

ADDENDUM No. 4
March 9, 2016

CHARTER TOWNSHIP OF CANTON
CANTON WATER STORAGE IMPLEMENTATION
0133-14-0010

The following changes, additions, and/or clarifications to the Contract Documents shall be incorporated in said documents and shall be provided for in the lump sum price bid by the Contractor in the Bid Form and shall represent the conditions as set forth in the Contract Documents and this addendum. The bidder shall acknowledge the receipt of this addendum on the BID FORM, Section 00 41 00, Page 1, of the Bid Form.

Refer to http://tools.ohm-advisors.com/bidlist/bidlist_project_display.cfm for addendum, bid tab and plan holders list information.

This Addendum contains 16 pages total.

Total Number of Reissued Sheets: 0 pages

The following Project Manual Sections are being issued:

- Section 00 40 00 – BID FORM (5 pages)
- Section 43 23 21 – SPLIT CASE CENTRIFUGAL PUMPS (10 pages)

ADDITIONS AND CHANGES TO THE BIDDING REQUIREMENTS

1. Section 00 41 00 – BID FORM, issued as part of Addendum #3. Remove and replace this section issued as part of this Addendum #4.

ADDITIONS AND CHANGES TO THE CONTRACT REQUIREMENTS

None

ADDITIONS AND CHANGES TO THE TECHNICAL SPECIFICATIONS

2. Section 07 14 13 - HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING, PART 2 – PRODUCTS, Sub-subparagraph A.1, Manufacturers, Add W.R. Meadows, to list of acceptable manufacturers.
3. Section 43 23 21 – SPLIT CASE CENTRIFUGAL PUMPS. Remove and replace this section issued as part of this Addendum #4.

ADDITIONS AND CHANGES TO THE DRAWINGS

4. Sheet A002 – Add an additional 3 fire extinguishers to those shown within the Booster Station Building. Locations shall be determined by Engineer during construction.

BID FORM

Canton Water Storage Implementation

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

Charter Township of Canton

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

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for sixty (60) days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

<u>Addendum No.</u>	<u>Addendum Date</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in SC-4.02, and (2) reports and drawings of Hazardous Environmental Conditions that have been identified in SC-4.06.

E. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and

procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.

- F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
- I. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.
- J. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.
- K. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.

ARTICLE 4 – FURTHER REPRESENTATIONS

4.01 Bidder further represents that:

- A. this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price:

Lump Sum	(\$ _____)
Base Bid Price	
_____	(numerals)
(words)	
Lump Sum for Cash Allowance #1 for Electrical Service	\$50,000
Lump Sum for Cash Allowance #2 for Natural Gas Service	\$15,000
Lump Sum for Cash Allowance #3 for Owner Specified Testing and Inspection	\$70,000

Lump Sum for Cash Allowance #4 for Instrumentation and Controls Programming by Kennedy Industries	\$60,000
Lump Sum for Cash Allowance #5 for Owner's Contingency	\$300,000
Lump Sum for Cash Allowance #6 for Security Service by Interstate Security, Inc.	\$25,000
Lump Sum for Cash Allowance #7 for Fiber Optic	\$30,000

All specified cash allowances are included in the price(s) set forth above, and have been computed in accordance with Paragraph 11.02 of the General Conditions.

Bidder to include in other Bid item(s) the other costs (if any) associated with accepting such assignment and administering the assigned contract.

5.02 Bidder will provide unit prices for the below items of Work in accordance with the Contract Documents for the following price:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price
1	Unsuitable Soil Removal and Replacement with Compacted Select Fill Material	CY	500	\$	\$
Total of All Unit Price Bid Items					\$

Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

Total of Lump Sum (Base Bid) and Unit Price Bids = Total Bid Price \$ _____

All specified cash allowances are included in the price(s) set forth above and have been computed in accordance with Paragraph 11.02 of the General Conditions.

5.03 Bidder may include prices for the following deductible alternatives. Bidder shall enter a value of zero if the alternative is not a deduction from the Bid Price:

Deductible Alternate A – Storage Tank Outlet Sump	\$
Deductible Alternate B – Generator Decibel Increase	\$

**Total of Lump Sum (Base Bid) and Unit Price Bids less
Deductible Alternatives = Total Alternate Bid Price** \$ _____

ARTICLE 6 – TIME OF COMPLETION

- 6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 14.07.B of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the Contract Times.

