

CIP NO.: OWASA CIP #272-42
PROJECT: Water Treatment Plant Finished Water Pumping Improvements
DATE: January 23, 2020

SECTION 00 91 13

ADDENDA

ADDENDUM NUMBER 02

DATE: January 23, 2020

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

OWASA CIP NUMBER: 272-42

OWNER: ORANGE WATER AND SEWER AUTHORITY

ENGINEER: AECOM Technical Services of North Carolina, Inc

TO: All Bidders

This Addendum forms a part of the Contract Documents and modifies the Bidding Documents dated December 17, 2019, Addendum Number 02 issued January 23, 2020, with amendments and additions noted herein below.

Acknowledge receipt of this Addendum in the space provided in the Bid form. Failure to do so may disqualify the Bidder.

This Addendum consists of 4 pages:

RESPONSES TO QUESTIONS RECEIVED DURING BIDDING:

1. What is the size of the pump discharge?
Per the plans, the Contractor is responsible for field verifying existing pipe installation conditions, which would include verifying the diameter and class of the pipe. Based on previous equipment and piping information, AECOM understands that the pump discharge may consist of a 16" x 18" discharge head. However, this information is only being provided for general reference and it remains the contractor's responsibility to field verify the existing conditions prior to bidding the project or ordering any materials. The Owner and Engineer assume no responsibility for confirmation of this information.
2. The existing pump looks like it has a 250# flange and then transitions to 150# with the connection pipe. I cannot find on the plans or specs if the new pump will have a 250# or 150# flange. Please verify.
Per the plans the Contractor is responsible for field verifying existing pipe installation conditions, which would include verifying the diameter and class of the pipe. Based on previous equipment information, AECOM understands that the discharge head has a 150# flange. However, this information is only being provided for general reference and it remains the contractor's responsibility to field verify the existing conditions prior to bidding the project or ordering any

Addenda
00 91 13-1

Water Treatment Plant Finished
Water Pumping improvements

materials. The Owner and Engineer assume no responsibility for confirmation of this information.

3. What is the anticipated notice of award date?
In February, the OWASA Board meets on February 27th, we anticipate that the Notice of Award will follow shortly.
4. What is the anticipated notice to proceed date?
The target Notice to Proceed date is April 1, 2020.
5. Are specific panels of the enclosure to be replaced due to corrosion? What type painting is required on the new panel?
Per Note 10 on sheet D2, one (1) panel is to be replaced. The finished coating should match that on the existing panel and those adjacent to it.
6. Are there any permits or fees associated with the work?
Yes, the Town of Carrboro will require an Electrical Permit (<https://www.townofcarrboro.org/748/Building-Permits>).
7. Have underground conduits to be reused been swapped or scoped?
No.
8. Have underground utility ductbanks been located?
No.
9. Have underground existing ductbanks been located?
No.
10. Are we to assume the pump head lay length will allow for both the ARV and the pressure gauge assemblies to be located on top or at 12:00? Details on sheet D-2 conflict.
The details shown reflect that an air release valve and a pressure gauge are to be supplied as part of the installed work. Contractors are to coordinate with the pumping system supplier to confirm installation requirements/intentions related to the orientation and exact location of the ARV and pressure gauge in relation to the discharge head. It is likely that installation of the ARV off of the discharge head will be similar to the existing installation, however this would need to be confirmed with the system supplier.
11. Are we to assume the existing FLxPE pipe will be reused with a new dresser coupling? Or are there specific fittings the owner would like to be used to make connection?
The Contractor is responsible for having reviewed the drawings and the existing field conditions prior to bidding the project. As noted on the plans, the contractor shall provide all required couplings, adapters, fittings required to connect the existing piping to the new pump.
12. Can you provide a paint schedule?

A paint schedule will not be provided. Refer to specifications for painting requirements.

13. Will new ARV assembly be short enough to install per detail and not hit or conflict with motor?

Coordinate with the pump system supplier to confirm dimensions, locations, etc. for installation of the ARV assembly. The ARV assembly will be able to be installed within the enclosure.

14. Is heat tape required?

No.

15. Will repair of sole plate just be around the exterior or will sole plate need to be removed and all grout replaced?

Refer to notes 5 and 6, as well as the specifications for the new pump for information regarding the sole plate and the grout.

16. Should we leave existing ARV in place or should that be removed?

Per the plans it will remain.

17. Does the owner have any specific time frames of shut down? Can plant operate without pump #5?

Refer to Note 9 on sheet D2 regarding removal of the existing pump. A schedule for removal and reinstallation will be provided by the contractor for review and approval by the Owner. Yes, the plant can, and normally does, operate without Pump 5 in production, however, as noted, the intention is for the disruption to the potential operation of Pump 5 to be minimized.

Shut downs are allowed, but need to be coordinated with OWASA. The notes on Sheet E4 describe the Sequence of Construction and prior notice requirements to the Owner. Shutdown notices should describe the contractor's planning and readiness.

18. Is there any laydown for contractor material and equipment?

While OWASA does not anticipate that the contractor will need a significant laydown area, they will identify an area for laydown and the contractor's employee parking during the work. OWASA needs clear access to the maintenance bay near the clearwell. Work shouldn't impact chemical delivery.

19. Please confirm discharge piping diameter and class.

Per the plans the Contractor is responsible for field verifying existing pipe installation conditions, which would include verifying the diameter and class of the pipe.

CHANGES TO THE SPECIFICATIONS:



CIP NO.: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

1. Water Utility Distribution Equipment (Section 33 12 00) – Paragraph 2.2.A.15 **INSERT** the word “future” before the word “Metrix”.
2. Water Utility Distribution Equipment (Section 33 12 00) – Paragraph 2.1.G.1, **DELETE** this sentence in its entirety and **REPLACE** with the following:

“1. Manufacturer to coat inside and outside of column piping, outside of bowls and inside of discharge head with Tnemec Series N140 or Scotchkote. All products are to be NSF approved and are to be installed in strict accordance with the product manufacturers requirements.”
3. Water Utility Distribution Equipment (Section 33 12 00) – Paragraph 2.1.G.2, **DELETE** this sentence in its entirety and **REPLACE** with the following:

“2. Manufacturer to apply prime coat only to exterior of discharge head. Final coatings are to be field applied by the Contractor. All coatings are to comply with Specification Section 09 90 00.”
4. Water Utility Distribution Equipment (Section 33 12 00) – Paragraph 2.5.D.1.d, **DELETE** this sentence in its entirety and **REPLACE** with the following:

“d. The VFD chassis and components shall be rated to handle a maximum ambient temperature of 40 °C (104 °F) air surrounding the VFD.”

