or Current Limit Start
    (b) Adjustable Kick Start Time, 0 – 10 seconds
    (c) Adjustable Kick Start Current, 0 – 300%
    (d) Adjustable Ramp Start Time, 0.5 – 120 seconds
    (e) Adjustable Initial Starting Ramp Current, 0 – 300%
    (f) Adjustable Smooth Stop Ramp Time, 0 – 60 seconds
21) Maximum continuous operation shall be at 125% of continuous ampere rating.

2.08 CUSTOMER METERING

A. Microprocessor-Based Metering Package as defined on Drawing E5.

B. Auxiliary Devices

1. Provide fixed potential transformers, fused type, of the quantity and ratings indicated on the contract drawings.
2. Provide window-type current transformers of the quantity and current rating as indicated on the contract drawings. Current transformer accuracy shall be suitable for the connected burden.
3. Provide an auxiliary control power transformer of the quantity and kVA rating as indicated on the contract drawings.

2.09 OPERATIONAL CONTROLS

A. The door mounted keypad shall have a button, which when activated, shall check each IGBT and display any errors in this self diagnostic test.

B. The RVSS shall include necessary components to protect the RVSS and motor against motor overload, internal faults in either the motor or RVSS and disturbances in the incoming AC line. The overload protection shall have a multiple motor thermal curve function that allows tailoring the drive overload for different applications. The failure shall be annunciated on the operator panel's LCD display. The RVSS shall be shut down with the output voltage reduced to zero for the following conditions:

1. Short circuit on the output of the RVSS
2. Instantaneous overcurrent
3. Motor overload
4. Undervoltage or overvoltage on the incoming AC line
5. Single-phasing of the AC incoming line
6. Overtemperature of the RVSS electronics from a component or ventilation failure
7. Gate driver power supply or control power supply undervoltage
8. RVSS output open circuit during operation
9. Overvoltage or ground fault of the RVSS output
10. Cause of individual power cell fault isolated to failed device.

C. The RVSS shall not return the motor to operating speed upon restoration of power following a voltage interruption on the AC incoming line which exceeds the RVSS ride-through capability.

D. The Manufacturer shall ensure the ASD will not restart until the motor has slowed sufficiently upon restoration of power following a voltage interruption on the AC incoming line.

E. The RVSS shall not provide electronic braking to slow the motor down. The motor shall always coast to a stop.

F. The input contactor shall include a normally closed auxiliary switch contact to control 120VAC motor heater power. The source of motor heater power is the external 208/120 Volt panel in the pump building. The motor heater will be ON

when the contactor is open and OFF when the contactor is closed.

2.10 ENCLOSURES

A. The enclosure shall meet NEMA ICS 6 standards. Enclosure shall be NEMA 3R, unless otherwise noted, completely front accessible, allowing for free-standing, against a wall, or back-to-back mounting.

B. Provide a dedicated incoming line enclosure section to accommodate the number and size of incoming cables for bottom entry.

C. Structures shall be welded steel frame, formed steel doors and side sheets, flat steel top and rear covers.

D. Standard hardware shall be grade 5, plated zinc-dichromate.

2.11 NAMEPLATES

A. Nameplates shall be 2-inch high x 2-1/2 inch wide x 1/16 inch thick, laminated white with black text.

B. Unit nameplate and device marker lettering shall be 3/16-inch high.

C. Meters, relays, switches, and other devices within the ASD shall be permanently identified using the same name as those appearing on the schematic diagrams and identified by IEEE device number.

2.12 FINISH

A. The finish for internal and external parts shall consist of a coat of ANSI 61 (gray) thermosetting, polyester, powder paint applied electrostatically to pre-cleaned phosphatized steel and aluminum surfaces.

2.13 ACCESSORIES

A. Provide a portable lifting device for transporting contactor outside its compartment.

B. The RVSS manufacturer shall provide a software tool to configure, monitor and troubleshoot the drive. The software shall have a path via an Ethernet connection for programming and diagnostics. The monitor feature shall have a trending feature where the RVSS signals can be displayed in real time.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. Wiring check
2. Sequence of control circuits
3. Dielectric Test (Hi Pot) per NEMA ICS 3 at 2000 volts plus 2.25 times nominal voltage, for 60 seconds, phase-to-phase and phase-to-ground

B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.02 SYSTEM STARTUP AND COMMISSIONING

A. Provide the services of a qualified factory-trained manufacturer's representative to provide startup of the equipment specified under this section for a period of 2 working days.

B. The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer's service representative:

1. Megger bus
2. Ground test
3. Verify that all mechanical interlocks are functioning properly
4. The Contractor shall provide three (3) copies of the manufacturer's field startup report.

C. Sequence the control circuit to verify that the starter will start and run properly.

D. The Supplier shall provide the RVSS manufacture's software tool with operational, maintenance and diagnostic features. Using a current model Owner supplied IBM compatible PC, this software shall permit the programming of parameters, display block diagrams, show bar graphs, report adjustment data, display trends, provide troubleshooting using first fault data/trace back data/trouble record, and contain links to system documentation and to system help. In addition, the software tool shall have the following features:

1. Ethernet interface
2. Animated function block diagrams with real time variables
3. Commissioning wizards
4. Integrated trending window

3.03 TRAINING

A. The factory trained manufactures representative shall provide a training session for up to five (5) owner representatives on site. The training shall occur at the time of the 2 day startup specified above. The training session shall include instructions on assembly, starters, and other major components.

3.04 INSTALLATION

A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

C. Check all bolted connections to assure that they are in accordance with the manufacturer's recommended torque requirements.

D. Install Motor Control Center such that it is level and plumb.

3.05 SPARE PARTS

A. One (1) Human Machine Interface Module (HIM) and associated keypad.

B. One (1) Set of critical card sets including the card sets associated with the HIM, MV Dividers, and Gate Drivers

C. One (1) of each type and size of all low voltage fuses

D. Two (2) transformer fuses

E. Three (3) power fuses

F. One (1) power stack

END OF SECTION

SECTION 33 13 00
DISINFECTION OF PIPING AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

This section includes materials and procedures for disinfection of water mains by the continuous feed method and by the slug method. Disinfect piping in accordance with AWWA C651, except as modified below.

1.02 RELATED SECTIONS

Pressure Testing of Pipe: 40 05 15.

1.03. JOB CONDITIONS

A. Discharge of chlorinated water into watercourses or surface waters is regulated by the National Pollutant Discharge Elimination System (NPDES). Disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility.

1. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with Owner and regulatory authorities including City officials.

B. Use potable water for chlorination.

C. Submit request for use of water from waterlines of Owner 24 hours in advance.

PART 2 MATERIALS

2.01 LIQUID CHLORINE

Inject with a solution feed chlorinator and a water booster pump. Follow the instructions of the chlorinator manufacturer.

2.02 CALCIUM HYPOCHLORITE (DRY)

Dissolve in water to a known concentration in a drum and pump into the pipeline at a metered rate.

2.03 SODIUM HYPOCHLORITE (SOLUTION)

Further dilute in water to desired concentration and pump into the pipeline at a metered rate.

2.04 CHLORINE RESIDUAL TEST KIT

For measuring chlorine concentration, supply and use a medium range, drop count, DPD drop dilution method kit per AWVVA C651, Appendix A. Maintain kits in good working order available for immediate test of residuals at point of sampling.

PART 3 EXECUTION

3.01 CONTINUOUS FEED METHOD FOR PIPELINES

Introduce potable water into the pipeline at a constant measured rate. Feed the chlorine solution into the same water at a measured rate. Proportion the two rates so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 50 mg/L. Check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added.

3.02 SLUG METHOD FOR PIPELINES

Introduce the water in the pipeline at a constant measured rate. At the start of the test section, feed the chlorine solution into the pipeline at a measured rate so that the chlorine concentration created in the pipeline is 300 mg/L. Feed the chlorine for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least 300 mg/L for at least three hours.

3.03 DISINFECTION OF VALVES, BLIND FLANGES, AND APPURTENANCES

During the period that the chlorine solution or slug is in the section of pipeline, open and close valves to obtain a chlorine residual at hydrants and other pipeline appurtenances. Swab exposed faces of valves and blind flanges prior to bolting flanges in place with a 1% sodium hypochlorite solution.

3.04 DISINFECTION OF CONNECTIONS TO EXISTING PIPELINES

Disinfect isolation valves, pipe, and appurtenances per AWWA C651, Section 4.7. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 1% sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor.

3.05 CONFIRMATION OF RESIDUAL

A. After the chlorine solution applied by the continuous feed method has been retained in the pipeline for 24 hours, confirm that a chlorine residual of 50 mg/L minimum exists along the pipeline by sampling at air valves and other points of access.

B. With the slug method, confirm by sampling as the slug passes each access point and as it leaves the pipeline that the chlorine concentration in the slug is at least 50 mg/L.

3.06 PIPELINE FLUSHING

After confirming the chlorine residual, flush the excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe is no higher than that generally prevailing in the distribution system.

3.07 BACTERIOLOGIC TESTS

Owner will collect and test for bacteriology.

3.08 REPETITION OF PROCEDURE

If the initial chlorination fails to produce required residuals and bacteriologic tests, repeat the chlorination and retesting until satisfactory results are obtained.

3.09 TEST FACILITY REMOVAL

After satisfactory disinfection, disinfect and replace air valves, restore the pipe coating, and complete the pipeline where temporary disinfection or test facilities were installed.

3.10 PIPING TO BE DISINFECTED

1. Disinfect all piping.

END OF SECTION

SECTION 40 05 00
GENERAL PIPING REQUIREMENTS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, seismic restraints, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.

B. The piping shown defines the specific layout, configuration, routing, method of support, pipe size, and pipe type. It is the Contractor's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, etc., for a complete and functional system.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch)
ANS1/ASME B16.5	Pipe Flanges and Flanged Fittings, NPS ½ to NPS 24
ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in.
ANS I/AWWA C219	Bolted, Sleeve-Type Couplings for Plain-End Pipe
ANSI/AWWA C606	Grooved and Shouldered Joints
ANSI/AWS D1.1	Structural Welding Code
ASTM A325	Specification for High-Strength Bolts for Structural Steel Joints
ASTM D 2000	Classification System for Rubber Products in Automotive Applications

1.03 CONTRACTOR SUBMITTALS

A. Submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems, in accordance with the requirements in Section 01 33 00—Submittal Procedures, and as indicated in the individual piping sections. The shop drawings shall include all necessary dimensions and details on pipe joints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools: spacers, adapters, connectors, fittings, and pipe supports and seismic restraints necessary to accommodate the equipment and valves provided in a complete and functional system.

B. All expenses incurred in making samples for certification of tests shall be borne by the Contractor at no increased cost to the Owner.

C. Submit as part of the shop drawings a statement from the pipe fabricator certifying that all pipes will be fabricated subject to a recognized Quality Control Program. An outline of the program shall be submitted to the Engineer for review prior to the fabrication of any pipe.

1.04 QUALITY ASSURANCE

A. Tests: Except where otherwise indicated, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. Welds shall be tested as indicated. Perform all tests at no additional cost to the Owner.

B. Welding Requirements: All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D1.1. Welding procedures shall be required for, but not necessarily limited to longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

C. Welder Qualifications: All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local, approved testing agency not more than 6 months prior to commencing Work on the pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests. Furnish all material and bear the expense of qualifying welders at no increased cost to the Owner.