ARTICLE 7 – ATTACHMENTS TO THIS BID

- 7.01 The following documents are attached to and made a condition of this Bid:
 - A. Required Bid security in the form of a Bid Bond.
 - B. Required Bidder Qualification Statement with Supporting Data
 - C. Iran Linked Business Certification

ARTICLE 8 – DEFINED TERMS

- 8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

9.01 This Bid submitted by:

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____ (SEAL)
(Individual's signature)

Doing business as: _____

A Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner – attach evidence of authority to sign)

Name (typed or printed): _____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____
Type (General Business, Professional, Service, Limited Liability): _____

By: _____
(Signature – attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____
(CORPORATE SEAL)

Attest: _____
(Signature of Corporate Secretary)

Date of Qualification to do business in _____ [State Where Project is Located] is
____ \ ____ \ ____.

A Joint Venture

Name of Joint Venturer: _____

First Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of first joint venture partner – attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Second Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of second joint venture partner – attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Bidder's Business address: _____

Phone: _____ Facsimile: _____

Submitted on _____, 20____.

State Contractor License No. _____. (If applicable)

SECTION 43 23 21 – SPLIT CASE CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes single stage, double suction, split case horizontal centrifugal pumps for pumping potable water with the following features:
1. Inverter rated motors.
 2. Variable frequency motor controllers.
 3. Base plate and concrete pump base.
 4. Power and control connections.
 5. Piping connections.
 6. Pressure gauges.
 7. Base plate drain piping.
 8. Related pump equipment for a complete and operational equipment install.
- B. Related Sections:
1. Section 26 29 23 "Variable Frequency Motor Controllers."
 2. Section 40 73 13 "Pressure and Differential Pressure Gauges."

1.2 REFERENCE STANDARDS

- A. American Bearing Manufacturers Association:
1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. ASME International:
1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.
- C. ASTM International:
1. ASTM A29/A29M - Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought.
 2. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
 3. ASTM A606/A606M - Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 4. ASTM A744/A744M - Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service.
 5. ASTM B148 - Standard Specification for Aluminum-Bronze Sand Castings.
- D. Hydraulic Institute Standards
- E. National Electrical Manufacturer's Association

1.3 COORDINATION

- A. Coordinate installation and startup of Work of this Section with plant operations.
- B. Hoisting equipment needed for pump installation will be furnished by Contractor. There is a new overhead crane proposed as part of the project design.

1.4 SCHEDULING

- A. Schedule Work of this Section to install pump prior to connecting piping Work.

1.5 SUBMITTALS

A. Shop Drawings:

1. Submit detailed dimensions for materials and equipment, including wiring and control diagrams, performance charts and curves, installation and anchoring requirements, fasteners, and other details.
 - a. All pumps shall be equipped with variable speed drives. Provide variable speed performance curves for each pump, between 75% of maximum speed and maximum speed in 100 rpm increments, developed by the pump manufacturer using affinity laws based on shop test results at maximum speed.
2. Anchor bolt details and loads. Information shall include calculations for axial and lateral shear, base moment and gravity loads.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Source Quality-Control Submittals: Indicate results of shop tests and inspections. Tests for limiting suction conditions are required.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

E. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manual: Provide two paper copies and one digital copy of the operation, maintenance and installation requirement of the supplied equipment.

B. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

1.7 WARRANTY

A. Furnish one-year manufacturer's warranty for pumps and accessories.

PART 2 - PRODUCTS

2.1 SPLIT CASE CENTRIFUGAL PUMPS

A. Manufacturers:

1. Pumps:
 - a. Goulds A-C.
 - b. Patterson Pumps
 - c. Flowserve
 - d. Peerless Pump Company
 - e. Fairbanks Morse Pump Corp
 - f. Substitutions: As specified in Section 01 60 00 - Product Requirements.
2. Premium Efficiency Motors:
 - a. US Electrical Motors
 - b. General Electric
 - c. Reliance
 - d. WEG
 - e. Baldor
 - f. Substitutions: As specified in Section 01 60 00 - Product Requirements.