-END OF DOCUMENT-

SECTION 33 12 00

WATER UTILITY DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide one (1) vertical turbine pump, with inverter duty electric motor drive, variable frequency drive, air release valve, and control devices, complete with accessories, all as indicated, specified herein and as needed to provide a complete and operable installation.

- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to the Special Provisions, General Specifications, and Sections in Division 1 of these specifications.
 - 2. Section 33 11 16 - Pump Station Piping Valves and Appurtenances.
 - 3. Section 03 60 00 - Grouting.
 - 4. Section 09 90 00 - Painting and Coating.
 - 5. Section 26 00 00 - Electrical.
 - 6. Section 40 95 00 - Supervisory Control and Data Acquisition System.

1.2 QUALITY ASSURANCE

- A. Referenced manufacturers/suppliers are as follows and are named to establish standards of quality:
 - 1. Pump manufacturers are Layne/Verti-Line, a Division of Pentair, Kansas City, Kansas, Fairbanks Morse and Flowserve.
 - a. Pumps to be manufactured in the manufacturer's main location, as referenced above.
 - b. Pumps manufactured or assembled in regional or agricultural centers or by third party vendors or distributors are not acceptable.
 - c. To insure quality control, all major components of the pumps shall be manufactured at the pump manufacturer's own facility referenced above. Major components consist of:
 - 1) Impellers.
 - 2) Bowls.
 - 3) Wear rings.
 - 4) Discharge heads.
 - 5) Column.
 - 6) Shafting.
 - 7) Shaft sleeves.
 - 8) Lineshaft couplings.

- 9) Bearing spiders.
 2. VFD manufacturer is Square D.
 3. Motor manufacturers are US Electric Motors or General Electric.
 4. Pump system supplier is Heyward Services, of Charlotte, North Carolina.
- B. Equal products of other manufacturers complying with these Specifications may be provided as outlined in the Proposal.
- C. Technical services:
1. Pumps: Provide service of the pump supplier's factory certified service technician, complying with Section 01 79 00 and the following:
 - a. Erection and installation instruction: One day, one trip.
 - b. Sole plate installation verification: One day, one trip.
 - c. Start-up and training: two days, one trip.
 - d. Six months after start-up: One day, one trip.
 2. Variable frequency drives:
 - a. A certified field start-up engineer from the VFD manufacturer shall perform start-up supervision services.
 - b. Provide service of a factory certified service technician, specifically trained on the type of equipment specified herein and complying with Section 01 79 00 at the following times:
 - 1) Installation and erection instruction: One day, one trip.
 - 2) Start-up and training: two days, one trip.
 - 3) Six months after start-up: One day, one trip.
 - c. The technician shall advise on installation, and inspect, test and start-up all VFD equipment provided
 - d. All equipment required for testing, start-up and performance verification shall be provided by the technician.
 - e. At a minimum, the start-up shall include:
 - 1) Pre-power check:
 - a) Inspect the VFD's mechanical and electrical devices.
 - b) Perform a tug test on all internal connections.
 - c) Verify critical mechanical connections for proper torque requirements.
 - d) Verify and adjust mechanical interlocks for permanent location.
 - e) Confirm all sectional wiring is connected properly.
 - f) Re-verify control wiring from any external control devices.
 - g) Set-up all VFD internal power supplies and control circuits.
 - h) Confirm cabling of line-to-VFD and VFD-to-motor.
 - i) Megger motor resistances.
 - 2) VFD power-up and commissioning:
 - a) Apply voltage to the VFD and perform operational checks.
 - b) Bump motor and tune VFD to the system attributes.
 - c) Run the VFD/motor system throughout the operational range to verify proper performance.
 - d) Record all measurements.

- e) Provide a field start-up report, including the VFD parameter listing.
- 3. The minimum days specified above do not relieve the system supplier of providing sufficient service to place the system in satisfactory operation.
- 4. At start-up, conduct vibration testing at 100 RPM increments over the proposed operating range of approximately 880 – 1180 RPM. Information shall include amplitude and frequency. This information shall be submitted to the Engineer.
- 5. After the pump and VFD have completed start up, provide at least one (1), four (4) hour day solely for the instruction of plant personnel in operation and maintenance of the pump, VFD, and accessories.
 - a. Schedule at least ten days in advance with the Owner and prior to start-up and acceptance by the Owner.
 - b. The final approved copies of Operation and Maintenance manuals must have been delivered to the Engineer prior to scheduling the instruction period with the Owner.
 - c. Maintenance shall be elaborated on during the training session, with information provided for a five (5) year maintenance program.
 - d. Training sessions are to be videoed and copies of the recorded sessions shall be provided to the Owner on a flash drive.
- D. Unit responsibility: All pumps, motors, valves, variable frequency drives, and control devices specified in this Section shall be provided by the supplier of the pump equipment in order to ensure compatibility.
 - 1. Pump System Supplier shall design and furnish a complete, integrated and functionally operating system warranted to perform the intended functions as herein specified.
 - 2. Provide all devices specified herein or required and provide all required and specified collateral services in connection with the system such as testing, calibration, start-up, operation and maintenance manuals.
 - 3. The Pump System Supplier will be responsible for coordinating I/O interface, both hardware and ethernet, with the SCADA Integrator to ensure proper operation
 - 4. All submittals from the pump system supplier must be sealed by a Professional Engineer who is registered in the State of North Carolina and who is an Officer and full-time employee of the system supplier. This is required to prove the depth and design capabilities of the pump system supplier.
- E. The Contractor shall assume full responsibility for the satisfactory installation of the entire system including pumps, motors, variable frequency drives, and controls as specified.
- F. The pump system supplier shall provide documentation of having provided at least three (3) systems with the same or larger pumps and VFD's and in systems of similar or greater complexity.
- G. Comply with ANSI/NSF 372 and NSF 61 for potable water pumping applications.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01 33 23.