1.05 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Where the assistance of a manufacturer's service representative is advisable, in order to obtain perfect pipe joints, supports, or special connections, furnish such assistance at no additional cost to the Owner.

1.06 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground, to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

1.07 CLEANUP

A. After completion of the Work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site. The entire piping system shall be handed over in a clean and functional condition.

PART 2 PRODUCTS

2.01 GENERAL

A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Specifications.

B. Pipe Supports: All pipes shall be adequately supported in accordance with the requirements of Specifications and Drawings as indicated.

C. Coating: All requirements pertaining to thickness, application, and curing of pipe coating, are in accordance with the requirements of the applicable Specifications, unless otherwise indicated. Pipes above ground or in structures shall be field or shop painted in accordance with Section 09 96 00 - High Performance Coatings.

D. Pressure Rating: All piping systems shall be designed for the maximum expected test pressure as defined in Section 40 05 15 - Pressure Testing of Piping.

E. All pipes, fittings, and appurtenances shall be in conformance with NSF/ANSI 61 and NSF/ANSI 372.

2.02 PIPE FLANGES

A. Flanges: Where the design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C207 Class D or ANSI/ASME B16.5 150-pound class. Where the design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to either ANSI/AWWA C207 Class E, Class F, or ANSI/ASME B16.5 150-pound class. However, AWWA flanges shall not be exposed to test pressures greater than 125 percent of rated capacity. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected. Where the design pressure is greater than 275 psi up to maximum of 700 psi, flanges shall conform to ANSI/ASME B16.5 300-pound class. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall conform to the applicable requirements of ANSI/AWWA C207. Flanges for miscellaneous small pipes shall be in accordance with the standards specified for these pipes.

B. Blind Flanges: Blind flanges shall be in accordance with ANSI/AWWA C207, or with the standards for miscellaneous small pipes. All blind flanges for pipe sizes 12 inches and over shall be provided with lifting eyes in form of welded or screwed eye bolts.

C. Flange Coating: All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. Flange Bolts: All bolts and nuts shall conform to Section 05 05 20— Bolts, Washers, Anchors, and Eyebolts. Studs and bolts shall extend through the nuts a minimum of ¼-inch; and shall not extend more than 1-inch through the nut. All-thread studs shall be used on all valve flange connections, where space restrictions preclude the use of regular bolts.

E. Flange Gaskets: Gaskets for flanged joints shall be full 1/8-inch thick and shall be one of the following:

1. Cloth-inserted rubber with a shore "A" hardness of 75 to 85. Gaskets shall be suitable for a working pressure of 200 psi at a temperature of 180 degrees F. Products: Garlock Style 19 or equal.

2. Acrylic or aramid fiber bound with nitrile. Products: Garlock "Blue-Gard," or equal. Gaskets shall be suitable for a pressure of 500 psi at a temperature of 400 degrees F.

F. Flange Gasket Manufacturers, or Equal

1. John Crane, Style 2160.

2. Garlock, Style 3000.

3. Durable, Duran 8500

2.03 THREADED INSULATING CONNECTIONS

A. General: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other nonconductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.04 MECHANICAL-TYPE COUPLINGS FOR GROOVED END PIPE

A. General: Mechanical-type couplings shall be provided where shown. The couplings shall conform to the requirements of ANSI/AWWA C606. Bolts and nuts shall conform to the requirements of Section 05 05 20 — Bolts, Washers, Anchors, and Eyebolts. All gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations. The wall thickness of all grooved piping shall conform with the coupling manufacturer's recommendations to suit the highest expected pressure. To avoid stress on equipment, all equipment connections shall have rigid-grooved couplings, or harness sets in sizes where rigid couplings are not available, unless thrust restraint is provided by other means. The Contractor shall have the coupling Manufacturer's service representative verify the correct choice and application of all couplings and gaskets, and the workmanship, to assure a correct installation.

B. Grooves shall be cut into the pipe or contain a shoulder with a cut groove that is cast or subsequently welded onto the pipe. Grooves cut directly into the pipe cylinder shall be cut on extra heavy wall pipe (SCH 80) or greater wall thickness as recommended by the manufacturer.

C. Roll grooves are not allowed.

D. Couplings shall be lined and coated with fusion bonded epoxy in accordance with AWWA C213.

E. Coupling shall be rated for minimum 350 psi working pressure.

F. Couplings for Steel Pipe, Manufacturers, or Equal

1. Victaulic; Style W77 AGS.

2. Or approved equal.

2.05 SLEEVE-TYPE COUPLINGS

A. Construction: Sleeve-type couplings shall be provided where indicated, in accordance with ANSI/AVVWA C219 unless otherwise indicated, and shall be of steel with steel bolts, without pipe stop, and shall be of sizes to fit the pipe and fittings. The middle ring shall be not less than 1/4 inch in thickness and shall be either 5 or 7 inches long for sizes up to and including 30 inches and 10 inches long for sizes greater than 30 inches, for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts shall conform to the requirements of Section 05 05 20 - Bolts, Washers, Anchors, and Eyebolts. Buried sleeve-type couplings shall be epoxy-coated at the factory.

B. Pipe Preparation: The ends of the pipe, where indicated, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with outside diameter not more than 1/64 inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

C. Gaskets: Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Durometer hardness 70 ± 5, or equivalent suitable elastomer.

1. The rubber in the gasket shall meet the following specifications:

a. Color - Jet Black.

b. Surface – Non-blooming.

c. Durometer Hardness - 70 ± 5.

d. Tensile Strength - 1,000 psi Minimum.

e. Elongation - 175 percent Minimum.

2. The gaskets shall be immune to attack by impurities normally found in water. All gaskets shall meet the requirements of ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above. All gaskets shall be compatible with the piping service and fluid utilized.

D. Insulating Couplings: Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to obtain insulation of all coupling metal parts from the pipe.

2.06 PIPE THREADS

A. All pipe threads shall be in accordance with ANSI/ASME B1.20.1.

PART 3 EXECUTION

3.01 GENERAL

A. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of the applicable Specifications. The lining manufacturer shall take full responsibility for the complete, final product and its application. All pipe ends and joints at screwed flanges shall be epoxy-coated, to assure continuous protection.

B. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction to avoid damage to embedded raceways and rebars.

C. Flanges shall be installed at least 12-inches from a wall. Fittings shall be installed with sufficient clearance.

END OF SECTION

SECTION 40 05 15
PRESSURE TESTING OF PIPING

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes the pneumatic and leakage testing of pressure piping for pumping stations, water distribution and transmission mains.

1.02 RELATED SECTIONS

A. Section 33 13 00 - Disinfection of Piping.

B. Section 40 50 20 - Valves General.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excessive pipe wall stresses,

C. Submit one copy of the test records to the Owner's Representative upon completion of the testing.

1.04 TEST PRESSURES

A. Test pressures for the various services and types of piping are shown in Subsection 3.08.

1.05 TESTING RECORDS

Provide records of each piping installation during the testing. These records shall include:

A. Date and times of test.

B. Identification of pipeline, or pipeline section tested or retested.

C. Identification of pipeline material,

D. Identification of pipe specification.

E. Test fluid.

F. Test pressure at low point in pipeline, or pipeline section.

G. Remarks: Leaks identified (type and location), types of repairs, or corrections made.

H. Certification by Contractor that the leakage rate measured conformed to the specifications.

PART 2 MATERIALS

2.01 TEST

BULKHEADS

A. Design and fabricate test bulkheads per Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70% of yield strength of the bulkhead material at the bulkhead design pressure. Include air release and water drainage connections.

2.02 TESTING FLUID

A. Testing fluid shall be water.

B. For potable water pipelines, obtain and use only potable water for hydrostatic testing.

C. Submit request for use of water from waterlines of Owner 24 hours in advance.

D. The Contractor may obtain the water from the Owner at no charge.

2.03 TESTING EQUIPMENT

A. Provide calibrated pressure gauges, pipes, bulkheads, compressors, chart recorder, and meters to perform the pneumatic testing.

PART 3 EXECUTION

3.01 TESTING PREPARATION

A. Conduct pressure tests on exposed and aboveground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters, or submit alternate plan if in place testing cannot be performed.

B. Provide any temporary piping needed to carry the test fluid to the piping that is to be tested. After the test has been completed and demonstrated to comply with the specifications, disconnect and remove temporary piping. Do not remove exposed vent and drain valves at the high and low points in the tested piping. Remove any temporary buried valves and cap the associated outlets. Plug taps or connections to the existing piping from which the test fluid was obtained.

C. Provide temporary drain lines needed to carry testing fluid away from the pipe being tested. Remove such temporary drain lines after completing the pressure testing. Drain the pipes after they have been tested.

D. Prior to starting the test, the Contractor shall notify the Owner's Representative.

3.02 CLEANING

A. For pneumatic tests, blow air through the pipes. Maintain a flushing velocity of at least 3 fps for water testing and at least 2,000 fpm for pneumatic testing. Flush pipes for time period as given by the formula:

$$T = \frac{2L}{3}$$

in which:

T = flushing time (seconds)

L = pipe length (feet).

B. For pipelines 24 inches or larger in diameter, acceptable alternatives to flushing are use of high-pressure water jet, sweeping, or scrubbing. Water, sediment, dirt, and foreign material accumulated during this cleaning operation shall be discharged, vacuumed, or otherwise removed from the pipe.

3.03 TESTING AND DISINFECTION SEQUENCE FOR POTABLE WATER PIPING

A. Perform required disinfection after hydrostatic testing, except when pipeline being tested is connected to a potable waterline.

B. Locate and install test bulkheads, valves, connections to existing pipelines, and other appurtenances in a manner to provide an air gap separation between existing potable water pipelines and the pipeline being tested. Disinfect water and pipeline being tested before hydrostatic testing when connected to a potable waterline.

3.04 TESTING NEW PIPE WHICH CONNECTS TO EXISTING PIPE

Prior to testing new pipelines that are to be connected to existing pipelines, isolate the new line from the existing line by means of test bulkheads, spectacle flanges, or blind flanges. After the new line has been successfully tested, remove test bulkheads or flanges and connect to the existing piping.

3.05 PNEUMATIC TESTING

A. Perform pneumatic testing using dry air or nitrogen. Perform tests only after the piping has been completely installed including supports, hangers, and anchors. Or submit alternate plan if in place testing is not possible. Protect test personnel and Owner's operating personnel. Secure piping to be tested to prevent the pipe from moving and to prevent damage to adjacent piping and equipment. Remove or isolate from the piping

any appurtenant instruments or devices that could be damaged by the test prior to applying the test.

Apply an initial pneumatic leakage test of 25 psig to the piping system prior to final leak testing. Examine for leakage, detected by soap bubbles, at joints and connections. After correcting visible leaks, gradually increase the pressure in the system to not more than one-half of the test pressure. Then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure has been reached. Continuously maintain the pneumatic test pressure for a minimum time of four hours and for such additional time as may be necessary to conduct a soap bubble examination for leakage. The piping system shall show no leakage. Correct any visible leakage and retest.

3.06 REPETITION OF TEST

A. If the actual leakage exceeds the allowable, locate and correct the faulty work and repeat the test Restore the work and all damage resulting from the leak and its repair. Eliminate visible leakage.

3.07 BULKHEAD AND TEST FACILITY REMOVAL

A. After a satisfactory test, remove the testing fluid, remove test bulkheads and other test facilities, and restore the pipe coatings.