B. General:

1. Pumps, motors, variable frequency drives and accessories shall be supplied as a complete package from a single pump supplier who shall be responsible for proper operation of the equipment. Variable frequency drives may be provided through a subcontractor; however, pump manufacturer is responsible for the final coordination of the drive horsepower. VFD drive horsepower shall match the selected pump's horsepower. Owner shall bear no cost for failure to coordinate pump size, pump motor and variable frequency drive.
2. All pump components shall be the product of the same manufacturer for purposes of parts interchangeability.

C. Performance Requirement:

1. Motor supplied shall be capable of operating the pump and impeller at any point on the curve without exceeding nameplate horsepower.
2. Pumps shall fit into the space provided on the Contract Drawings, without adjustment of adjacent piping.
3. When operating over the specified range of conditions, the pumps shall not cavitate and shall be free of undue noise and vibration. Vibration levels of each installed pump and motor shall be less than inches per second as shown in the Hydraulic Institute Standards.
4. Pumps and drive units shall be designed for variable speed operations, and shall operate without undue noise and vibration between 50% and 100% of rated synchronous speed.

D. Description: Centrifugal, horizontal split case pump, with close-coupled electric motor.

1. Horizontal, single-stage axially split centrifugal pump, with variable-speed electric motor.
2. Number of Stages: One.
3. Rotation: Pump shall be capable of either CW or CCW operation and set for the appropriate rotation prior to shipment. Rotation shall be adjustable in field.

2.2 Materials and Construction

A. Casing:

1. Type: Axially split; removable top portion.
2. Material: ASTM A48/A48M, cast iron for working pressures up to 175 psig
3. Connections:
 - a. ½" NPT openings for air vent and drain.
 - b. ¼" NPT openings for suction and discharge gauge connections.
4. Suction Inlet: Furnish flow guide vanes.
5. End Connections:
 - a. Flanged.
 - b. Comply with ASME B16.1, Class 125.
 - c. Suction and discharge flanges shall be located on a common centerline in both the horizontal and the vertical planes.
6. Mounting feet shall be cast integral with lower half casing.

B. Impeller:

1. Material: ASTM B148, aluminum-bronze or 316 stainless steel.
2. Description: One piece cast bronze, hydraulically and dynamically balanced, keyed to pump shaft and held in place by bronze shaft sleeves secured by shaft nuts.
3. Impeller shall be provided with renewable bronze wear rings securely fastened to the impeller hub.
4. Impellers shall be keyed to the shaft and fixed in an axial position. Hubs shall have sufficient metal thickness to allow machining for installation of impeller rings.
5. Impeller shall not be maximum size available for selected pump curve.

C. Shaft:

1. Materials: ASTM A29/A29M, steel; accurately machined and designed to transmit the full driver output.

2. Furnish positioners to center impeller on shaft. Shafts shall be sized such that deflection shall not exceed 0.002 inches at the face of the stuffing box when the pump is operating at 25% of the best efficiency point capacity for the impeller diameter supplied at the maximum speed of operation.
3. Shafts shall be protected from the pumped liquid in the stuffing box area by a replaceable shaft sleeve, ASTM B584-932 bronze. An O-ring seal shall be provided between the shaft and shaft sleeve to prevent leakage of pumped liquid out and/or air into the pump.

D. Coupling:

1. Connect pump shaft to drive motor with universal flexible coupling to compensate for minor misalignment.
2. Shaft Guard: Enclose shaft and universal joint with enclosed-type metal shaft guard complying with OSHA standards.

E. Wearing Rings:

1. Type: Renewable.
2. Material: Bronze.
3. Fasteners: Stainless steel.

F. Glands and Stuffing Boxes:

1. Stuffing box housings and bearing brackets shall be made of the same material as the pump casing. Stuffing boxes shall be tapped for $\frac{3}{4}$ -inch connection and shall be piped to drain. Seal arrangement shall be designed such that seal leakage cannot enter the bearing housings.
2. Design shall allow field conversion from packing to mechanical seals without modifying the stuffing box. Adequate space shall be provided for re-packing or other normal stuffing box maintenance.
3. Stuffing box glands shall be ASTM B584-932 bronze axially split and designed to permit easy removal without requiring disassembly of other parts.
4. Stuffing boxes shall be equipped with a mechanical seal. Mechanical seals shall be John Crane Type 8 or equal, equipped with Ni-Resist stationary faces, carbon rotating faces, stainless steel springs and Viton bellows.
5. Pumps shall be equipped with an internal system for seal lubrication and cooling consisting of brass piping arranged to supply high pressure water from the pump volute to the stuffing box.