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

- B. Pump product data: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section.
 2. Manufacturer's specifications and other data needed to provide compliance with the specified requirements.
 3. Shop drawings showing plan, elevation and sectional views, materials of construction, stuffing box details, column assembly details, bowl assembly details, base plate and anchor bolt details.
 4. A guaranteed performance curve signed by an Officer of the Pump Manufacturing Company.
 5. Certification of Section 1.2.A.1 signed by an Officer of the Pump Manufacturing Company.
 6. Names and addresses of the nearest service and maintenance organization that readily stocks repair parts.
 7. Typical test reports and data for similar motors as specified in paragraph 2.4.
 8. Wiring diagrams, layout drawings, component details, and sequence of operation for the control system.
 9. Vibration testing procedure for system start-up.
 10. As required by paragraph 1.2.D.4. of this Specification, all submittals must be sealed by a Professional Engineer registered in the State of North Carolina and who is an Officer and full-time employee of the system supplier.
- C. Provide operation and maintenance manuals complying with Section 01650.
1. Pump manuals shall include a cross sectional drawing prepared after approval of shop drawings and cannot be marked up typical drawing. Each cross sectional drawing shall include:
 - a. Elevation drawing showing all item numbers.
 - b. A plan view of the discharge head and sub-base showing all dimension and item numbers.
 - c. A detailed drawing of the coupling arrangement.
 - d. A detailed drawing of the stuffing box arrangement.
 - e. A detailed drawing of the bottom bowl assembly.
 - f. A flange force and moment drawing.
 - g. A complete bill of materials showing item number, quantity, description, and material.
 - h. A title block showing customer information, pump design information, motor information, and weights.
 2. VFD manuals shall include as minimum:
 - a. Operating instructions shall incorporate a functional description of the entire system, including the system schematics that reflect "as-built" modification.
 - b. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures.
 - c. Sequence of operation.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 66 00.
- B. Each unit shall be carefully transported, stored, handled and set in place in a manner that will prevent distortion, misalignment or other damage to the units.
- C. During storage prior to installation and following installation, but prior to placing in service, the manufacturer's recommendations regarding handling shall be followed.
- D. Schedule the delivery of the VFD panel and equipment to coordinate with the project completion schedule.
 - 1. Each item of equipment to be tagged with identifying numbers shown on the shop drawings.
- E. Contractor's attention is directed to the fact that VFD's, instruments and control system are delicate components, which have been shop-calibrated. Extreme care shall be taken in handling this control system to avoid internal and/or external damages.
- F. Damaged instruments and control system will not be accepted.
- G. Instrument and equipment not for immediate use shall be stored inside a building, with enclosures under protective coverings, and shall be fully protected from moisture, dust, extreme heat and vibration.

1.5 WARRANTY

- A. Comply with provisions of Section 01 60 00.

1.6 SPARE PARTS

- A. Provide the following spare parts:
 - 1. Two (2) sets of packing and packing box washers for each pump.
 - 2. One (1) packing box gland for each size pump.
 - 3. One (1) stuffing box sleeve for each pump.
 - 4. One (1) flanged coupling, for each size pump, with all related hardware.
 - 5. One (1) set of Perihedral seal rings for each size bowl assembly.
 - 6. VFD spare parts shall be furnished, as follows:
 - a. One (1) set of each type of power and control fuse.
 - b. One (1) main control board.
 - c. One (1) VFD I/O board.
 - d. One (1) human interface module (keypad).
 - e. One (1) Ethernet module.
 - f. One (1) replacement cooling fan.
 - g. Two (2) replacement air filters.

7. All parts are to be supplied with the equipment and shall be crated and properly labeled with the part number for ease of identification.
8. Contractor is to provide one years worth of lubricants required for operation of equipment. Refer to Section 01 60 00 Product Handling.

PART 2 - PRODUCTS

2.1 VERTICAL TURBINE PUMP

- A. General: Provide variable speed, open lineshaft, potable water lubricated type, complete with coupling, motor, discharge head, and all specified appurtenances.
- B. Performance: Furnish pump conforming to the pump schedule at the end of this Section.
 1. Primary Design and Guarantee Point – 5600 gpm @ 260', 1180 RPM, 84% Bowl Efficiency.
 2. Secondary Full Speed Points:
 - a. 6700 gpm @ 190', 78%
 - b. 3500 gpm @ 340', 75%
 3. Reduced Speed Points:
 - a. 1150 RPM:
 1. 5600 gpm @ 240', 85%
 2. 6500 gpm @ 180', 77%
 3. 3500 gpm @ 320', 75%
 - b. 980 RPM:
 1. 4700 gpm @ 180', 84%
 2. 2700 gpm @ 240', 72%
 - c. 880 RPM:
 1. 3000 gpm @ 180', 72%
- C. Impellers:
 1. Furnish enclosed type, carefully machined and dynamically balanced.
 - a. Submit certified dynamic balance report with hydraulic test data, prior to shipment.
 - b. Do not ship without approval of report.
 2. Open or semi-open impeller designs will not be accepted.
 3. No thrust balancing allowed.
 4. Provide impellers of 316 SS.
 5. Lock securely to the Type 416 (ASTM A582) stainless steel bowl shaft using a 400 series stainless steel key.
 6. Machine impeller to mate with Perihedral bowl seal rings to allow for future impeller adjustment to regain efficiency from wear.
- D. Bowls:
 1. Furnish ductile iron (ASTM A-395, Grade 60/40/18) bowls with properly designed guide vanes. Minimum tensile strength of 40,000 psi.
 2. Furnish ductile iron (ASTM A-395, Grade 60/40/18) suction bells.

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

3. Coat interior of bowl with NSF Approved 3M SK134 fusion bonded epoxy.
 - a. Apply at temperatures below 550°F to prevent bowl distortion.
4. Use bismuth bronze (C89835) bowl bearings.
5. Fit each bowl casing with Type 416 SS seal wear ring to mate with a perihedral step impeller.
 - a. Design perihedral seal rings to provide both radial and axial sealing.
 - b. Perihedral seal rings to be field replaceable.
6. Bowl studs and nuts to be Type 316 stainless steel.
7. Provide Type 316 stainless steel suction strainer for each pump.
8. Hydrostatically test each casing to 1.5 times the design head or 1.25 times the shutoff head, whichever is greater.
9. Suction case bearings to be grease packed.
 - a. Provide Type 316 stainless steel grease line terminated at the baseplate to allow greasing from the operating floor.
 - b. Provide sand collar of bismuth bronze ASTM C89835 to protect the suction case bearings from abrasives.
 - c. Utilize Food Grade Grease.
10. Match mark each bowl.