3.08 TEST PRESSURE AND TEST FLUIDS

A. Testing and design pressures (psig) shall be as listed below:

Pipe Service	Pipe Material	Testing Fluid	Design Pressure	Test Pressure
Pump Station and yard Discharge	CML or Epoxy Lined and Epoxy or Polyurethane Coated Steel	Water/Air	300 psi	350 psi

END OF SECTION

SECTION 40 05 21
VALVE ACTUATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Valve actuators and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to all valves except where otherwise indicated in the Contract Documents.

C. Unit Responsibility: A single manufacturer shall be made responsible for furnishing the Work and for coordination of design, assembly, testing, and installation of the Work of each type of valve; however, the Contractor shall be responsible to the Owner for compliance with the requirements of each valve. Unless otherwise indicated, the single manufacturer shall be the Manufacturer of the valve.

D. Single Manufacturer: Where two or more valve actuators of the same type or size are required, the actuators shall all be produced by the same manufacturer. The manufacturer will have a minimum of 5 years of experience in producing and installing specified actuators.

1.02 RELATED SPECIFICATIONS, CODES, AND STANDARDS

ANSI/AWWA C540	Standard for Power-Actuating Devices for Valves and Sluice Gates
JIC H-1	Joint Industrial Council, Hydraulic Standards for Industrial Equipment and General Purpose Machine Tools
ASTM A 105	Specification for Forgings, Carbon Steel, for Piping Components
ASTM A 276	Specification for Stainless Steel Bars and Shapes
ASTM F 593	Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F 594	Specification for Stainless Steel Nuts
ASME B 31.1	Power Piping
NFPA/NEC	National Electrical Code (Latest Edition)
ANS1/NEMA	National Electrical Manufacturers Association (As Applicable)

1.03 CONTRACTOR SUBMITTALS

A General: Submittals shall be furnished in accordance with Section 01 33 00 - Submittal Procedures. The following information should also be included in the submittal.

1. Maximum torque required to open and close each motor-operated valve.
2. Submit motor data including nameplate data, insulation type, duty rating, and torque output at duty rating.
3. Submit electrical schematic drawings and physical wiring diagrams showing all components.
4. Submit certified factory performance test records.

B. Shop Drawings: Shop Drawings of all actuators shall be submitted together with the valve submittals as a complete package.

1.04 WARRANTY

A. Actuators for all valves, which require a warranty, shall also be warranted against material and workmanship defects for the same period as the valves. The manufacturer's warranty shall be submitted with the valves' warranties prior to acceptance.

PART 2 PRODUCTS 2.01 GENERAL

A. General: Unless otherwise indicated, all shutoff and throttling valves, and externally actuated valves, shall be provided with manual or power actuators. Furnish all actuators complete and operable with mounting hardware, motors, gears, controls, wiring, solenoids, handwheels, levers, chains, and extensions, as applicable. All actuators shall be capable of holding the valve in any intermediate position between fully-open and fully-closed without creeping or fluttering. All wires of motor-driven actuators shall be identified by unique numbers.

B. Manufacturers: Where indicated, certain valves may be provided with actuators manufactured by the valve Manufacturer. Where actuators are furnished by different manufacturers, coordinate selection to have the fewest number of manufacturers possible.

C. Materials: All actuators shall be current models of the best commercial quality materials and liberally sized for the maximum expected torque. All materials shall be suitable for the environment in which the valve is to be installed.

D. Mounting: All actuators shall be securely mounted by means of brackets or hardware specially designed and sized for this purpose and of ample strength. The word "open" shall be cast on each valve with an arrow indicating the direction to open in the counter-clockwise direction. All gear and power actuators shall be equipped with position indicators.

E Standard: Unless otherwise indicated and where applicable, all actuators shall be in accordance with ANSI/AWWA C 540 - AWWA Standard for Power-Actuating Devices for Valves and Sluice Gates.

F. Functionality: Electric, pneumatic, and hydraulic actuators shall be coordinated with power and instrumentation equipment indicated elsewhere in the Contract Documents. Electrically operated valves shall be UL listed.

2.02 MANUAL ACTUATORS

A. General: Unless otherwise indicated, all valves shall be furnished with manual actuators. Valves in sizes up to and including 4 inches shall have direct acting lever or handwheel actuators of the Manufacturer's best standard design. Larger valves shall have gear-assisted manual actuators, with an operating pull of maximum 60 pounds on the rim of the handwheel. All gear-assisted valves for pressures higher than 250 psi, and where so indicated, shall have worm-gear actuators, hermetically sealed and grease-packed. All other valves 6 inches to 24 inches in diameter may have worm-gear actuators, spur- or bevel-gear actuators, as appropriate for each valve.

B. Manual Worm-Gear Actuator: The actuator shall consist of a single or double reduction gear unit contained in a weatherproof cast-iron or steel body with cover and minimum 12-inch diameter handwheel. The actuator shall be capable of 90-degree rotation and shall be equipped with travel stops capable of limiting the valve opening and closing. The actuator shall consist of spur or helical gears and worm-gearing. The spur or helical gears shall be of hardened alloy steel and the worm-gear shall be alloy bronze. The worm-gear shaft and the handwheel shaft shall be of 17-4 PH or similar stainless steel. All gearing shall be accurately cut with hobbing machines. Ball or roller bearings shall be used throughout. Actuator output gear changes shall be mechanically possible by simply changing the exposed or helical gearset ratio without further disassembly of the actuator. All gearing shall be designed for a 100 percent overload.

2.03 ELECTRIC MOTOR ACTUATORS

A. Electric motor actuators shall be in accordance with section 40 92 10, electric motor Actuators for Valves.

PART 3 EXECUTION

3.01 SERVICES OF MANUFACTURER

A. Field Adjustments: Field representatives of manufacturers of valves with hydraulic or electric actuators shall adjust actuator controls and limit switches in the field for the required function.

B. A manufacturer's factory-trained representative shall check and approve the installation before operation. The representative shall operate and test the system in the presence of the Engineer and verify that the equipment conforms to requirements; and shall instruct plant personnel on care and maintenance. The representative shall revisit the job site as often as necessary until all deficiencies are corrected.

C. Testing, checkout and start-up of the equipment shall be performed under the technical direction of the manufacturer's factory-trained representative. Motor operators shall not be energized without authorization from the manufacturer's representative.

D. In addition to the above requirements, furnish services of a qualified factory-trained operations and maintenance serviceman to instruct and train operators in the proper care, operation and maintenance of the equipment

3.02 INSTALLATION

A. All valve and gate actuators and accessories shall be installed in accordance with Section 40 05 22 – Butterfly Valves.

END OF SECTION

SECTION 40 05 22
BUTTERFLY VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Butterfly valves and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 40 05 21 - Valve Actuators.

1.02 CONTRACTOR SUBMITTALS

A. The Contractor shall furnish submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.03 WARRANTY

A. The butterfly valve manufacturer shall warrant valves 24" and larger, and their operator, against material and workmanship defects for a period not less that 2 years, which commences at final acceptance of the project. Submit the manufacturer's warranty prior to final acceptance.

PART 2 PRODUCTS

2.01 BUTTERFLY VALVES, FLANGED, RUBBER-SEATED, 4 INCHES AND LARGER:

A. General: Butterfly valves shall be short body, flanged/lug type for exposed valves and valves in vaults or structures. Minimum working differential pressure across the valve disc shall be 150 psi as identified on the drawings. Flanged ends shall be Class 125, ANSI B16.1. Valve shafts shall be Type 304, 316, or 416 stainless steel. Valve shafts shall be stub shaft or one-piece units extending completely through the valve disc. Materials of construction shall be as follows:

Component	Material	Specification
Body	Ductile iron, cast iron	AWWA C 504
Exposed body capscrews and bolts and nuts	Stainless steel	ASTM A 276, Type 304 or 316
Discs	Cast iron, ductile iron, Nylon 11, or	AWWA C504
Disc fasteners, seat retention segments, and seat fastening	Stainless steel	ASTM A 276, Type 304 or 316
Seat material	Buna-N, EPDM	--

Where the rubber seat is applied to the disc, it shall be bonded to a stainless steel seat retaining ring which is clamped to the disc by Type 304 or 316 stainless steel screw fasteners. The rubber valve seat shall be secured to or retained in the valve body. Tongue and groove seat design shall be tongue and grooved seat retention method with primary hub seal and a molded 0-ring suitable for weld-neck and slip-on flanges.

B. Actuators: Actuators shall conform to Section 40 05 21 - Valve Actuators and to ANSI/AWWA C540 - Power Actuating Devices for Valves and Sluice Gates, subject to the following requirements. Unless otherwise indicated, all manually-actuated butterfly valves shall be equipped with a handwheel and 2-inch square actuating nut and position indicator. Screw-type (traveling nut) actuators will not be permitted.

C. Worm Gear Actuators: Valves shall be equipped with worm-gear actuators, lubricated and sealed to prevent entry of dirt or water into the housing.

D. Manufacturers, or Equal

1. DeZurik Corporation.
2. Henry Pratt Company.
3. Bray

2.02 HIGH PRESSURE BUTTERFLY VALVES

Valves shall be Class 300 as indicated per ANSI B16.34, "Standard Class."

A. The valves shall be certified to NSF/ANSI 61 and to NSF/ANSI 372.

B. Minimum design differential pressure = 740 psi for Class 300 valves at a temperature of 100°F.

C. Factory test pressures shall be per ANSI B16.34, Section 7.

D. Valves shall be operable and hydrodynamically stable for fluid velocities up to 18 fps, fluid temperatures of 33°F to 125°F, and environmental temperature range of 35°F to 125°F. The disc position shall be partially to fully open under the above criteria. Valve shaft, key, actuator, and complete assembly shall not fail at the specified maximum fluid velocity. Valve disc shall not change position under any line velocity scenario, including maximum velocity.

E. The valve size shown in the drawings is the inside diameter of the valve body. The port diameter shall not be more than 1.25 inches smaller than the nominal valve size.

F. For the fully open position, the valve resistance factor ($K = 2h\ g/v2$) shall not exceed 0.80 for Class 300 as determined per AWWA Manual M49.

Where:

h= head loss across valve (feet).

g= acceleration due to gravity.

v = fluid velocity (fps) based on inlet area as determined by nominal valve diameter.

G. Design discs to provide a tight shutoff in both directions at the specified design differential pressure, with a pressure of 0 psig on the face of the disc opposite the pressurized side.

H. Provide the valve actuator with an internal mechanical stop per AWWA C504, Section 4.5.8, in addition to the actuator limit switch settings.

I. Each valve shall operate in fully opened and in intermediate positions as the valve opens and closes without noticeable flutter or vibration of the disc and shall be free of backlash or loose connections in the operating mechanism, linkage, and shaft connections.

J. Do not provide a body design utilizing internal or external reinforcing ribs.

J. Disc 1. Provide a solid disc or flow-through disc design.

K Resilient Seat Design

1. Resilient valve sealing design shall incorporate a RTFE resilient 0-ring, providing torque seating of the disc to the seat. Design the valve so that the disc can never be rotated through the seat. Valves shall have a seat field-replaceable capability.
2. Valve seating shall be achieved by applying a predetermined and calculated torque value to the valve disc. This value shall be consistent for all valves of the same size. Valve leakage shall be bubble tight in water.
3. Seal shall be bi-directional.