G. Lubrication: Grease.

H. Bearings:

1. Thrust and radial roller bearings with split-bearing housing.
2. Bearing housings shall be bolted to the end of the bearing bracket. Housings shall provide a fit for the inboard bearing that allows for thermal expansion. The outboard bearing shall be clamped in place to take all thrust loads and keep the rotating element in its proper axial location. Plugged openings for adding new grease and draining old grease shall be provided.
3. Minimum L-10 Life: 100,000 hours at continuous maximum load and speed, according to ABMA 9.

I. Base:

1. Pumps and motors shall be mounted on a common fabricated steel base plate sufficiently rigid to support the pump and driver. The base plate shall incorporate a perimeter drip rim equipped with $\frac{3}{4}$ -inch tapped drain connection.
2. Anchor bolts shall be stainless steel, provided by the pump manufacturer. Anchor bolts shall restrain the pump while operating at shut-off head. Anchor bolts shall be furnished complete with nuts and sleeves and shall be of sufficient length to permit proper embedment in the

foundation concrete. Epoxy adhesive anchors may be used where pump is to be installed on an existing concrete foundation.

3. Anchorage shall comply with manufacturer's instructions.
4. Pump and Drive Mating Surfaces: Machine finished.

J. Pump-Motor Coupling:

1. Flexible type with die cast high strength alloy flanges connected by a rubber sleeve.
2. Provide a guard over the coupling to comply with Laws and Regulations.

K. Resistance Temperature Detectors (RTD's): Provide RTD's on the drive bearing, opposite drive bearing and the coupling bearing for monitoring bearing temperatures. RTDs to be three-wire platinum with a 0.00385 TCR and a resistance of 100 ohms at 0 degrees C.

L. Miscellaneous:

1. All pumps shall be furnished with stainless steel data plates installed in a readily visible location on the pump. Data plates shall contain the manufacturer's name, pump size and type, serial number, rated speed, impeller diameter, capacity and head rating, and other pertinent data. A special data plate shall be fastened to the pump frame, which shall contain identification of frame and bearing numbers.
2. Pump shall be furnished with the following features:
 - a. Air Release Valve: Cast iron body and cover, stainless steel float, 1/2-inch inlet; Apco Valve and Primer Corporation, Model 55, or as approved.
 - b. Air Release Valve Drain Piping: Provide piping from each pump base and air release valve to the nearest floor drain.
 - 1) Materials:
 - a) Pipe: Copper, ASTM B88, seamless tubing, Type K annealed temper.
 - b) Fittings: Soldered, ASME B16.18 cast bronze, or ASME B16.22 wrought copper and bronze.
 - c) Solder: ASTM B32, Grade 95TA.
 - c. Pressure Gauges: Provided on suction and discharge ends; installed so as to be clearly visible. Pressure gauges shall be in accordance with Section 40 73 13, ranges shall be as shown or scheduled.
 - d. Anti-Plugging Switch: Provide to prevent a pump start during reversing of the pump; Allen-Bradley Bulletin 808, or as approved; NEMA 13 enclosure, normally closed contacts. Do not include lockout solenoid.
 3. Fully assembled pump, plate, and driver shall not exceed rated working weight of provided crane.

2.3 MOTORS

A. General

1. The drive unit for each pump shall be a standard unit as furnished by the pump manufacturer. Motors shall be of the horsepower, electrical characteristics and enclosure type scheduled. Insulation shall be Class B minimum.
2. Premium efficiency, NEMA Design B.
3. Motors shall be labeled for inverter duty to permit operation with a variable frequency drive (VFD) unit to be supplied as part of the pump package.
4. Motors shall be suited to the environmental conditions in which they will be installed and shall be suitable for starting and stopping across the line.
5. Motors shall be capable of continuous operation at full load and rated frequency with a voltage variation of ± 10 percent.
6. Sound Power Levels: Conform to NEMA MG 1.

B. Stator Construction

1. The stator iron coreplate shall be of high grade low loss silicon steel.
2. Stator coils shall be random wound insulation.