E. Discharge column and lineshaft:

1. Furnish outer discharge column of carbon steel ASTM A53 and A36, Grade B with flanged joints and Type 316 stainless steel bolting.
2. Provide column and lineshaft in maximum lengths of five (5) feet.
3. Furnish Type 416 stainless steel lineshaft, with Type 316 stainless steel sleeves at each bearing point and Type 416 stainless steel screw couplings.
4. Place lineshaft sleeves on full size shaft (no undercutting) and secure in place without welding.
5. Replacement sleeves shall permit field installation without special tools.
6. Minimum lineshaft size to be as shown in the Pump Schedule and to be of adequate size to transmit the full horsepower of the pumping unit without slip, vibration or excessive elongation, and shall have screw joints.
7. Match mark each column section.
8. Provide lifting eyebolts for future use for each column section, adequately sized to lift the entire pump assembly, less motor. Package and tag for future installation and use.

F. Discharge head:

1. Furnish each pump with a fabricated three (3) segment mitered steel discharge head conforming to the pump schedule and matching the existing dimensions.
 - a. All contractor provided discharge piping to be provided with hardened fasteners.
2. Discharge head to be fabricated to allow ample room for adjustment and replacement of the water flush packing box gland, packing, and sleeve without disturbing the coupling or requiring motor removal or lifting.
3. Discharge head to match existing discharge dimensions and sole plate dimensions.

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

4. Design discharge head to elevate the discharge head natural frequency above the operating speeds. Provide design calculations with shop drawings.
5. Furnish with a suitable centering ring to receive a vertical hollow shaft motor.
6. Design head for above ground discharge and fit with flanged discharge of size and rated indicated in pump schedule.
 - a. Discharge head to be designed such that packing and follower can be adjusted and removed without removing the motor or motor shaft.
7. Provide cast iron (A48 Class 30) water flush packing box, 400 # rating, fitted with split type bronze follower and a Type 316 stainless steel sleeve, locked in place with Loctite and easily replaced through the packing box.
8. Furnish with Type 416 stainless steel screwed motor coupling.
9. Design the discharge head window, of adequate size to use a sling to lift the entire pump assembly, less motor. Package and tag for future installation and use.
10. Pump discharge flange to be machined to accept a 1/2" NPT pressure transmitter connection
11. Pump discharge head to be fabricated with an additional flange connection for connection of the air release valves specified herein.

G. Special coatings:

1. Manufacturer to coat inside and outside of column piping, outside of bowls and inside of discharge head with Tnemec Series N140 or Scotchkote. All products are to be NSF approved and are to be installed in strict accordance with the product manufacturers requirements.
2. Manufacturer to apply prime coat only to exterior of discharge head. Final coatings are to be field applied by the Contractor. All coatings are to comply with Specification Section 09 90 00.

H. Ship each pump as fully shop assembled unit, less sole plate, strainer, motor, motor shaft, and motor coupling.

2.2 MOTORS

A. General:

1. Provide 480-volt, 1200 RPM, inverter duty rated, NEMA MG1 Section IV part 31.40.4.2 electrical high efficiency design, including normal starting torque and current inrush characteristics, direct connected, TEFC, vertical hollow shaft, squirrel cage induction motors, built to form an integral part of the pump head assembly.
2. Furnish with Class H insulation, normal starting torque and low starting current characteristics, and follow NEMA Design B torque characteristics.
3. Motors shall not be overloaded at the design condition or at any point on the pump curve, excluding the service factor.
4. Provide minimum service factor of 1.0 on VFD and 1.15 on sine wave 60 Hz.
5. Design motor bearings for an average L-10 life of 100,000 hours.
6. Provide steady bushing.
7. Provide non-reversing ratchets and adjusting nuts.
8. Furnish high thrust or extra high thrust in conformance with thrust requirements of the pump schedule.



CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

9. Furnish motor in current NEMA design, cast iron frame with copper windings conforming to current NEMA premium efficiency standards.
10. Maximum sound pressure level of the motors, when measured at a distance of one meter away shall not exceed 90 dB (A).
11. Provide two (2) resistance temperature detectors in each of the three windings of each motor and at upper and lower bearings. RTD's to be 120 ohm nickel.
12. Provide 120-volt space heaters in each motor, powered from the pump control panel when the motors are not energized.
13. Provide oversized conduit boxes based on the cable and conduit sizes shown on the electrical drawings.
14. Provide lifting eyes of adequate capacity to lift the motor.
15. Provide mounting for future Metrix Model ST5491E-021-11-10-00 vibration transmitter for each pump motor. Make provisions to allow for mounting the transmitter at either the front or rear motor bearings with a 1/2" FNPT tapped connection.
16. Motor bearings to be protected from damage from induced current by insulated bearings and shaft grounding brushes.
17. Motor design shall be confirmed by the motor manufacturer to be capable of meeting pump speed/torque required for the application based on speed/torque information from the pump manufacturer.
18. Furnish motor with manufacturer's standard coating, with final coatings by contractor, per Section 09900.
19. Acceptable manufacturer: US Electric and General Electric Motors.

B. Characteristics: Provide motors properly selected to perform under these operating conditions:

1. Maximum horsepower: See pump schedule.
2. Maximum speed: See pump schedule.
3. Operational current: 480 V, 3 Phase, 60 hertz.

2.3 AIR RELEASE VALVE

A. Provide each pump assembly with an automatic air/vacuum valve to suit the pumping conditions.

1. Valve to be of the Kinetic design and be capable of exhausting air at up to sonic velocity without blowing shut.
2. Conform to the requirements of AWWA C-512.
3. Body and cover to be ASTM A-126 Class B cast iron.
4. Float to be stainless steel and tested to 1,000 psi.
5. Seat to be manufactured of Buna-N and be field replaceable.
6. Provide adjustable throttling device on the outlet to regulate the exhaust rate of air.
7. Provide surge check on the inlet side of the valve. Surge check to be ASTM A-126 Class B cast iron with bronze internals.
8. Valves to be lined and coated with 12 mil DFT of NSF-61 certified fusion bonded epoxy per AWWA C550.