L. Shaft and Shaft Sealing System

1. Valve shaft shall be a one-piece unit extending completely through the disc. Disc to shaft connection shall be keyed or pinned. Shaft shall conform to API 609 anti-blowout protection.
2. Provide shaft seals of a design such that they can be replaced without removing either the valve shaft or the actuator. Provide a stuffing box for the seals having size sufficient to accept at least four rings of split-V packing. Valve shaft seal shall incorporate an adjustable packing box.
3. Combined torsional and transverse shear stress for shaft under condition of maximum design differential pressure plus motor actuator stall torque shall not exceed 66% of the yield strength of the specified material.
4. Design the connection between the shaft and disc to transmit shaft torque equivalent to at least 75% of the torsional strength of the shaft diameter.
5. Valve shafts shall be full size for the portion of the shaft that extends through the valve bearings, valve disc, and shaft seal. In the event that the valve shaft is turned down to fit connections to the valve-operating mechanism, the turned-down portion shall have fillets with radii equal to the offset to minimize the possibility of stress concentration at the junction of the two different shaft diameters. The turned-down portion of the shaft shall be capable of transmitting torque equivalent to at least 75% of the torsional strength of the minimum required shaft diameter and shall be capable of transmitting the maximum actuator torque without exceeding a torsional shear stress of 11,500 psi.
6. Provide alignment marks on the valve shaft and on the valve body to indicate the fully closed and fully open positions.

M. Shaft Bearings

1. Fit the valve with:

    a. Hardened stainless steel or austenitic ductile iron (with graphite packing rings), press-fit shaft bearings with replaceable inboard bearing protectors; or

N. Provide top and bottom bearing flush taps to prevent ingress of particulates or contaminants to the bearing area. Alternatively, seal the bearings by means of energized graphite packing rings. Flanged End Connections

1. Determine the pressure class of the valve and associated flanges based on the test pressures. For test pressures greater than 285 psi, use Class 300 flanges.

2. Class 300 flanges shall have the following facings unless otherwise indicated:

Class 300 Flange Facings		
Test Pressure (Psi)	**Size Range (inches)**	**Flange Facing**
286 to 350	48 and smaller	Flat

3. Class 300 flanges Flanges 24 inches. and smaller with flat faces shall comply with ANSI B16.5. Flanges 30 inches through 48 inches with flat faces shall comply with ANSI B16.47 (Series A), Table 6.

4. Provide flat-faced flanges as described above where connecting to cast-iron flanges and where otherwise indicated.

O. Packing, 0-Rings, and Gaskets

Packing, 0-rings, and gaskets shall be one of the following non-asbestos materials:

a. Teflon.

b. Kevlar aramid fiber.

c. Acrylic or aramid fiber bound by nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal.

d. Buna-N (nitrile).

e. Combination of graphite die-formed rings and braided graphite rope anti-extrusion rings.

Materials of Construction

1. Materials of construction for the valve components shall be as tabulated below.

Component	Material	Specification
Body, flanges	Carbon Steel	ASTM A 216, Grade WCB.
Disc	Stainless steel	ASTM A 351, Grade CF8M.
Valve seating surface in contact with seal ring	Use stainless steel disc with stainless steel seating edge	
Shaft, taper pins, dowels	Stainless steel, Monel, or precipitation hardened steel .	ASTM A 182, Grade F6a; ASTM A 276, Type 316; ASTM B 164, Alloy N04400; or ASTM A 564, Grade 517400.
Seat Assembly	RTFE RIFE	ASTM A240 or A 666, Type 316; ASTM B 127; UNS Grade 531803; UNS Grade S32205; or UNS Grade
Packing gland metal parts	Monel, or stainless steel	UNS N04400 or UNS S31600.
Shaft bearings	Stainless steel, or austenitic ductile iron	UNS Grade S31600 or ASTM A 439, Grade D2.
Bolts, studs, capscrews, nuts	Stainless steel	ASTM A 193, Grade B8M; ASTM A 194, Grade 8M

PART 3 EXECUTION

3.01 INSTALLATION

A. All exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator. The installation shall be in accordance with Section 40 50 20 Valves, General.

END OF SECTION

SECTION 40 05 23
CHECK VALVES

PART I GENERAL

1.01 SECTION INCLUDES

A. Check valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.02 RELATED SECTIONS

A. Section 40 50 20 - Valves, General.

1.03 CONTRACTOR SUBMITTALS

A. The Contractor shall furnish submittals in accordance with Section 40 05 20 - Valves, General.

PART 2 PRODUCTS

2.01 SILENT CHECK VALVES

A. General: Silent check valves for water service shall be globe style spring type, in accordance with ANSI/AWWA C 508-Swing-Check Valves for Waterworks Service, 2-inch. through 24-inch. NPS, unless otherwise indicated, with full-opening passages, designed for a water-working pressure of 300 psi.

B. The valves shall be certified to NSF/ANSI 61 and to NSF/ANSI 372.

C. All component parts shall be field replaceable without the need of special tools.

D. The valve shall provide zero leakage at both high and low pressures without overloading or damaging the seal.

E. Body: The valve body and cover shall be of ductile iron conforming to ASTM A536 Specification for Ductile Iron Castings, with Class 300 flanged ends conforming to ANSI/ASME B 16.42

F. Plug and Seat: The plug and seat shall be lead-free bronze or Type 316 stainless steel.

G. Spring: The spring shall be of Type 316 stainless steel with ends ground flat.

H. Manufacturers, or Equal

1. APCO Model 674
2. ValMatic Series 1800

PART 3 EXECUTION

3.01 GENERAL

A. All valves shall be installed in accordance with provisions of Section 40 50 20 - Valves, General.

END OF SECTION

SECTION 40 05 24
BALL VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ball valves and appurtenances, in accordance with the Contract Documents.

1.02 RELATED SECTIONS

A. Section 40 50 20 - Valves, General.

B. Section 40.05 21 - Valve Actuators.

1.03 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 — Submittal Requirements.

B. For rubber-seated ball valves, submit manufacturer's certification that rubber seat is field adjustable and replaceable.

1.04 WARRANTY

A. The manufacturer shall warrant ball valves against material and workmanship defects for a period of 1 year, which commences at final acceptance of the project. Submit the manufacturer's warranty prior to final acceptance.

PART 2 PRODUCTS

2.01 METAL BALL VALVES (4-INCH AND SMALLER)

A. General: Unless otherwise indicated, general purpose metal ball valves in sizes up to 4 inches shall have actuators in accordance with Section 40 05 21 - Valve Actuators.

B. Body: All ball valves up to 1-1/2 inches (incl.) in size shall have bronze or 316 stainless steel, as stated in drawings, 2- or 3-piece bodies with screwed ends for a pressure rating of not less than 600 psi. Valves 2 inches to 4 inches in size shall have bronze or stainless steel 2- or 3-piece bodies with flanged ends for a pressure rating of ANSI 125 psi or 150 psi unless otherwise indicated.

C. Balls: The balls shall be solid chrome plated brass or bronze, or stainless steel, with standard port (single reduction) or full port openings.

D. Stems: The valve stems shall be of the blowout proof design, of bronze, stainless steel, or other acceptable construction, with reinforced Teflon seal.

E. Seats: The valve seats shall be of Teflon or Buna-N, for bi-directional service and easy replacement.

1. Manufacturers, or Equal
   1. Conbraco Industries, Inc. (Apollo).
2. ITT Engineered Valves.
3. Neles-Jamesbury, Inc.
4. NIBCO, inc.

5. Watts Regulator.

6. Worcester Controls.

PART 3 EXECUTION

3.01 GENERAL

A. All valves shall be installed in accordance with provisions of Section 40 50 20 Valves, General. Care shall be taken that all valves in plastic lines are well supported at each end of the valve.

B. Gear actuators shall operate valves from fully open to fully closed through 10 cycles without binding or sticking. If actuators stick or bind or if pulling forces and torques exceed the values stated in Section 40 05 21, repair or replace the actuators and repeat the tests. Actuators shall be fully lubricated in accordance with the manufacturer's recommendations prior to operating.

END OF SECTION

SECTION 40 07 64
PIPE HANGARS AND SUPPORTS

PART I GENERAL

1.01 SECTION INCLUDES

A. This section includes materials and installation of pipe hangers and supports including accessory items, such as anchor bolts and screws.

1.02 RELATED SECTIONS

A. Section 09 90 00 - Painting and Coating.
B. Section 09 96 00 - High Performance Coatings.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Section 01 33 00.

B. Submit catalog information on each type of hanger and support used. Clearly indicate actual pipe outside diameter (not just nominal pipe size) that is used for the hangers and supports.

PART 2 MATERIALS

2.01 DESIGN CRITERIA

A. Provide pipe supports for every piping system installed. Support piping by pipe support where it connects to pumps or other mechanical equipment.

B. Pipe support and hanger components shall withstand the dead loads imposed by the weight of the pipes, fittings, and valves (all filled with water), plus valve actuators and any insulation, and shall have a minimum safety factor of five based on material ultimate strength.

2.02 HANGER AND SUPPORT SYSTEMS

A. Pipe hangers and supports shall be as manufactured by Anvil, Unistrut, B-Line, Superstrut, or equal.

B. Pipe hangers and supports shall comply with MSS SP-58 for the standard types referenced in the drawings. Construct special hangers and supports if detailed in the drawings. Type numbers for standard hangers and supports shall be in accordance with MSS SP-58.

C. Pipe supports shall be cast iron. Bases, rollers, and anchors shall be cast iron (ASTM A 48).

2.03 ANCHOR BOLTS AND SCREWS

A. Anchor bolts and screws for attaching pipe supports and hangers to walls, floors, ceilings, and roof beams shall be Type 316 stainless steel, ASTM A276 or F593. Nuts shall be Type 316 stainless steel, ASTM A194, Grade 8M, or ASTM F594, Type 316 stainless steel.

PART 3 EXECUTION

3.01 PIPE SUPPORT SPACING FOR SUPPORTS ON TOP OF SLABS OR GRADE

A. Install pipe supports on horizontal runs at the spacing shown or detailed in the drawings. Provide supports of the type shown or detailed in the drawings.

3.02 INSTALLING PIPE HANGERS AND SUPPORTS

A. Provide separate hangers or supports at each valve. Provide one hanger or support around each end of the valve body, or on the adjacent connecting pipe within one pipe diameter of the valve end. Provide additional hangers or supports to relieve eccentric loadings imposed by offset valve actuators.

B. Provide separate hangers or supports at each pipe elbow, tee, or fitting. Provide separate hangers or supports on both sides of each nonrigid joint or flexible pipe coupling.

C. Install leveling bolts beneath support baseplates. Provide 1 -inch thick grout pad beneath each base.

D. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps, and other equipment to which the pipe is connected.

3.03 PAINTING AND COATING

A. Grind welds of fabricated steel pipe supports smooth, prepare surface by sandblasting, and apply coating system.

B. Paint exposed pipe hangers and supports to match the color of the adjacent piping Section 09 96 00.

END OF SECTION

SECTION 40 20 01
GENERAL REQUIREMENTS FOR STEEL PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes general requirements for materials, fabrication, installation, and testing of steel pipe.