3. Design for continuous operation in 40-degree C environment, with temperature rise according to NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
4. Each stator coil shall be provided with a three-wire, 120-ohm nickel resistive temperature detector (RTD).

C. Rotor Construction

1. Rotors shall be fabricated bar construction copper or cast aluminum.
2. The method of brazing shall be by induction heating. When copper bars or copper end rings are used they shall be made of "oxygen free" copper to minimize embrittlement of copper on outer edges.
3. All bars shall be maintained tight in the slot to limit vibration and thus bar fatigue. The rotor cage shall be maintained centered on the rotor laminations by providing end stops to limit ratcheting of bars. The preferred method is pieces of bar symmetrically spaced on the overhanging sections of the bars about the rotor and brazed to the current carrying rotor bars (active bars).

D. Bearings

1. Bearings shall be sleeve type, self-aligning, spherically seated, ring-oil lubricated split type.
2. Where scheduled, bearings shall be provided with three-wire, 120-ohm nickel RTDs.

E. Enclosure

1. Motors shall be TEFC.

F. Insulation

1. Insulation shall be Class F minimum.

G. Resistance Temperature Detectors (RTDs): Provide a drilled and tapped opening in the motor housing by the motor manufacturer for installation of RTDs at the front and rear bearings for temperature sensing. RTDs to be three-wire platinum with a 0.00385 TCR and a resistance of 100 ohms at 0 degrees C.

H. Nameplate

1. Motor nameplate shall be stainless steel, securely fastened to the motor frame with pins of like material.
2. Nameplates shall include the following information, at a minimum:
 - a. Rated horsepower
 - b. Full load speed
 - c. Frequency
 - d. NEMA kVA code
 - e. Rated voltage and phase
 - f. Manufacturer's serial number and type
 - g. Service factor
 - h. Insulation class
 - i. Maximum ambient temperature
 - j. Full load current at nameplate voltage
 - k. Frame size designation
 - l. Oil requirements
 - m. Stator air gap

I. Terminal Boxes

1. Terminal boxes shall be of fabricated steel or cast iron construction compatible with the motor enclosure specified and when possible, shall be diagonally split and capable of rotation in 90 degree increments. Boxes not suitable for rotation shall be capable of top entry.

2. The area in which the main terminal box is connected with the motor frame shall be fully gasketed to prevent entrance of foreign matter into the motor and to provide support for the stator leads where they pass through the motor frame.
3. A properly sized grounding terminal shall be mounted in the main terminal box.
4. The main terminal box shall be sufficiently oversized (one size above standard) to allow terminations of power cables.
5. Auxiliary terminal boxes shall be provided to house connections for accessory devices not mounted in the main terminal box (i.e., RTDs).

J. Leads

1. Main motor leads shall have EPDM type jackets and shall be permanently tagged for identification.

2.4 VARIABLE FREQUENCY DRIVES

- A. Each pump shall be supplied with a variable frequency drive in accordance with Section 26 29 23 "Variable Frequency Motor Controllers."
- B. It is the responsibility of the pump manufacturer to coordinate the sizing of the variable frequency drives with the selected pump horsepower and/or amp draw. Drives shall be capable of operating over the entire pump range.

2.5 SPARE PARTS

- A. Furnish the following spare parts for model of pump supplied:
 1. One (1) complete set of casing gaskets;
 2. One (1) shaft sleeve with nuts and O-rings;
 3. One (1) complete set of impeller and casing wear rings with screws;
 4. One (1) set inboard and outboard bearings;
 5. One (1) set mechanical seals;
 6. One (1) set lantern rings.
- B. Spare parts shall be packed in wooden boxes, labeled with the manufacturer's name, address and telephone number; local representative's name, address and telephone number; name of equipment the parts are for and list of parts contained therein.

2.6 FINISHES

- A. Factory-prime all metal parts except machined and polished surfaces, stainless steel, or non-ferrous and galvanized metals.
- B. Surface Preparation:
 1. Non-Submerged Surfaces: Abrasive blast to SSPC-SP6 commercial blast.
- C. Primers: Epoxy primer compatible with field-applied finish coats specified in Division 9. Remove incompatible, factory-applied primers in the field.
- D. Protect all other surfaces not specified to be factory-primed from corrosion.