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

- B. Location: Locate air/vacuum valve on pump discharge head if possible; if not, the Contractor shall locate valve in first section of piping after the discharge head.
- C. Provide inlet stainless steel ball valve, per Section 33 11 16.
- D. All piping, nipples, plugs, etc., to be Schedule 40, Type 304 stainless steel.
- E. Air/Vacuum valves shall employ the Kinetic Design Principle and be G.A. Industries Figure 933-DK with throttling mechanism and slow closing surge check valve on the inlet. Valve inlet to be flanged and outlet to NPT, Class 125. Valves to be 2".

2.4 INSTRUMENTATION

A. General:

- 1. Design drawings and specifications are not intended to cover all details involved in the design of the complete system.
- 2. The completed system shall be compatible with the functions required and the equipment furnished by the Contractor.
- 3. All electrical control components of the system shall operate on 120 volt, single phase, 60 Hertz power supply, unless otherwise specified.

2.5 VARIABLE SPEED DRIVE

A. Provide one (1) 450 HP 480V, variable frequency drives as manufactured by SquareD/Schneider Electric, Altavar 600 series. The following components must be integrated into the VFD system:

- 1. Main Incoming Circuit Breaker.
- 2. Current-limiting fuses.
- 3. Surge protection device.
- 4. Passive harmonic filter, with capacitor cutout contactor or Active Front End.
- 5. VFD Unit (with integral Ethernet module, I/O module, common mode choke).

B. DESIGN REQUIREMENTS

- 1. Provide VFD Controller in accordance with the detailed specifications and plans.
- 2. The VFD Systems (VFD unit with all associated appurtenances) described herein are to be manufactured, assembled, tested and shipped complete from the VFD Manufacturer. The use of third-party supply/assembly is not acceptable and will be rejected.
- 3. The VFD Systems (VFD unit with all associated appurtenances) described herein shall be completely enclosed systems. All components of each VFD System (other than a possible externally-mounted heat-sink) shall be mounted inside a Hoffman-like, Rittal-like or MCC-like enclosure. Each VFD System described herein shall contain a maximum of one VFD Controller (i.e. multiple VFDs in a single enclosure are not allowed).

C. VFD UNIT RATINGS

1. Certifications
 - a. Listed to UL508C and CAN/CSA-C22.2 No. 14-05
 - b. In conformity with EMC Directive (2004/108/EC) and Low Voltage Directive (2006/95/EC). Standards applied; EN 61800-3:2004, EN 61800-5-1:2007
 - c. In conformity with EN 61800-3:2004, EN 61800-5-1:2007, EN ISO 13849-1:2008, EN ISO 13849-2:2003, EN 61800-5-2:2007, EN 61508 PARTS 1-7:2000, EN 62061:2005, and EN 60204-1:2006
 - d. In conformity with Radiocommunications Act: 1992, Radiocommunications Standard: 2008, and Radiocommunications Labeling Notice: 2008. Standards applied: EN 61800-3:2004
 - e. Electric Power Research Institute. Certified compliant with standards SEMI F47 and IEC 61000-4-34
 - f. Compliant with the European "Restriction of Hazardous Substances" Directive
2. Hardware
 - a. Utilize diode bridge or SCR bridge on the input rectifier.
 - b. Utilize DC bus inductor on all six-pulse VFDs.
 - c. Utilize switching logic power supply operating from the DC bus.
 - d. Incorporate phase to phase and phase to ground MOV protection on the AC input line.
 - e. Microprocessor based inverter logic shall be isolated from power circuits.
 - f. Utilize latest generation IGBT inverter section.
 - g. Battery receptacle for Lithium battery power to the Real Time Clock.
 - h. Additional DPI port for handheld and remote HIM options.
 - i. Dedicated Digital Input for hardware enable.
 - j. Conformal coated printed circuit boards.
 - k. Optional onboard 24V DC Auxiliary Control Power Supply.
3. Control Logic
 - a. Ability to operate with motor disconnected.
 - b. Provide a controlled shut down, when properly protected, with no component failure in the event of an output phase to phase or phase to ground short circuit. Provide annunciation of the fault condition.
 - c. Provide multiple programmable stop modes including Ramp, Coast, DC-Brake, Ramp-to-Hold, Fast Braking, and Current Limit Stop.
 - d. Provide multiple acceleration and deceleration rates.
 - e. Adjustable output frequency up to 650Hz.
4. Motor Control Modes
 - a. Selectable Sensorless Vector, Flux Vector, V/Hz, and Adjustable Voltage Control modes selectable through programming.
 - b. The drive shall be supplied with a Start-up and Auto-tune mode.
 - c. The V/Hz mode shall be programmable for pump curve or full custom patterns.
 - d. Capable of Open Loop V/Hz.
5. Adjustments
 - a. A digital interface can be used for all set-up, operation and adjustment settings.

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

- b. All adjustments shall be stored in nonvolatile memory (EEPROM).
 - c. No potentiometer adjustments shall be required.
 - d. EEPROM memory for factory default values shall be provided.
 - e. Software must be available for trending and diagnostics, as well as online and offline programming functionality.
6. Skip Frequencies
 - a. Three adjustable set points that lock out continuous operation at frequencies which may produce mechanical resonance shall be provided.
 - b. The set points shall have a bandwidth adjustable from Maximum Reverse Speed to Maximum Forward Speed.
 7. Fault Reset / Run
 - a. The drive shall provide a series of automatic restart attempts separated by increasingly longer waiting periods - 1s, 5s, 10s, then 1 minute for the following attempts - following a fault condition before locking out and requiring manual restart.
 - b. The automatic mode shall not be applicable to a ground fault, shorted output faults and other internal microprocessor faults.
 - c. The maximum time for the automatic restart function can be set to 5, 10 or 30 minutes, 1, 2, or 3 hours, or continuous.
 8. Run on Power Up
 - a. A user programmable restart function shall be provided to allow restart of the equipment after restoration of power after long duration power outages. Restart time dependent on presence of incoming signal.
 9. Fault Memory
 - a. The last 15 fault codes shall be stored and time stamped in a fault buffer.
 - b. Information about the drive's condition at the time of the last fault such as operating frequency, output current, dc bus voltage and twenty-seven other status conditions shall be stored.
 - c. A power-up marker shall be provided at each power-up time to aid in analyzing fault data.
 - d. The last 30 warning codes shall be stored and time stamped for additional troubleshooting reference.
 10. Overload Protection
 - a. The drive shall provide internal class 10 adjustable overload protection.
 - b. Overload protection shall be speed sensitive and adjustable.
 - c. A viewable parameter shall store the overload usage.
 11. Auto Economizer
 - a. An auto economizer feature shall be available to automatically reduce the output voltage when the drive is operating in an idle mode (drive output current less than programmed motor FLA). The voltage shall be reduced to minimize flux current in a lightly loaded motor thus reducing kW usage.
 - b. When the load increases, the drive shall automatically return to normal operation.
 12. Terminal Blocks
 - a. Separate terminal blocks shall be provided for control and power wiring.
 - b. I/O terminal blocks shall be removable with wiring in place.
 13. Flying Start

