

SECTION 11316

NON-CLOG SUBMERSIBLE PUMPS FOR WASTEWATER (70 HP AND GREATER)

PART 1. GENERAL

1.01 GENERAL DESCRIPTION

- A. This specification shall govern for all work necessary for furnishing, delivering, installing, connecting, testing and placing into initial operation the non-clog submersible pumps for lift stations.
- B. The pumps shall be non-clog type designed to pump unscreened raw sewage and wastewater. The equipment shall be designed in a manner that the pump unit can be automatically and firmly connected to the discharge base when lowered into place through a dual guiderail system that perfectly aligns the pump discharge port with the discharge base inside the wet well and its perfectly sealed by the pump own weight. The pumps shall be easily removable from the wet well for inspection, cleaning and maintenance without the need for personnel to enter the wet well.
- C. CONTRACTOR shall be responsible for accounting for all expenses for installation of the submersible non-clog pump, connecting power cables install and connect protection relay and perform any incidental work required for all connections and mounting. Part of the incidentals include tools, heavy machinery, specialized personnel and modifications to existing infrastructure to fit the new heat exchangers and its accessories.

1.02 QUALITY ASSURANCE

- A. All equipment, materials and accessories specified in this Section shall be new, unused, clean, unrusted, and free of defects such as dents, paint chips, scars, scratches, stains, fractures and bends when delivered, and shall be specifically designed and selected for the function and service specified herein. No equipment or materials shall be delivered without prior approval by SAWS.
- B. The pumps shall be furnished by a manufacturer engaged in the production of submersible non-clog pumps for wastewater for a minimum of 10 years. The manufacturer shall have furnished similar pumps for at least 5 other installations in Texas performing similar duty. Each installation shall have performed satisfactorily for at least 5 years and are still in operation.
- C. All manufacturer parts and components shall be engineered for long, continuous and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts.
- D. Where like items are incorporated into equipment systems (i.e. motors, pushbuttons, etc.), such items must be identical to achieve standardization for appearance, operation, maintenance, spare parts and service. Corresponding parts for multiple units shall be interchangeable.
- E. All stages of the manufacturing process shall be carefully inspected at the factory by factory inspectors who shall use whatever means necessary to assure the proper fit for all field connections and compliance with all material and fabrication requirements and specifications.
- F. The pump, pump monitoring and level control panel shall be factory wired and assembled. Assembly and wiring shall be to the point where the only field interconnections to numbered terminal blocks are required.

- G. It is absolutely imperative that parts and service shall be available within 50 miles of the project site for immediate repairs should service become necessary. Unless it can be demonstrated that parts are available at a service center through the same financially sound firm on a continuing basis.

1.03 REFERENCES

- A. Submersible Non-Clog pump and accessories shall be manufactured in compliance with the following standards:
 - 1. AISI – American Iron and Steel Institute.
 - 2. ANSI – American National Standards Institute.
 - 3. HI – Hydraulic Institute.
 - 4. NEC – National Electrical Code.
 - 5. NEMA – National Electric Manufacturer’s Association.
 - 6. ASME – American Society of Mechanical Engineers.
 - 7. ASTM – American Society for Testing and Materials.
 - 8. AWS – American Welding Society.
 - 9. UL – Underwriter Laboratories

1.04 SUBSTITUTIONS

- A. Whenever the term “ENGINEER APPROVED EQUAL” or “APPROVED EQUAL” appears in the specifications, the CONTRACTOR has the option to submit a product or system for SAWS review and approval.
- B. All proposed substitutions shall clearly state in writing the product for which the substitution was made.
- C. Any product which is proposed as a substitute shall be accompanied by drawings and specifications which must clearly show dimensions, weights, capacities, reference standards and performance information.
- D. Such proposed substitutions shall meet or exceed all the requirements and specifications listed in this Contract.
- E. Space requirement is critical; therefore the dimensions and connections are very critical due to limited space and location of existing discharge base, guiderail system and motor controls.
 - 1. During Mandatory Pre-Bid meeting, the CONTRACTOR shall be responsible to take pictures, measurements, bring specialized personnel as to determine if field modifications to existing infrastructure are needed to fit their product.
- F. Submittal information, installation drawings with dimensions and a list of all required field modifications to existing infrastructure shall be submitted in writing 5 working days prior to the Bid Submittal deadline.

1. CONTRACTOR will be notified by SAWS in writing if their proposed equipment is approved to participate in the Bid 3 working days prior to bid submit deadline.