2.7 CONCRETE AND GROUT FOR SUPPORT PADS

- A. Concrete: MDOT, 3000 psi minimum.
- B. Grout: Non-shrink, non-corrosive.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Construct concrete support pads.
- B. Install pumping equipment in accordance with the configuration shown on the Contract Drawings and the Standards of Hydraulic Institute.
- C. Install in accordance with manufacturer's instructions.
- D. Anchor and level equipment base plates and bolt down against metal shims or wedges. Fill space between base plate and foundation with non-shrink, non-ferrous grout. Prior to grouting, check alignment of pump and motor and realign if required.
- E. Lubricate pumps before start-up.

3.2 INSTALLATION

- A. Install pumps according to manufacturer instructions.
- B. Provide and connect piping, power and control conduit, and wiring to make system operational and ready for startup.
- C. Flush piping with clean water.

3.3 MANUFACTURER'S FIELD SERVICE

- A. The Contractor shall engage the services of a manufacturer's erecting engineer or qualified manufacturer's representative to be present at and assist in the startup of each pump included in this section. The duration of service shall be as required to complete the successful startup of the pumps.
- B. The manufacturer's erecting engineer or factory representative shall start and operate the equipment and conduct field tests to adequately demonstrate that the equipment has been properly installed and will function as herein specified. All tests shall be subject to the Engineer's review.

3.4 FIELD QUALITY CONTROL

- A. Preoperational Check: Before operating system or components, perform following:
 - 1. Check pump and motor alignment.
 - 2. Check for proper motor rotation.
 - 3. Check pump and drive units for proper lubrication.
- B. Startup and Performance Testing:
 - 1. Operate pump on clear water at design point for continuous period of two hours, under supervision of manufacturer's representative and in presence of Engineer.
- C. Verify pump performance by performing time-drawdown test or time-fill test.
- D. Check pump and motor for high bearing temperature and excessive vibration according to manufacturer instructions. Check for motor overload by taking ampere readings.

E. Equipment Acceptance:

1. Adjust, repair, modify, or replace system components that fail to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

3.5 PUMP SCHEDULE

1. HIGH FLOW PUMPS

- a. Quantity: 3
- b. Pump names: Booster Pumps #1 through #3
- c. Tag numbers: PU-1, PU-2, PU-3
- d. Liquid pumped: Clean, potable water
- e. Design temperature, max: 80 degree F
- f. Nominal rated speed, max: 1800 rpm
- g. Performance at rated speed:
 - 1) 4,200 gpm @ 198 feet TDH (design point)
- h. Pump efficiency: 83% at duty point
- i. NPSH required, max: Flooded at all times
- j. Motors:
 - 1) Type: Horizontal, inverter duty for VFD
 - 2) Enclosure: TEFC
 - 3) Horsepower: 300 Hp maximum
 - 4) Characteristics: 460V, 3 phase, 60 Hz
 - 5) Service factor: 1.15
 - 6) Stator RTDs: Yes
 - 7) Bearing RTDs: Yes
- k. Variable Frequency Drives: Booster Pumps #1 through #3
 - 1) Rated for maximum Pump Horsepower.
 - 2) Provided and coordinated by pump manufacturer.

2. LOW FLOW PUMPS

- a. Quantity: 2
- b. Pump names: Booster Pumps #4 and #5
- c. Tag Numbers: PU-4, PU-5
- d. Liquid pumped: Clean, potable water
- e. Design temperature, max: 80 degree F
- f. Nominal rated speed, max: 1800 rpm
- g. Performance at rated speed:
 - 1) 2,100 gpm @ 161 feet TDH (design point)
- h. Pump efficiency: 83% at duty point
- i. NPSH required, max: Flooded at all times
- j. Motors:
 - 1) Type: Horizontal, inverter duty for VFD
 - 2) Enclosure: TEFC
 - 3) Horsepower: 200 Hp maximum
 - 4) Characteristics: 460V, 3 phase, 60 Hz
 - 5) Service factor: 1.15
 - 6) Stator RTDs: Yes
 - 7) Bearing RTDs: Yes
- k. Variable Frequency Drives: Booster Pumps #4 and #5
 - 1) Rated for maximum Pump Horsepower.
 - 2) Provided and coordinated by pump manufacturer.

END OF SECTION 43 23 21