- a. The drive shall be capable of determining the speed and direction of a spinning motor and adjust its output to "pick-up" the motor at the rotating speed. This feature is disabled by default.
- 14. Inputs and Outputs
 - a. The Input / Output option modules shall consist of both analog and digital I/O.
 - b. No jumpers or switches shall be required to configure digital inputs and outputs.
 - c. All digital input and output functions shall be fully programmable.
 - d. The control terminal blocks shall be rated for 24V DC.
 - e. Inputs shall be optically isolated from the drive control logic.
 - f. The control interface card shall provide input terminals for access to fixed drive functions that include start, stop, external fault, speed, and enable.
 - g. The VFD shall be capable of supporting up to 5 analog inputs, 2 analog outputs, 12 digital inputs, 6 relay outputs, 2 digital outputs, and 4 positive temperature coefficient (PTC)/PT100/PT1000/KTY84 inputs.
 - h. The Input / Output option modules shall have the following features:
 - 1) Analog Inputs:
 - a. Quantity three (3) differentially isolated, 0-10VDC, impedance 30k ohm; 0-20mA, impedance 250 ohm; resolution 12 bits.
 - b. Analog inputs shall be user programmable for a variety of uses including frequency command and process loop input. Analog inputs shall be user programmable for function scaling (including invert), offset, signal loss detect and square root.
 - 2) Analog Outputs:
 - a. Quantity two 0-10VDC, impedance 470 ohm; 0-20mA, maximum load impedance 500 ohm; resolution 10 bits.
 - b. The analog output shall be user programmable to be proportional to one of fourteen process parameters including output frequency, output current, encoder feedback, output power.
 - c. Programming shall be available to select either absolute or signed values of these parameters.
 - 3) Digital Inputs:
 - a. Quantity of six (6) digital inputs rated 24V DC/115V AC.
 - b. All inputs shall be individually programmable for multiple functions including: Start, Run, Stop, Auxiliary Fault, Speed Select, Jog and Process PI functions.
 - 4) Digital Outputs:
 - a. At least three (3) relay output (N.O. or N.C.).
 - b. For 250V AC or 30V DC, N.O. contact output ratings shall be 2-amp max., general purpose (inductive)/resistive. N.C. contact output ratings shall be 3-amp max., resistive only.
 - c. Relays shall be programmable to multiple conditions including: Fault, Alarm, At Speed, Drive Ready and PI Excess Error.

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

- d. Timers shall be available for each output to control the amount of time, after the occurring event, that the output relay actually changes state.
 - e. At least one (1) transistor output.
 - f. For 24V DC, transistor output rating shall be 1 amp max, Resistive.
15. Reference Signals
- a. The drive shall be capable of using the following input reference signals:
 - 1) Analog inputs
 - 2) Preset speeds
 - 3) Remote potentiometer
 - 4) Digital MOP
 - 5) Human Interface Module
 - 6) Communication modules
16. Loss of Reference
- a. The drive shall be capable of sensing reference loss conditions.
 - b. In the event of loss of the reference signal, the drive shall be user programmable to the following:
 - 1) Fault the drive and coast to stop.
 - 2) Issue a minor fault - allows the drive to continue running while some types of faults are present.
 - 3) Alarm and maintain last reference.
 - c. When using a communications network to control the drive, the communications adapter shall have these configurable responses to network disruptions and controller idle (fault or program) conditions:
 - 1) Fault
 - 2) Stop
 - 3) Zero Data
 - 4) Hold Last State
 - 5) Send Fault Configuration
17. Metering
- a) At a minimum, the following parameters shall be accessible through the Human Interface Module, if installed:
 - 1) Output Current in Amps
 - 2) Output Voltage in Volts
 - 3) Output Power in kW
 - 4) Elapsed MWh
 - 5) DC Bus Voltage
 - 6) Frequency
 - 7) Heatsink Temperature
 - 8) Last eight (32) faults
 - 9) Elapsed Run Time
 - 10) IGBT Temperature
18. Faults
- a) At a minimum, the following faults shall be accessible through the Human Interface Module:
 - 1) Power Loss
 - 2) Undervoltage
 - 3) Overvoltage

- 4) Motor Overload
 - 5) Heat Sink Over-temperature
 - 6) Maximum Retries
 - 7) Phase to Phase and Phase to Ground Faults
19. Predictive Diagnostics
- a) At a minimum, the following predictive diagnostic features shall be provided:
 - 1) Fan Diagnostics
 - 2) HMI LED Diagnostics
 - 3) IGBT Diagnostics w/motor
 - 4) IGBT Diagnostics w/out motor
20. Real-Time Clock
- a) Shall be capable of providing time stamped events.
 - b) Shall have the ability to be set locally or via a remote controller.
 - c) Shall provide the ability to be programmable for month, day, year and local time zones in HH:MM:SS.
21. Motor Protection Relay
- a) Provide motor protection relay equipped with the following protection functions:
 - 1) 12 RTD inputs with associated over-temperature protection functions including alarm and trip settings, with corresponding settable time delays, and associated outputs.
 - 2) The following additional functionality shall be provided, associated to RTDs:
 - a. Able to configure each of the twelve RTDs as “None” or any one of four application types: “Stator”, “Bearing”, “Ambient”, or “Other”.
 - b. RTD type shall be selectable between four different RTD types: “100 Ohm Platinum”, “120 Ohm Nickel”, “100 Ohm Nickel”, or “10 Ohm Copper”
 - 3) The motor relay shall incorporate the RTD inputs to support the following:
 - a. Thermal overload model biasing
 - b. Temperature alarms and trips
 - c. RTD open- or short-circuit alarm
 - 4) The motor relay shall include trip voting for extra reliability in the event of RTD malfunction. If enabled, a second RTD must also exceed the trip temperature of the RTD being checked before a trip is issued.
 - 5) Provisions shall be included to allow the RTDs to be identified by name.
 - b. Inputs and Outputs
 - 1) Provide a minimum of six (6) relay outputs. Output relay shall be connected to VFD to shut off pump if high temperature occurs.
 - 2) Provide a minimum of six (6) 4-20 mA outputs, one for each RTD. Outputs shall be connected to SCADA system.
 - c. User interfaces shall include:
 - 1) A large display, navigation keys, and a keypad