G. Substitutions are acceptable in the following cases:

1. Products specified by reference standards, performance requirements and/or by description only: Any product meeting those specifications.
2. Products specified by naming one or more manufacturers with a substitution paragraph: Submit a request for substitution for any manufacturer not specifically named.
3. Products that clearly show a scaled installation drawing, and indicates all the required field modifications to existing infrastructure.
 - a. SAWS will evaluate the impact of such proposed modifications and will determine if such modifications are acceptable or not.
4. Modifications to the new equipment being furnished in order to fit the existing infrastructure.
 - a. Such proposed modifications shall be acknowledged by the equipment manufacturer, and shall agree in writing as to award the warranty established in this contract.

H. It is absolutely imperative that parts and service shall be available within 50 miles of the project site for immediate repairs should service become necessary. Unless it can be demonstrated that parts are available at a service center through the same financially sound firm on a continuing basis.

1.05 SUBMITTALS

A. General

1. Submittals shall be complete and shall contain data to confirm compliance or exception to all sections of these specifications. Any exception must be clearly indicated. Absence of data will be considered as non-compliance and basis for disapproval. Approval for incorporation into the bid competition will be made only after the review of shop drawings, specifications and performance data. Before manufacture, the CONTRACTOR shall furnish for ENGINEER's review and approval of the submittal documentation as required hereinafter.

B. Copies.

1. Hard Copies
 - a. Submit Two (2) hard copies for all submittal data
 - b. Submit four (4) copies for all submittal data.
 - c. Quality and Format.
 - i. Photocopied information must be clear, legible and of high resolution and quality. Submittal sheets shall be 8.5 x 11 inches (letter size) so that the title block is visible without then need to unfold. Drawings shall be 11 x 17 inches (ledger size) and be attached to the submittal as long as they are properly folded.

Information requiring sheet sizes larger than 11 x 17 inches (ledger size) shall be properly folded and inserted in pockets as appropriate.

2. Electronic Copies

- a. Submit Two (2) electronic copies of all submittal data in each hard copy provided.
- b. Quality and Format
 - i. Each electronic copy shall contain all the information provided in the hard copy, and shall be saved in PDF format with searchable word capability.
 - ii. Provide Two (2) electronic copies in each hard copy submittal.
 - iii. CONTRACTOR shall provide, upon SAWS request, additional electronic copies either on additional CDs or being e-mailed to contact persons shown in this Contract Document.

C. Drawings.

1. All mechanical and electrical components specified herein must be included to be considered a complete submittal. Drawings shall be complete with all pump and discharge base dimensions, anchor locations, location of any required electrical connections.
2. Submittal must include drawings and specifications of all accessories; including, high temperature and seal leak protection relay, access hatch, safety grate, guiderail system, brackets, cable hangers, lifting chain, pulling eye grip, etc.

D. Specifications.

1. Reference standards shall be included in all specifications for all materials, mechanical, electrical and accessories.
2. Descriptive information such as catalogs, performance data, and other product literature showing equipment meets the specified design criteria.
3. Catalog cut sheets on accessory equipment such as pressure gauges, diaphragm seals, motor high temperature and seal leak protection relay, power cables, etc.
4. Specifications of coating system to be used in equipment.

E. Installation Instruction Manual.

1. Include Manufacturer's detailed step-by-step instruction manual with drawing details for the installation of the submersible non-clog pumps. Such instructions shall include discharge base design, anchoring requirements, guiderail system, and connection of power cables and high temperature and seal leak relay.

F. Startup Instruction Manual.

1. Include detailed submersible non-clog pump startup instructions, including the sequence of actions, testing before and after pump has been installed and performance readings.

G. Operation and Maintenance Instruction Manual.

1. Complete operation and maintenance instructions and sequences for equipment, components and accessories specified in this Section, including electrical, instrumentation and mechanical, shall be included in the submittal.

H. Delivery, Storage and Handling Instructions.

1. Include Manufacturer's specific instructions for the following:
 - a. Equipment shipment, including instructions for loading and unloading of equipment.
 - b. Project site storage of equipment, handling and protection

I. Performance Data.

1. Manufacturer catalog pump curves must show the Best Efficiency Point (BEP) and the Duty Points specified in this section under Pump Performance, and also shall include all the following information; but not limited to:
 - a. Manufacturer name.
 - b. Pump model.
 - c. Pump discharge size (inch).
 - d. Impeller size.
 - e. Pump speed (RPM).
 - f. Sphere pass size.
 - g. Flow in gallons per minute.
 - h. Head in feet.
 - i. Motor rated power (HP).
 - j. Pump performance at best efficiency point (BEP).
 - k. Voltage
 - l. Phases
 - m. Frequency.
 - n. Number of poles.
 - o. Rated motor current (Amps).
 - p. Starting current (Amps).
 - q. Locked rotor kVA.
 - r. Motor efficiency at 50% 75% and 100% full load
 - s. Motor power factor at 50%, 75% and 100% full load.