1.02 RELATED SECTIONS

A. Section 09 96 00 — High Performance Coatings.

B. Section 40 05 00 — General Piping Requirements.

C. Section 40 05 15 — Pressure Testing of Piping.

D. Section 40 07 64 — Pipe Hangers and Supports.

E. Section 40 23 15 — Fabricated Steel specials.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Section 01 33 00.

B. Submit materials list showing material of pipe and fittings with ASTM reference and grade. Submit manufacturer's certification of compliance with referenced standards, e.g., ASTM A 53, A 135, and A 587 and AWWA C200. Show piping service (fuel oil, gasoline, water, air, etc.).

C. For piping 6 inches and larger, submit piping layout drawings showing location and dimensions of pipe and fittings. Include laying lengths of valves, meters, in-line pumps, and other equipment determining piping dimensions. Label or number each fitting or piece of pipe and provide the following information for each item:

1. Material of construction, with ASTM or API reference and grade.
2. Wall thickness of steel cylinder.
3. Mortar lining thickness (if pipe has been specified to have a mortar lining).
4. Mortar coating thickness, where mortar coating is required.
5. Paint prime coating, where prime coat is required.
6. Manufacturer's certificates of compliance with referenced pipe standards, e.g., ASTM 53, ASTM A135, API 5L, AWWA C200.
7. Show weld sizes and dimensions of grooved-end collars, flanges, reinforcing collars, wrapper plates, and crotch plates.

PART 2 MATERIALS

2.01 STEEL PIPE CYLINDERS

A. The yield strength of the steel for pipe and fabricated fittings having grooved-end joints shall be minimum 35,000 psi.

B. Provide seamless pipe or pipe having straight longitudinal weld seams where pipe passes through rubber annular sealing devices.

C. The minimum pipe wall thickness shall be determined as outlined in latest version of Manual M11 published by the American Water Works Association with a design pressure of 300 psi and a maximum design stress of 17,500 psi.

2.02 FITTINGS

See Section 40 23 15.

2.03 JOINTS

A. Where piping connects to wall pipes, meters, valves, or other equipment, the pipe ends shall match the ends of the wall pipes, meters, valves, or equipment.

2.04 GROOVED-END COUPLINGS

A. As shown on drawings.

2.05 FLANGES

A. Forged flange material shall conform to ASTM A105, A181, or A182. Steel flange material shall conform to ASTM A283 (Grade C or 0), A285 (Grade C), or A36.

B. Determine the pressure class of the flanges based on the test pressures shown in Section 40 05 15. For test pressures 200 psi and less, use Class 150 flanges. For test pressures greater than 200 psi, use Class 300 flanges having the following facings unless otherwise indicated:

Test Pressure (Psi)	Size Range (inches)	Flange Facing
150 to 350	48 and smaller	Flat

C. Class 150 flanges shall comply with AWWA C207, Class D or E as follows. Use welding neck flanges conforming to ANSI B16.5 where connecting to wrought steel elbows and tees. Flanges shall be flat faced. Use the following pressure classes of flanges based on the specified test pressures:

Test Pressure (psi)	Pipe Size (inches)	Flange Pressure Class
175 and less	4 to 12	Class D
175 to 200	4 to 12	Class E
150 and less	14 to 144	Class D
150 to 200	14 to 144	Class E

D. Class 300 flanges 24 inches and smaller with flat faces shall comply with AWWA C207, Class F or ANSI B16.5. Flanges 30 inches through 48 inches with flat faces shall comply with AWWA C207, Class F.

2.06 BOLTS, NUTS, AND GASKETS FOR FLANGES See Section 05 05 20,

PART 3 EXECUTION

3.01 FABRICATION, ASSEMBLY, AND ERECTION

A. Beveled ends for butt-welding shall conform to ANSI B16.25. Remove slag by chipping or grinding. Surfaces shall be clean of paint, oil, rust, scale, slag, and other material detrimental to welding. When welding the reverse side, chip out slag before welding.

B. Fabrication shall comply with ANSI B31.3, Chapter V. Welding procedure and performance qualifications shall be in accordance with Section IX, Articles II and III, respectively, of the ASME Boiler and Pressure Vessel Code.

C. The minimum number of passes for welded joints shall be as follows:

Steel Cylinder Thickness (inch)	Minimum-Number of Passes for Welds
Less than 0.1875	1
0.1875 through 0.25	2
Greater than 0.25	3

Welds shall be full penetration.

D. Use the shielded metal arc welding (SMAW) submerged arc welding (SAW), flux-cored arc welding (FCAW), or gas-metal arc welding (GMAW) process for shop welding. Use the SMAW process for field welding.

E. Welding preparation shall comply with ANSI B31.3, paragraph 328.4. Limitations on imperfections In welds shall conform to the requirements in ANSI B31.3, Table 341.3.2 and paragraph 341.4 for visual examination.

F. Identify welds in accordance with ANSI B31.3, paragraph 328.5.

G. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.

H. Welding electrodes shall comply with AWS A.5.1.

3.02 REINFORCEMENT FOR SPECIALS

See Section 40 23 15.

3.03 Shop Testing of Fabricated or Welded Components

A. After completion of fabrication and welding in the shop and prior to the application of any lining or coating, test each component according to the referenced standards. Test fabricated fittings per AWWA C200. Test the seams in fittings that have not been previously shop hydrostatically tested by the dye penetrant method as described in ASME Boiler and Pressure Vessel Code Section VIII, Appendix B. In lieu of the dye penetrant method of testing, completed fittings may be hydrostatically tested. Use the field hydrostatic test pressure or 125% of the design pressure, whichever is higher.

3.04 PRODUCT MARKING

A. Plainly mark each length of straight pipe and each special and fitting at the bell end to identify the design pressure or head, the steel wall thickness, the date of manufacture, and the proper location of the pipe item by reference to the layout schedule. For beveled pipe, show the degree of bevel and the point on the circumference to be laid uppermost.

3.05 INSTALLING FLANGED PIPING

See Section 40 05 00.

3.06 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

See Section 40 05 00.

3.07 INSTALLING ABOVEGROUND OR EXPOSED PIPING

See Sections 40 05 00. 3.09 PAINTING AND COATING

A. Coat pipe located above ground or in vaults and structures in accordance with Section 09 96 00, High Performance Coatings.

B. Coat the interior metal surfaces of blind flanges per Section 09 96 00, High Performance Coatings.

3.8 FIELD THICKNESS MEASUREMENT AND REPAIR OF PAINT COATINGS FOR STEEL PIPE

A. Field repair shop applied prime coats per Section 09 96 00, High Performance Coatings.

B. Test linings and coatings per ASTM G62, Method B, with a holiday detector set at 125 volts per mil coating thickness. Repair holidays and pinholes by applying the prime, intermediate, and finish coatings to each holiday or pinhole and retest.

C. Measure the lining and coating thickness on each pipe section using a calibrated coating thickness gauge. Make five separate spot measurements (average of three readings) spaced evenly over every 15 linear feet (or fraction thereof) to be measured. Make three gauge readings for each spot measurement of either the substrate or the paint. Move the probe a distance of 1 to 3 inches for each new gauge reading. Discard any unusually high or low gauge reading that cannot be repeated consistently. Take the average (mean) of the three gauge readings as the spot measurement. The average of five spot measurements for each area shall not be less than the specified thickness. No single spot measurement in any area shall be less than 80%, or more than 120%, of the specified thickness. One of three readings that are averaged to produce each spot measurement may underrun by a greater amount. If a section of the pipe, item, or piece of equipment does not meet these criteria, remove the entire lining or coating and recoat the entire item or piece of equipment.

D. Thickness determination shall meet the following requirements:

1. No individual reading shall be below 75% of specified thickness.

2. Individual spot readings (consisting of three point measurements within 3 inches of each other) shall have an average not less than 80% of specified thickness.

3. The average of all spot readings shall be equal to or greater than nominal thickness specified.

E. Thickness determinations shall be conducted using a Type 1 magnetic thickness gauge as described in SSPC PA2 specification.

F. If the item has an insufficient film thickness, clean and topcoat the surface with the specified finish coatings to obtain the specified coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded coating, feathering the edges. Then coat in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

END OF SECTION

SECTION 40 23 15
FABRICATED STEEL SPECIALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes materials and fabrication of steel pipe specials of sizes 4-inches through 120-inches, in accordance with AWWA C200, C205, and C208 and the following options and restrictions, for use in transmission and distribution mains and in manifold piping facilities, such as pumping stations, metering structures, and other piping associated with mechanical equipment.

1.02 SPECIALS

A. A special is defined as any piece of pipe other than a normal full-length straight section. This includes but is not limited to elbows, manhole sections, short pieces, reducers, adapter sections with special ends, sections with outlets, etc.

1.03 RELATED SECTIONS

A. Section 09 96 00 - High Performance Coatings.

B. Section 40 05 00 - General Piping Requirements.

C. Section 40 05 15 - Pressure Testing of Pipe.

D. Section 40 20 01 - General Requirements for Steel Piping.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Section 01 33 00.

B. Submit drawings for fabricated steel specials showing dimensions, wall thickness, reinforcing at openings, type of coating, and lining. Label or number each special and provide the following information:

1. Material of construction, with ASTM or API reference and grade.

2. Paint primer coating, where primer coat is required.

3. Weld sizes and dimensions of flanges, reinforcing collars, wrapper plates, and crotch plates.

C. Submit affidavit of compliance with referenced standards (e.g., AWWA C208, ASTM A53, etc.).

D. Submit welding procedure specifications (WPS) and procedure qualification records (PQR) for each welding process and welder qualification records (WQR) for each welder and welding operator.

E. Submit certified original copies of mill test reports on each heat from which steel is rolled. Tests shall include physical and chemical properties. Submit certified original copies of mill test reports for flanges including details of stress relief used. Manufacturer's certificates of compliance with referenced pipe standards, e.g., ASTM A 53, ASTM A 135, API 5L. Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.

F. Submit dimensional check reports on each steel pipe special after fabrication.

G. Submit manufacturer's certificates of welding consumables used for shop and field welding.

PART 2 MATERIALS

2.01 FITTINGS AND SPECIALS

A. Provide fabricated cement-mortar lined and dielectric coated steel fittings for buried service. Coat exposed fittings per Section 09 96 00 - High Performance Coatings.

B. Mortar Lining: Cement shall be in accordance with ASTM C150, Type If for mortar lining.

C. Ends of the fittings shall be compatible with the pipe joint for the particular type of pipe to which the steel fittings or specials connect.

2.02 STEEL FITTINGS

A. A fitting is defined as a special piece of pipe other than a normal straight section. Elbows, manhole sections, reducers, and sections with outlets are fittings.

B. Unless stated otherwise in the detailed pipe specifications, fittings shall comply with ANSI B16.9 or AWWA C208, as follows:

1. Specials and wrought steel butt-welded fittings 4 through 10 inches shall comply with ASME B16.9. Material shall comply with ASTM A234, Grade WPB. Elbows shall be of the long-radius type unless otherwise shown in the drawings.

2. For tees and crosses, comply with ASME B16.9 or AWWA C208, Figure 1 and Table 1.

3. For reducing tees, laterals, wyes, reducers, and tangent outlets, comply with AWWA C208, Section 4. Reducers complying with ASME B16.9 may also be used.

C. If no design pressure is shown in the drawings, assume the design pressure to be 25 psi less than the test pressure.

D. Material for fabricated fittings 12 through 30 inches in diameter shall be the same as the pipe or shall comply with ASTM A283 (Grade D), ASTM A36, or ASTM A572 (all grades). Carbon content: 0.25% maximum.