- 2) Indicator LEDs on the front panel which shall provide a quick visual indication of status
- 3) A front panel RS232 serial port that shall provide easy computer access. The communications protocol shall be Modbus RTU
- 4) Two rear RS485 ports. The communications protocol shall be Modbus RTU
- 5) An RJ45 Ethernet port shall be provided to allow 10BaseT Ethernet connectivity to Local or Wide Area Networks. The communications protocol shall be Modbus TCP
- 6) The relay shall be capable of being set by Windows-based, easy to use, Setup graphical terminal interface to make the data acquisition more efficient, the motor relay shall provide a User Definable Memory Map, which shall allow a remote computer to read up to 125 nonconsecutive data registers by using one Modbus packet. The User Definable Memory Map shall be programmed to join any memory map address to one in the block of consecutive User Map locations, so that they can be accessed by means of these consecutive locations. The User Definable area shall have two sections:
 - a. A Register Index area containing 125 Actual Values or Setpoints registers
 - b. A Register area containing the data located at the addresses in the Register Index

D. VFD SYSTEM RATINGS

1. Ratings
 - a. Voltage
 - 1) Capable of accepting nominal plant power of 480V AC at 60Hz.
 - 2) The supply input voltage tolerance shall be $\pm 10\%$ of nominal line voltage.
 - b. Displacement Power Factor
 - 1) Six-pulse VFD shall be capable of maintaining a minimum true power factor (Displacement P.F. X Distortion P.F.) of 0.95 or better at rated load and nominal line voltage, over the entire speed range.
 - c. Efficiency
 - 1) A minimum of 95% (+/- 1%) at 100% speed and 100% motor load at nominal line voltage.
 - d. The VFD chassis and components shall be rated to handle a maximum ambient temperature of 40 °C (104 °F) air surrounding the VFD.
 - e. Operating relative humidity range shall be 5% to 95% non-condensing.
 - f. Operating elevation shall be up to 1000 Meters (3,300 ft) without derating.
2. Sizing
 - a. System shall be rated based on continuous output amps, and matched to meet or exceed the nameplate-rated Motor Full Load Amps.
 - b. Overload current rating of each VFD System shall be rated appropriately for the application.
3. Ride-Through

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

- a. The VFD system shall attempt to ride through power dips up to 20% of nominal. The duration of ride-through shall be inversely proportional to load. For outages greater than 20%, the drive shall stop the motor and issue a power loss alarm signal to a process controller, which may be forwarded to an external alarm signaling device. SEMI F-47 compliant.
4. Run on Power Up
 - a. The VFD system shall provide circuitry to allow for remote restart of equipment after a power outage. Unless indicated in the contact drawings, faults due to power outages shall be remotely resettable. The VFD system shall indicate a loss of power to a process controller, which may be forwarded to an external alarm signaling device. Upon indication of power restoration the process controller will attempt to clear any faults and issue a run command, if desired.
5. Communications
 - a. VFD shall be capable of communicating on multiple networks.
 - b. VFD shall be capable of supporting the following network options:
 - 1) DeviceNet
 - 2) Ethernet/IP
 - 3) ControlNet Coax
 - 4) ControlNet Fiber
 - 5) Interbus
 - 6) CANopen
 - 7) Modbus/TCP
 - 8) Modbus RTU
 - 9) Profibus DP
 - 10) RS-485 DF1
 - 11) RS-485 HVAC
 - 12) Remote I/O
6. Enclosure Door-Mounted Human Interface Module (HIM)
 - a. VFD shall provide a HIM with integral LCD display, operating keys and programming keys.
 - b. An enclosure door mounted HIM, rated IP 65/UL Type 12, shall be provided.
 - c. The HIM shall have the following features:
 - 1) A seven (8) line 240x160 pixel character backlit LCD display with graphics capability.
 - 2) Shall indicate drive operating conditions, adjustments and fault indications.
 - 3) Description/other characteristics: 16 MB memory; 24 languages; 2-color backlit display; trend curves, energy data, process data; pump curves; static and dynamic QR codes; 4 function keys; stop/reset button; run button; navigation buttons – OK, Turn, ESC, Home, Information.
7. System Enclosure
 - a. Shall be rated NEMA/UL Type (1) or (12).
 - b. Shall be painted per the manufacturer's standard.
 - c. Shall provide entry and exit locations for power cables.
 - d. Shall contain a label for UL508.

- e. The drive system nameplate shall be marked with system Short Circuit Current Rating (SCCR).
- 8. Drive Enclosure Input Disconnect
 - a. Provide an enclosure door interlocked disconnect with thermal magnet circuit breaker.
 - b. Operator Handles
 - 1) Provide externally operated main disconnect handle.
 - 2) Handles shall be lockable with up to three lockout / tagout padlock positions.
- 9. Current-Limiting Fusing
 - a. Input fusing, motor circuit protector (MCP), or inverse time circuit breaker shall be provided.
- 10. Control Power Transformer
 - a. Provide a control power transformer mounted and wired inside of the drive system enclosure.
 - b. The transformer shall be rated for the VFD power requirements, and any additional capacity (as indicated on the plan drawings)
- 11. Passive Harmonic Filter with Capacitor Cutout Contactor or Active Front End
 - a. The VFD system shall utilize a Passive Harmonic Filter that is designed to limit harmonic distortion (current and voltage) to levels that allow the overall system to meet IEEE519-1992 at the Point of Common Coupling. Acceptable brands/models include MTE Corporation / Series D or TCI (Trans-Coil Inc) / Model HG7 or Block. The Passive Harmonic Filter shall include a capacitor cut-out contactor to disconnect the capacitor assembly under no-load, low-load and/or generator power conditions.
 - b. Three-Level Active Front End with common mode filter.
- 12. Reflected Wave Filter
 - a. Each VFD System shall utilize a Reflected Wave Filter (DV/DT Filter or Reflected Wave Reducer (output load reactor plus damping resistor)) that is designed to limit the effects of Reflected Wave such VFD-to-Motor cable distances for these particular Wastewater Return VFDs and Motors can be up to 800-ft, without limiting the carrier frequency of the VFD to a value less than 4 kHz. (The VFD shall maintain at least two choices for carrier frequency at 4kHz or less.) The VFD Manufacturer shall supply a DV/DT Study within the VFD Submittal that confirms meeting this requirement.
 - b. Each Reflected Wave Filter shall be housed within its respective VFD System enclosure.