- t. Pump performance curve (Flow vs Head).
 - u. Pump efficiency curve.
 - v. Pump break-horsepower curve.
 - w. Motor input horsepower curve.
 - x. NPSHre curve for specified RPM.
2. In addition to the manufacturer catalog pump curves, the pump manufacturer shall furnish individual certified pump curves for each pumping unit showing the pump model and serial number, and the complete testing results of those pumping units to be furnished. Pumps shall be tested at the duty points specified in this section under Pump Performance and shall include all the information shown hereinafter.

1.06 PUMP PERFORMANCE

- A. The submersible pumping units shall comply with all the following:
- 1. Pump discharge size: 6-inch
 - 2. Incompressible solid sphere pass: 2.9-inch or greater.
 - 3. Pump rated speed: 1775-RPM
 - 4. Motor Voltage/Phase/Frequency: 460/3/60.
 - 5. Power cable length: 50 ft.
- B. The pumping unit shall comply with the following duty points operating with the same impeller and at the same speed:
- 1. Duty Point 1:
 - a. Flow: 900 gpm with an allowable tolerance of +/- 5 gpm.
 - b. Head: 218.4 ft with an allowable tolerance of +/- 0.2 feet
 - c. Pump NPSHre: 24-feet or lower.
 - d. Pump break-horsepower: 80.4 HP or lower.
 - e. Pump efficiency: 61.9% or greater.
 - f. Motor input power: 87.1 HP or lower.
 - g. Motor efficiency: 92% or greater.
 - h. Motor Power Factor: 82% or greater.
 - i. Motor operating current: 100 Amps or lower.
 - 2. Duty Point 2:
 - a. Flow: 513 gpm with an allowable +/- 5 gpm

- b. Head: 240.6 ft with an allowable tolerance of +/- 0.2 feet
- c. Pump NPSHre: 25.1 ft or lower.
- d. Pump break-horsepower: 71.0 HP or lower.
- e. Pump efficiency: 44.0 % or greater.
- f. Motor input power: 76.8 HP or lower.
- g. Motor efficiency: 92.5 % or greater.
- h. Motor power factor: 80 % or greater.
- i. Motor operating current: 92 Amps or lower.

1.07 WARRANTY

A. General

- 1. Pump manufacturer will pay cost of parts and labor during the warranty period, provided that the pump, with cable attached, is returned prepaid to an authorized repair facility for repairs. Coverage of parts and labor will be provided for periods indicated below.
- 2. This warranty does not apply to any product or part of product which has been subjected to misuse, misapplication, accident, alteration, neglect, or physical damage and monitoring equipment has been by-passed or removed.
- 3. Warranty does not cover costs for standard and/or scheduled maintenance or parts that, by virtue of their operation, require replacement through normal wear, unless a defect in material or workmanship can be determined by manufacturer.
- 4. Warranty period shall be as follows and from the actual date of OWNER's acceptance.
 - a. 0 – 36 months warranty is 100%

PART 2. PRODUCTS

2.01 PUMPS

A. Manufacturers

- 1. Pumps shall be the product of ITT Flygt, model CP3300.181HT.
 - a. The specification for the Submersible Non-Clog Pumping Units was based on ITT Flygt. Specifically the model shown above; **however**, this does not exclude ITT Flygt to participate in the Mandatory Pre-Bid meeting and taking field information and measurements to verify the need for modifications to existing infrastructure, and to assure the heat exchangers can be installed and perform properly.
- 2. KBS.
- 3. Hydromatic.
- 4. Approved Equal.

B. Design

1. General

- a. Major pump components shall be of gray cast iron, ASTM A-48 Class 35B, with smooth surfaces devoid of blowholes and other irregularities.
- b. Exposed bolts and nuts shall be AISI type 304 stainless steel construction.
- c. All surfaces, other than stainless steel, shall be protected by a factory applied spray coating system of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior surface of the pumping unit.
- d. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Vitron rubber O-rings. Sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.
- e. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease or other devices shall be used.