E. Maximum circumferential stress at the design pressure: 40% of minimum yield stress. Minimum wall thickness of steel fittings other than mitered elbows shall be the same as the pipe of same size per ANSI B36.10.

F. Mortar lining thickness shall match the piping. Mortar lining thickness and I.D. dimensions for specials larger than 10 inches shall be such that the lining inside diameter equals the nominal pipe size.

2.03 FLANGES

See Section 40 20 01

2.04 BOLTS, NUTS, AND GASKETS FOR FLANGES

See Section 40 05 00.

2.05 OUTLETS AND NOZZLES IN STEEL SPECIALS

See Section 40 20 01.

PART 3 EXECUTION

3.01 FABRICATION, ASSEMBLY, AND ERECTION OF STEEL SPECIALS

See Section 40 20 01.

3.02 HYDROSTATIC, RADIOGRAPHIC, ULTRASONIC, SOAP AND COMPRESSED AIR, LIQUID PENETRANT, AND MAGNETIC PARTICLE TEST METHODS

See Section 40 20 01.

3.03 FIELD HYDROSTATIC TESTING

See Section 40 20 01

END OF SECTION

SECTION 40 50 20
VALVES, GENERAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Valves, actuators, and appurtenances.

B. The provisions of this Section shall apply to all valve actuators except where otherwise indicated. Valves and actuators in particular locations may require a combination of units, sensors, limit switches, and controls indicated in other Sections of the Specifications.

C. Unit Responsibility: A single manufacturer shall be made responsible for coordination of design, assembly, testing, and furnishing of each valve; however, the Contractor shall be responsible to the Owner for compliance with the requirements of each valve section. Unless indicated otherwise, the responsible manufacturer shall be the Manufacturer of the valve.

D. Single Manufacturer: Where two or more valves of the same type or size is required the valves shall be furnished by the same Manufacturer.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

ASTM A48	Specification for Gray Iron Castings,
ASTM A126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A216	Specification for Steel Castings, Carbon Suitable for Fusion Welding for High Temperature Service
ASTM A351	Specification for castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts
ASTM A395	Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
ASTM A515	Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate and Higher Temperature Service
ASTM A536	Specification for Ductile Iron Castings
ASTM B62	Specification for Composition Bronze or Ounce Metal Castings
ASTM B84	Specification for Copper Alloy Sand Castings for General Applications
MSS SP25	Standard Marking Systems for Valves, Fittings, Flanges, and Unions

1.03 CONTRACTOR SUBMITTALS

A. General: Submittals shall be furnished in accordance with Section 01 33 00 - Submittal Requirements.

B. Shop Drawings: Shop drawings shall contain the following information:

1. Valve name, size, Cv factor for 10% through 100% in increments of 10%, pressure rating, identification number (if any), and specification section number.
2. Complete information on valve actuator, including size, Manufacturer, model number, limit switches, and mounting. Dimensions and orientation of valve actuator needs to be included.
3. Cavitation limits for all control valves.
4. Assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, handwheels, position indicators, limit switches, integral control systems, needle valves, and control systems.
5. Data in accordance with Section 40 92 10 Electric Motor Actuators for Valves for all electric motor-actuated valves.
6. Complete wiring diagrams and control system schematics.
7. Valve Labeling: A schedule of valves to be labeled, indicating in each case the valve location and the proposed wording for the label.
8. Show valve linings and coatings. Submit manufacturer's catalog data and descriptive literature. Indicate materials of construction, specification (AISI, ASTM, SAE, CDA, etc.) and grade or type.

C. Operation and Maintenance Manual: The Manual shall contain the required information for each valve. Manual must conform to specification 01 78 23 Operating and Maintenance Data.

D. Factory Test Data: Where indicated, signed, dated, and certified factory test data for each valve requiring certification shall be submitted before shipment of the valve. The data shall also include certification of quality and test results for factory-applied coatings. Submit one copy of a report verifying that the valve interior linings and exterior coatings have been tested for holidays and lining thickness. Describe test results and repair procedures for each valve.

1.01 WARRANTY

A. All valves 24-inch and larger in diameter shall be warranted by the manufacturer against material and workmanship defects for a period not less than 2 years, or longer if otherwise stated, which commences at final acceptance of the project. The manufacturer's warranty shall be submitted prior to final acceptance.

PART 2 PRODUCTS

2.01 PRODUCTS

A. General: All valves shall be new and of current manufacture. All shut-off valves 6- inches and larger shall have actuators with position indicators.

B. Valve Actuators: Unless otherwise indicated, valve actuators shall be in accordance with Section 40 05 21 - Valve Actuators.

C. Protective Coating: The exterior surfaces of all valves and the wet interior surfaces of all ferrous valves of sizes 4 inches and larger shall be coated in accordance with Section 09 96 00 - High Performance Coatings. The valve Manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with these Specifications. Flange faces of valves shall not be epoxy coated but shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is complete.

D. Valve Labeling: Except when such requirement is waived in writing, a label shall be provided on all shut-off valves and control valves except for hose bibbs and chlorine cylinder valves. The label shall be of 1/16-inch plastic or stainless steel, minimum 2 inches by 4 inches in size and shall be permanently attached to the valve or on the wall adjacent to the valve as directed by the Field Representative.

E. Valve Testing:

1. All valves 3 inches and smaller shall undergo the Manufacturer's standard test.

2. As a minimum, unless otherwise indicated, each valve body 4 inches and larger shall be tested hydrostatically to 1.5 times its rated 100 degrees F design water-working pressure, for a period of 5 minutes, without showing any leaks or loss of pressure. In addition, each valve 4 inches and larger shall undergo a functional test to demonstrate satisfactory operation throughout its operating cycle, and a closure test at rated 100 degrees F water-working pressure for a period of 5 minutes to demonstrate tight shut-off. Minor stem seal leakage shall not be a cause for rejection.

3. All valves 24 inches and larger shall be factory tested as complete assembled units including actuator and the tests shall be witnessed by the Field Representative. The Contractor shall furnish notification to the Field Representative a minimum of 4 weeks prior to testing. The Contractor shall submit all written factory testing results to the Field Representative for review prior to shipment

F. Certification: Prior to shipment, submit for all valves over 4 inches in size, certified copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, and ASTM.

G. Valve Marking: All valve bodies shall be permanently marked in accordance with MSS SP25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

2.02 MATERIALS

A. General: All materials shall be suitable for the intended application. Materials not specified shall be high-grade standard commercial quality, free from all defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended. Unless otherwise specified, valve bodies shall conform to the following requirements:

1. Cast Iron: Cast iron valve bodies shall be of close-grained gray cast iron, conforming to ASTM A48 - Specification for Gray Iron Castings, Class 30, or to ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings, Class B.

2. Ductile Iron: Ductile iron valve bodies shall conform to ASTM A536 - Specification for Ductile Iron Castings, or to ASTM A395 - Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

3. Steel: Steel valve bodies shall conform to ASTM A216 - Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service, Grade WCB or to ASTM A515 - Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service, Grade 70.

4. Bronze: Bronze valve bodies shall conform to ASTM B62 - Specification for Composition Bronze or Ounce Metal Castings, and valve stems not subject to dezincification shall conform to ASTM B584 - Specification for Copper Alloy Sand Castings for General Applications,

5. Stainless Steel: Stainless steel valve bodies and trim shall conform to ASTM A351 - Specification for Castings, Austenitic, for Austenitic-Ferritic (Duplex) for Pressure-Containing Parts, Grade CF8M, or shall be Type 316 stainless steel.

2.03 VALVE CONSTRUCTION

A Bodies: Valve bodies shall be cast, forged, or welded of the materials indicated, with smooth interior passages. Wall thicknesses shall be uniform in agreement with the applicable standards for each type of valve, without casting defects, pinholes, or other defects that could weaken the body. All welds on welded bodies shall be performed with approved welding procedures and procedure qualifications. All welders shall be certified. Welds shall be ground smooth. Valve ends shall be as indicated and be rated for the maximum temperature and pressure to which the valve will be subjected.

B. Bonnets: Valve bonnets shall be clamped, screwed, or flanged to the body and shall be of the same material, temperature, and pressure rating as the body. The bonnets shall have provision for the stem seal with the necessary glands, packing nuts, or yokes.

C. Stems: Valve stems shall be of the materials indicated, or, if not indicated, of the best commercial material for the specific service, with adjustable stem packing, 0-rings, Chevron V-type packing, or other suitable seal. Where subject to dezincification, bronze valve stems shall conform to ASTM B 62, containing not more than 5 percent of zinc or more than 2 percent of aluminum, with a minimum tensile strength of 60,000 psi, a minimum yield strength of 40,000 psi, and an elongation of at least 10 percent in 2 inches. Where dezincification is not a problem, bronze conforming to ASTM B 584 may be used. Stems made of 316 stainless steel to ASTM A 182, Grade F6 of 17-4 PH to ASTM A 564, Grade 630 are also acceptable.

D. Internal Parts: Internal parts and valve trim shall be as indicated for each individual valve. Where not indicated, valve trim shall be of Type 316 stainless steel or other best suited material.

E. Nuts and Bolts: All nuts and bolts on valve flanges and supports shall be in accordance with Section 05 05 20 - Bolts, washers, anchors and eyebolts.

2.04 VALVE ACCESSORIES

A. All valves shall be furnished complete with the accessories required to provide a functional system.

PART 3 MANUFACTURE

3.01 VALVE INSTALLATION

A. General: All valves, actuating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the Manufacturer's written instructions and as indicated. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. Access: All valves shall be installed with easy access for actuation, removal, and maintenance and to avoid interference between valve actuators and structural members, handrails, or other equipment.

C. Valve Accessories: Where combinations of valves, sensors, switches, and controls are indicated, assemble and install such items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

END OF SECTION

SECTION 40 92 10
ELECTRIC MOTOR ACTUATORS FOR VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes materials and installation of electric motor actuators for valves.

1.02 RELATED SECTIONS

A. Section 09 96 00 - High Performance Coatings.

B. Section 40 07 64 - Pipe Hangers and Supports.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions Section 01 33 00.

B. Submit manufacturer's catalog data showing motor actuator parts and materials of construction, referenced by AISI, ASTM, SAE, or CDA specification and grade. Show motor actuator dimensions and weights. Show coatings.

C. Show the maximum torque required to open and close each motor actuated valve.

D. Submit certified factory performance test records.

E. Submit motor data including nameplate data, insulation type, duty rating, and torque output at duty rating.

F. Submit electrical schematic drawings and wiring diagrams showing physical locations of components.

PART 2 MATERIALS

2.01 ACTUATOR IDENTIFICATION

A. Motor actuators shall have the name of the manufacturer cast or molded onto the actuator body or shown on a permanently attached plate in raised letters.

2.02 ACTUATOR TAGGING

A. Provide identifying tags for electric motor actuated valves. Show valve actuator name or designation as shown in the drawings, and valve size. Attach tags to actuators by means of stainless steel wire.

2.03 ACTUATOR TORQUE REQUIREMENTS

A. When subjected to the most severe operating condition including any mechanical friction and/or other restrictive conditions that are inherent in the valve assembly. Do not include hammer-blow effect in sizing the actuator to comply with this torque requirement. Coordinate with the valve manufacturer to assure that the motor actuator stall torque output does not exceed the torque limits of the valve operating stem or shaft.

B. Maximum torque shall include seating or unseating torque, bearing torque, dynamic torque, and hydrostatic torque. Assume that the differential pressure across the valve is equal to the pressure or head rating of the valve.