PART 3 - EXECUTION

3.1 SHOP PUMP TESTING

- A. Perform a complete full speed performance test of each pumping unit, as a completely assembled unit, in the manufacturer's shop, at full speed, with a job motor.

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

- B. Perform variable speed performance tests of each pumping unit, as a completely assembled unit, in the manufacturer's shop, at 1180, 1030, and 880 RPM with a job motor and shop VFD.
 - 1. Based on the data generated at 1180, 1030, and 880 RPM, provide calculated curves for all speeds in the pump schedule.
- C. Performance tests to include characteristic curves of head, capacity, horsepower required and efficiency.
 - 1. Test code of the Hydraulic Institute shall be followed in the test procedures.
 - 2. Seven (7) points, including the basic design point and best efficiency point on the head capacity curve, shall be tested and indicated in plotting the curve including shutoff head.
- D. Shop test curves shall be in substantial accord with the approval characteristics curves submitted with the shop drawings.
- E. Pump performance (GPM and head) as defined in the pump schedule are for bowl assemblies only.
 - 1. Lab Efficiencies shown in the Pump Schedule are for Bowl Assemblies only.
 - 2. Pump Efficiencies shown in the Pump Schedule are for fully assembled pumps.
- F. Certified copies of the test curves and other design points and data sheets, in triplicate, shall be submitted to the Engineer for approval, prior to shipment.

3.3 OPERATOR TRAINING

- A. Provide one half day (4 hours) of Operator Training at the Pump Station, to include instruction on the Operation and Maintenance of the Pumps, VFD's, and Control Devices.
- B. Coordinate all training sessions with the Owner/Engineer.

3.4 SHOP MOTOR TESTING

- A. A complete performance test shall be conducted on each motor in the motor manufacturer's shop.
- B. Three (3) copies of the certified test reports shall be submitted for approval prior to shipment.
- C. Tests shall include the following, at a minimum:
 - 1. Measurement of winding resistance
 - 2. No-load readings for current, power, nominal speed at rated voltage and frequency.
 - 3. High-potential test per NEMA MG 1-20.47

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

4. Mechanical balance per NEMA MG 1-20.53

3.5 INSTALLATION

- A. Install and assemble pump/motor in strict conformance with recommendations of the manufacturer.
- B. Verify condition of existing sole plate, including soundness of installation, level in all directions, etc.
 1. Tighten anchor bolts finger tight.
 2. Pump supplier to inspect and certify prior to pump installation.
 2. Repair existing grout as needed with non-shrink grout complying with Section 03600. Existing edge chamfer grouting is to be chipped out, cleaned up and new grouting installed using required bonding agents.
 3. Snug down anchor bolts securely.
 4. Pump supplier to inspect and certify prior to final pump setting.
- C. Set pumping unit level and carefully align with connecting piping.
 1. Support discharge piping so that the pump discharge flange carries no weight.
 2. Align pump and discharge piping, so the flanges are parallel and there are minimal forces applied to the pump flange.
 3. Pump supplier to inspect unbolted pump and certify, prior to installing and tightening flange bolts.
 4. Tighten flange bolts.
 5. Pump supplier to re-inspect bolted pump and re-certify alignment prior to operation.

3.6 ELECTRICAL

- A. Make all control and power connections complying with Section 26 00 00.

3.7 FINISH PAINTING

- A. Apply finish coats in compliance with Section 09 90 00.

3.8 FIELD TEST

- A. Provide vibration analyzer test on each pumping unit.
 1. Use analyzer equal to Diagnostics Instruments Model 2200.
 2. Verify amplitude of all apparent frequencies of pump and motor after installation.
 3. Measurements shall not exceed the acceptable levels as specified by the Hydraulic Institute.
 4. Provide calibration reports demonstrating proper calibration of the vibration analyzer.
 5. Provide plotted graphs of vibration results in inches per second, unfiltered, RMS per Hydraulic Institute Standards.

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

- a. Take readings every 50 RPM over the specified speed range and over each specified operating scenario.
- b. Plot the results in a 3-D Map or waterfall display.
6. Submit the plotted graphs and calibration report, along with a data review prepared and sealed by a Professional Engineer registered in the State of North Carolina, and who is a full-time employee of the System Supplier.

B. Performance tests:

1. Check each unit in presence of the Engineer and a representative of the pump manufacturer.
2. Field tests shall be in substantial agreement with approved shop test curves.
3. Units shall show satisfactory mechanical operating characteristics and cavitation noises shall not be present under the normal design conditions.

C. Units failing to meet the specified conditions shall be rebalanced or otherwise corrected to meet the requirements, or replaced with units that do meet these requirements.

1. Alterations, balancing or replacement of unsatisfactory units shall be made at no additional cost to the Owner.

3.9 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the items under this Section and all costs for same shall be included in the lump sum price bid for the project.

CONTRACT: OWASA CIP #272-42

PROJECT: Water Treatment Plant Finished Water Pumping Improvements

DATE: January 23, 2020

Location/ Service	GPM	TD H (Ft)	Max Shutoff Head	Min Eff Field %	Min VL Bowl Eff %	NPSHR	Min Submergenc e	Max RPM	BHP Design Point	Motor HP	Max Oper Down Thrust Lbs.	Max Down Thrust Lbs.	Disch Size (In)	Disch Rating (psi)	Min Column Size (In)	Min Wall Thick (In)	Min Dia Line Shaft (In)	Min Dia Imp Shaft (In)
Guaranteed Design Point	5,600	260	460	82	84.0	18'	30"	1180	430	450	11000	22000	16	250	16	0.375	2.4375	2.4375

END OF SECTION