2.04 DESIGN OF ELECTRIC MOTOR ACTUATORS

A. Actuators shall comply with AWWA C540, except as modified herein. Output capacity of motors shall be sufficient to open or close the valve against the maximum differential pressure when the voltage is 10% above or below normal at the specified service conditions. Motors shall have Class F or H insulation system. Provide motor with torque output (at duty rating) that exceeds the requirements of the following paragraphs including safety factor.

B. Design the actuator to move valves from fully closed to fully open in the time specified in the subsection on "Service Conditions."

C. Provide a reversing starter, three overloads (one in each ungrounded leg) or two motor thermal cutouts, 120-volt control power transformer, local-off-remote selector switch, open-stop-close push buttons, and opened and closed indicator lights. Provide magnetic starters in actuators for open/close operation and solid-state starters in actuators for modulating operation. Provide dry contact for remote indication of the actuator mode of operation. The contact shall be closed when the local-off-remote selector switch is in the remote position and the internal control power exists.

D. Do not use external conduit for wiring any components within the actuator.

E. Gear actuators shall be total enclosed and factory-grease packed or oil lubricated. The power gearing shall consist of helical gears of heat-treated steel. Worm gears shall be alloy bronze accurately cut with a hobbing machine. Worm shall be hardened steel alloy. Design gears for 24-hour continuous service with an AGMA rating of 1.50.

F. Position switches shall be integrally geared to the actuator and shall be adjustable and capable of actuation at any point between fully opened and fully closed positions. The position switches shall operate while the actuator is either in manual or in motor operation. Provide motor actuators with position switches capable of being separately used to provide remote indication of end of travel in each direction and to stop motion at the end of travel in each direction.

G. Provide two individually adjustable torque switches to protect the valve and motor against overload in the opening and closing directions. To prevent hammering, the torque switch shall not reclose until the valve is made to travel in the opposite direction.

H. Provide a manually operated handwheel which shall not rotate during electrical operation. In the event electrical power is interrupted, handwheel operation shall be activated by a hand lever attached to the mechanism. While the valve is being operated manually, the motor shall not rotate. Upon restoration of electrical power, the handwheel shall automatically disengage. Design the handwheel diameter such that hand operation will not damage the valve.

I. Provide a lost motion device for open/close operation to permit the motor to reach full speed before the load is applied. Provide lost motion action for manual operation also. Do not provide lost motion device for modulating applications.

J. Provide minimum 10-watt space heater mounted in the actuator housing to prevent condensation and maintain the temperature in the actuator housing 5 degrees above the ambient temperature in the structure. Heater shall be on at all times.

K. Controls shall be electro-mechanical type without microprocessors or other electronic devices.

L. Motor shall de-energize in the event of a stall when attempting to unseat a jammed valve.

M. Provide a time delay to prevent instant reversal of the actuator motor.

N. Provide terminal connections for external remote controls fed from an internal 120-volt supply.

O. Electric motor actuators shall be Limitorque Model L120, or approved equivalent. Actuators on the project shall be of one manufacturer.

2.05 FACTORY PERFORMANCE TESTING OF MOTOR ACTUATOR

A. Test each actuator prior to shipment in accordance with AWWA C540, Section 5.3. The application torque shall be the maximum torque required to open or close the valve at any position including seating and unseating conditions.

PART 3 EXECUTION

3.01 ATTACHING ELECTRIC ACTUATORS

A. The valve manufacturer shall mount the electric motor actuator and accessories on each new valve and stroke the valve prior to shipment. The Contractor shall mount the new electric motor actuator on each valve at the site without removing the valve and stroke the valve. Adjust limit switch positions and torque switches.

3.02 PAINTING AND COATING

A. Coat electric motor actuator factory standard color. Apply at the place of manufacture.

3.03 FIELD INSTALLATION

A. Install the valve and/or actuator as indicated in the drawings in accordance with the manufacturer's instructions. Keep units dry, closed, and sealed to prevent internal moisture damage during construction.

3.04 FIELD TESTING OF MOTOR ACTUATORS

A. Test motor actuators as installed by measuring the current drawn (in amperes) by each motor for unseating, seating, and running conditions. The measured current shall not exceed the current measurement recorded during the factory performance test.

B. If the measured current drawn exceeds the above value, provide a larger motor or gear drive or adjust the actuator so that the measured amperage does not exceed the value.

C. Assure that limit switches are placed at their correct settings. Open and close valves twice and assure that limit switches function.

END OF SECTION

SECTION 40 97 15
PRESSURE GAUGES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes materials and installation of pressure gauges and accessories.

1.02 RELATED SECTIONS

A. Section - 40 05 15 - Pressure Testing of Piping

B. Section 40 50 20 - Valves, General

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit manufacturer's catalog data and descriptive literature. Call out materials of construction by ASTM reference and grade. Submit manufacturer's certificate of compliance with the referenced ANSI standards.

PART 2 MATERIALS

2.01 PRESSURE GAUGES

A. Pressure range shall be as designated as shown in the drawings.

B. Gauges 4-1/2 inches and larger shall comply with ANSI B40.1, Grade 2A. Gauges shall incorporate the following features:

1. Solid or open front with side or rear blowout relief.
2. Pressure tight.
3. 270-degree arc with adjustable pointer.
4. Stem mounted.
5. Liquid filled

Size of gauge shall be 4-1/2 inches. Stem or connection size shall be 1/2 inch.

C. Materials of construction shall be as shown in the following table:

Item	Material	Specification
Case	Stainless steel, aluminum, polypropylene or phenolic plastic	AISI 316, 6061-T6
Bourdon tube	Stainless steel	AISI 316
Window	Acrylic plastic	
Ring	Stainless steel	AISI 316
Stem	Stainless steel	AISI 316
Dial face	Aluminum with clear baked-on acrylic coating	ASTM B209, 6061-T6

2.02 TYPE 1 DIAPHRAGM SEALS (STAINLESS STEEL)

A. Provide diaphragm seals with gauge assemblies where shown in the drawings. Material of construction shall be Type 316 stainless steel. Mount the pressure gauge directly on the socket of the diaphragm seal top housing. Instrument (gauge) connection socket shall be 1/2 inch. Diaphragm seal connection socket shall be 1/2-inch NPT threaded female with flush connection. Pressure rating shall be at least that of the pressure gauge to which it is attached. Liquid filling shall be silicone or glycerin.

B. Gauge and diaphragm seal shall be assembled together at the factory, with the liquid fill included. Provide a Type 316 stainless steel plug or cock in the flush connection.

2.03 PRESSURE SNUBBERS

A. Provide pressure snubbers with gauge assemblies where shown in the drawings. Material of construction shall be Type 316 stainless steel. Snubber design shall incorporate a porous metal disc for use with the process fluid in the pipeline. Inlet and outlet connections shall be NPT female and shall match the connection size of the attached pressure gauge.

2.06 PIPE NIPPLES AND FITTINGS

A. Nipples for connecting gauges to piping shall be stainless steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install gauges before conducting pressure tests. Do not disassemble gauges from the factory-assembled diaphragm seals or isolation sleeves or rings.

END OF SECTION

SECTION 44 42 56
VERTICAL TURBINE PUMPS

PART1 GENERAL

1.01 SECTION INCLUDES

A. One vertical turbine pump.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittals.

B. Section 01 78 23 - Operating and Maintenance Data.

C. Section 09 96 00 - High Performance Coatings.

D. Section 44 46 99 - Equipment Installation.

E. Section 26 05 10 - Large Motors.

1.03 SUBMITTALS

A. Characteristic variable speed curves for pumps, showing total dynamic head, efficiency and brake horsepower plotted against capacity in gpm for full range of impeller.

B. Field Test -Vibration spectral data measurement and analysis for each prepared in accordance with the Hydraulic Institute. Pump Vibration Standard Section 9.6.4.3 and Allowable Pump Field Vibration values in accordance with Figure 9.6.4.13.

C. Catalog cuts, with equipment dimensions, including pump and pump head details.

D. Parts list, with materials of construction.

E. Design data.

F. Installation instructions.

G. Spare parts list.

H. Operation and maintenance manuals.

1.04 SERVICE REPRESENTATIVE

A. Manufacturer of equipment shall provide qualified service representative to perform functions described in Section 01 43 33.

1.05 TESTS

A. Factory test all actual pumps at manufacturer's plant using variable frequency drives. Perform tests in accordance with Test Code of Hydraulic Institute Standards. Perform factory and field, noise and vibration test.

B. Shop tests shall be made of each pumping unit to determine the capacity, efficiency, and brake horsepower when operating under the full range of heads. Certified copies of the shop test results shall be furnished and approved by the Engineer before shipment of the equipment.

C. Test curves shall cover full range of operation from shutoff to maximum capacity, and have capacity plotted as abscissas, and operating head, brake horsepower, efficiency and net positive suction head required plotted as ordinates. Net positive suction head required testing can be waived if the net positive head required from the manufacturer's standard curves is lower than the net positive suction head available by a minimum of 10 feet. Provide test data results to Engineer.

D. Test points:
   Shut off.
   Maximum run out.
   Design operating condition.
   Two additional points, one on each side of rated operating point.

E. Test tolerances:
   Pumps shall be within one of following tolerance:
   a. At rated head: +10% of rated capacity.
   b. At rated capacity: +5% of rated head.
   c. No minus tolerance or margin shall be allowed with respect to capacity or total head at rated or specified condition.
   d. Pump manufacturer shall provide shop space, tools, equipment, instruments, personnel, and facilities required for satisfactory completion of tests. Payment for tests shall be included in Contract Price.

F. Certified Pump Characteristic Test curves shall be submitted and reviewed prior to pumps being released for shipment.

1.06 SYSTEM REQUIREMENTS

A. See PART 2 for specific hydraulic design requirements for each pump.

B. Provide drive units, accessories, specials and similar items required for complete installation.

C. Pumps shall be suitable for continuous operation at flow conditions stated herein without excessive noise, vibration, heating, cavitation, or damage to pump.

D. Head characteristics for pumps: Continuously rising as flow is decreased.

E. The shutoff head shall be at least 110% of the head that occurs at the highest design point.

F. The NPSH required shall be at least 5 feet less than the minimum NPSH available at all points on the pump curve up to 120% of the flow at the best efficiency point (BEP)

G. The operating point shall be to the right of the Best Efficiency Point (BEP) on the pump curve.

H. Shafts: Accurately grind and machine surface to ensure interchangeability of shafts and parts attached to shaft; sufficient size to transmit required horsepower.

I. Pump support base and bolts shall accommodate hydraulic thrust forces; no supplementary support will be provided.

J. Equip with connections suitable for working pressures identified on the drawings.

K. Discharge flange or casing shall be tapped for gage connection with openings sealed by removable plugs.

L. Materials or features not specified herein shall be manufacturer's standard for equipment and shall be suitable for specified service conditions. Pumps and motors shall be engineered and designed as complete, coordinated functioning units.

PART 2 PRODUCTS

2.01 TURBINE PUMPS

A. Type: Vertical Turbine Pump with above ground discharge.

B. Pumps and motors shall be engineered and designed as a complete functioning unit and compatible. The characteristic curves for each pump shall have steep slopes. Flat curves will not be acceptable.

C. Pump and motors shall be designed for non-reverse rotation. Motor shall be provided with non-reversing ratchet assembly.

D. A suitable basket strainer of galvanized steel shall be provided having a free area of at least five times the flow area of the Suction Pipe.

E. Quantity of pumps: 1

F. Design Conditions: Pump hydraulic performance conditions and design data shall be as shown below:

Vertical Turbine Pump

Pump Tag	**Pump #4**
Service	Indoor
Altitude (ft.)	4556
Fluid	Water
Fluid Temperature (degrees F)	35-65
Pump Speed	1800 rpm
Minimum NPSHA	60 ft.
Number of Stages	4-6
Motor Horsepower	1250
Motor Type	Vertical, Induction
Start	RVSS
Suction Flange	Class 150
Discharge Flange	Class 300, grooved end
Type of Packing	Mechanical Seals

Design Points	Capacity (gpm)	Head (ft)	Min pump efficiency (%)
1	6,650	565	86
Design Point	7,200	530	86
3	7,820	500	86

G. Provide bid price for an alternate pump with a minimum 83% pump efficiency and conforming to the specifications listed in Section 44 42 56.

H. Complete units, when operating at specified conditions of service and speed, shall be free from excessive vibration, cavitation, noise, oil or water leaks.

I. Provide lifting lugs on all components.

J. Pump submergence requirements shall be compatible with specification ANSI/HI 9.8-2012.

K. Pump assembly shall be NSF/ANSI 61 and NSF/ANSI 372 certified.

L. Pump manufacturer shall design the discharge head to withstand the natural frequencies of the motor through its operating speed range. Perform Reed Critical analysis on pump discharge head to minimize vibration of the pump and motor assembly.

M. Construction:
Motor mounting on each pump shall be for a direct connected motor.
Suction bell: Flared, cast iron with flanged connection to adjacent component of pump bowl assembly with vortex suppressor.
Bowl assembly: Smooth finish cast iron with flanged ends. Wall thickness shall be equal to or greater than that of discharge column.
Provide sleeve type bearings at each stage.
Impeller: One-piece cast bronze, smooth finish, open, dynamically balanced. Impeller shall be locked to pump shaft in a manner to permit ready removal.
Pump shaft: 416 stainless steel of sufficient diameter to transmit full load torque and thrust with a safety factor and to prevent excessive deflection.
Discharge column assembly: Flanged base plate.

a. Discharge: Steel, end to accommodate grooved flexible coupling. Size to match discharge pipe diameter as indicated on the Drawings.
b. Line shaft and couplings: Solid 416 stainless steel shaft with adjustable spacer coupling.
c. Line shaft bearing: Water lubricated with bronze bearings.
d. Base plate: Steel.

Seals:

e. General - The seal system for pumps shall be mechanical type seals. Unless specified otherwise, mechanical seals shall conform to the requirements set forth in this paragraph.

f. Seal detail - The cartridge seal shall be a single, balanced design capable of 300 psig service with O-ring secondary seals and set screw drive. Materials of construction shall be tungsten carbide or silicon carbide vs. carbon graphite face material, 316 SS metals, Hastelloy springs, and Viton elastomers. Seal type to be Chesterton Model 155 cartridge seal, Flowserve ISC or equal.

g. The mechanical seal shall be plumbed with an API Plan 13 (1/8" orifice in line plumbed from seal to suction).

Balance: Each rotating assembly, including coupling, shaft impeller with wearing rings, and impeller nut, shall be dynamically balanced prior to final assembly. When properly balanced, each rotating element shall meet the following minimum criteria at speeds varying from 50% to 100% of the maximum operating speed. When properly balanced, each rotating element shall meet the following at every point throughout this range:

Maximum speed -rpm	**Maximum amplitude**
900	0.0035
1200	0.0033
1500	0.0025
1800	0.002

The Contractor shall furnish five certified copies of all logs to demonstrate that all rotating elements have been balanced in accordance with these specifications. All balancing logs shall be submitted to and accepted by the ENGINEER as a condition precedent to shipment of the equipment from the factory.

K. Shop painting:
Refer to specification section 09 96 00.

L. Manufacturer: Flowserve, Peerless, Floway, American-Marsh, or approved equivalent.

M. Electric motors: a. Standards: See Section 26 05 10 - Large Motors.

2.02 IDENTIFICATION

A. Permanently attach stainless steel nameplate to pump. Nameplate shall contain following information:
Equipment number (see Drawings).
Serial number of pump.
Rated capacity in gpm.
Rated pumping head in feet.
Full rated speed, rpm.
Manufacturer's name.
Size and type of pump.
Design pressure.

2.03 SPARE PARTS

A. Provide four sets of gaskets and seals for each size pump.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with Section 44 46 99.

B. Install the vertical turbine pumps in accordance with the Drawings and manufacturer's written instructions.

C. Lubricate all moving parts as recommended by the manufacturer's written instructions.

D. Make sure that each pump is securely anchored. Also make certain that all connections are tight.

E. Install pumping units level and plumb to insure the units are uniformly supported.

F. The pump manufacturer shall provide the complete pumping system. The pump supplier shall provide factory-trained personnel to supervise installation and initial operation of all components. Pump supplier shall certify that the equipment is installed in a manner to insure proper operation.

3.02 COATING

A. Coat exposed surfaces of pump above bottom of pump mounting plate. Coating shall be as specified in Section 09 96 00.

3.03 FIELD TESTING

A. After installation, each pumping unit shall be field-tested to ensure compliance with performance requirements as specified. The complete pumping system must be tested for multiple pump operations and controls in accordance with manufacturer's written instructions. Each pump shall be field tested to establish field head and overall efficiency. Report and test shall include voltage and amperage measurements.

B. Perform vibration spectral data measurement and analysis for each pump in accordance with Hydraulic Institute Standards for pump vibration Section 9.6.4.3 and Allowable pump field vibration values in accordance with Figure 9.6.4.13 Hydraulic Institute Standards 2000.

C. Documented on-site vibration analysis shall be performed to establish an operating condition vibration signature. Field tests shall include full vibration spectral data measurement (rms) for each pump across the specified speed range (900 rpm to 1800 rpm).

D. The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern. Test results for each pump shall be submitted to the Engineer for review along with the certified pump curves stated in Part 3.

3.04 CLEANING

A. Clean grease, oil or any other debris from the exterior surfaces of the pump and motor.

3.05 MANUFACTURER'S SERVICE

A. The services of a qualified representative of the manufacturer shall be provided to inspect the installation, place the units in operation, make any necessary adjustments and instruct the operating personnel in the operation and maintenance of the equipment.

B. Each pumping unit shall be field tested to demonstrate compliance with the Specifications. A written report on this test shall be submitted to the Engineer showing the actual performance of the pumping units.

END OF SECTION

SECTION 44 46 99
EQUIPMENT INSTALLATION

PART I GENERAL

1.01 SECTION INCLUDES

A. Installation of Vertical Turbine Can Pump and Equipment.

B. Installation of Electrical Cabinets and Equipment.

1.02 DELIVERY, STORAGE AND HANDLING

A. Receive and unload shipments to site from suppliers of equipment under this Contract.

B. Unload equipment as soon as possible after arrival.

C. Provide physical protection for equipment placed in storage.

1. Store and maintain materials and equipment after receipt until completed installation is accepted by Owner. Such storage and maintenance shall be in accordance with manufacturer's recommendations and requirements of these Specifications. Provide materials, equipment, and labor required for such storage and maintenance. Contractor shall be accountable for any deterioration of materials or equipment occasioned by improper storage or maintenance, and shall recondition, repair, or replace any such materials or equipment without addition cost to Owner.
2. Stored equipment shall be supported above ground and shall be covered with canvas or other heavy-duty sheeting. Cover shall be securely fastened and shall be replaced if torn or otherwise damaged during storage period.
3. Motors shall be stored in dry, warm place and in accordance with manufacturer's recommendations. Motors over 20 hp shall have shaft rotated 90° each month. Provide Engineer with evidence that this requirement is met.
4. Desiccant shall be maintained between cover and motor frames on motors. Provide desiccant of type permitting visual determination of condition of desiccant. Replace desiccant when it becomes ineffective.
5. Following items shall be stored in weatherproof building complete with bins for storage of small pieces of equipment. Heat to a minimum of 50°F (10°C).

    a. Electronic instruments and cabinets.
    b. Electrical equipment with general-purpose enclosures.
    c. Insulation materials.
    d. Rotating equipment.
    e. Miscellaneous electronic equipment, gaskets, and small fixed machined parts.
    f. Instruments and controls.
    g. Vertical Turbine Pumps.

D. Inspect stored equipment weekly. Renew protective coatings as necessary to preserve fitness of equipment.

1.03 SUBMITTALS

A. Submit to Engineer certificates for each welder, showing proof of qualifications as outlined in code, prior to *any* field welding, either temporary or permanent.

PART 2 EQUIPMENT

2.01 EQUIPMENT

A. Provide dowel pins and shims necessary for leveling and doweling equipment to baseplates. Shims shall be stainless steel.

B. Provide bolting required to anchor equipment securely to building and adjacent equipment.

C. Provide expansion anchors where required, subject to review by Engineer.

PART 3 EXECUTION

3.01 FLOOR SHORING

A. Shore parts of structure for which design loading would be exceeded during construction or installation of equipment.

B. Protect flooring and other finished surfaces by means of heavy planking.

C. Remove shoring and repair any damage to floors or other parts of structures after equipment has been installed.

3.02 INSTALLATION PROCEDURES

A. Equipment shall be installed in strict accordance with manufacturer's recommendations.

B. Provide access space around equipment for service. Provide no less than minimum as recommended by manufacturer.

3.03 CLEANING

A. Before assembly or erection, thoroughly clean equipment of temporary protective coatings and foreign materials; completely remove shop-applied flushing compounds.

B. Blow out with compressed air as required to remove foreign material.

C. After erection of equipment, clean external surfaces of oil, grease, dirt, or other foreign material; touch up shop paint, primer, and filler; leave surfaces smooth and ready for finish painting.

3.04 ALIGNING

A. Align equipment in accordance with manufacturer's recommendations.

B. If required, use shims of sheet and plate steel; use shims with laminations having individual layers not heavier than 0.015" (0.40 mm) for 1132" (1 mm) to 1/8" (3 mm) directly under equipment. Check alignment of equipment after piping and other external connections. Check alignment of equipment after piping and other external connections have been made and before equipment is placed in operation. Realign equipment as necessary.

C. Include costs for labor required to obtain alignment within allowable limits on equipment installed.

3.05 SUPPORTS

A. Provide devices to support equipment.

B. Fabricate supports of structural steel sections, plates, or rods arranged to provide rigid and sturdy mounting for equipment

C. Provide connections or fasteners required between equipment supports and building structure.

D. Equipment foundation pads: As shown on Drawings.

E. Provide devices to support equipment piping and appurtenances where specific support is not detailed on Drawings. Support piping adjacent to equipment such that no weight is carried on equipment.

3.06 GROUTING

A. Place minimum of 1" (25 mm) nonshrink grout under equipment being mounted on concrete foundations unless specified otherwise. Determine quantity of grout required.

B. Entire space between top of foundation and bottom of equipment base shall be completely filled with grout, free of any voids.

C. Place no grout that has been allowed to set, after mixing, beyond time limitations set forth by grout manufacturer.

D. Remove and replace grout that shows cracking.

3.07 MANUFACTURER'S FIELD SERVICES

A. Provide qualified service representative to perform functions described in Section 01 43 33.

END OF SECTION