2. Impeller

- a. The impeller shall be of gray cast iron, ASTM A-48 Class 35B, dynamically balanced, closed, double shrouded, non-clog design.
- b. The impeller shall be induction hardened to Rc 45, screw shaped leading edges and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater.
- c. Impeller shall be locked to the shaft and shall be coated with alkyd resin primer.

3. Volute

- a. Pump volute shall be single piece gray cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller.
- b. Minimum inlet and discharge size shall be as indicated herein.

4. Wear Ring

- a. A wear ring system shall be used to provide efficient sealing between volute and suction inlet of the impeller.
- b. The pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is driven fitted to the volute inlet.

5. Motor

- a. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. Oil filled motors are not acceptable.
- b. The submersible motor shall be FM or UL Listed for Class I, Division 1, Groups C and D, explosion-proof hazardous locations.

- c. The stator windings shall be insulated with moisture-resistant Class H insulation for 180 °C.
- d. Motor shall be inverted duty type suitable for both continuous and intermittent operation with variable frequency drives at different speeds and soft starters that feature starting and stopping ramps of up to 60 seconds.
- e. The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%.
- f. The motor shall be designed for continuous duty while handling pumped media of up to 104 °F.
- g. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of fastening devices used to hold or locate the stator and that penetrate the stator housing are not acceptable.
- h. The motor service factor shall be at least 1.15. The motor shall have a voltage tolerance of +/- 10%.
- i. The motor shall be designed for continuous duty capable of fifteen (15) evenly spaced starts per hour.
- j. The motor shall be designed for a continuous operation in up to a 40 °C ambient temperature, and shall have a NEMA Class B maximum operating temperature rise of 80 °C.
- k. The motor shall be capable of continuous operation without overheating in dry well installations and in wet well installations while the motor is totally, partially or not submerged.
- l. The motor shall be one-piece, extending through the pump and motor. Extension couplings shall not be acceptable. Shaft shall be constructed of stainless steel 431 type. Shaft sleeves shall not be acceptable.
- m. The motor shall be capable of continuous submergence under wastewater without loss of watertight integrity to a depth of 65 feet or greater.

6. Cable Entry Seal

- a. The power cable entry seal design shall preclude specific torque requirements to insure a watertight seal and shall allow simple field changing of power without affecting pump or motor warranty.
- b. The cable entry shall consist of a single cylindrical elastomeric grommet, flanked by washers, having a close tolerance fit against the cable outer diameter and the entry inner diameter, and compressed by the body containing a strain relief function, separate from the function of sealing the cable.
- c. The power cable shall be sized according to NEC and ICEA standards, and shall a length of 50 feet without splices.
- d. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber.

- e. The cable shall be capable of continuous submergence under wastewater without loss of watertight integrity to a depth of 65 feet or greater.
- f. A separate junction chamber shall be provided inside the pump for connection of power cables to stator leads. The chamber shall be sealed by a non-metallic terminal board bolted to a machined surface and utilizing an O-ring to obtain a watertight seal.

7. Cooling System

- a. The pump shall be provided with an integral closed-loop cooling system with or without cooling jacket.
- b. The coolant shall consist of a non-poisonous and an environment friendly media such as Monopropylene-Glycol.
- c. The main cooling area shall be the seal housing cover.
- d. The cooling liquid shall pass about stator housing in the closed-loop system in turbulent flow to provide superior heat transfer.

8. Mechanical Seal

- a. Pumps shall be provided with a mechanical seal system consisting of two totally independent seal assemblies operating in an oil chamber between pump volute and motor chamber for seal lubrication and cooling. The oil shall be a white paraffin based oil meeting the Standards of FDA 172.87B.
- b. The lower seal (volute side) shall act as the primary unit to prevent entry of pumped liquid to the oil chamber. It shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide rings. Silicon-carbide rings are also acceptable.
- c. The upper seal (motor side) shall act as a secondary unit to prevent pumped liquid or oil from entering the stator housing. And it shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide rings. Silicon-carbide rings are also acceptable.
- d. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.
- e. Mounting of the lower seal on the impeller hub is not acceptable.
- f. The seal system shall allow continuous pump operation with the motor exterior totally dry.
- g. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing.

9. Bearings

- a. The motor bearings shall be permanently grease lubricated with a B-10 design life of 50,000 hours at any duty point along the pump curve at maximum speed.

- b. The upper bearing shall be single row ball bearing.
- c. The lower bearing shall be a two row angular contact bearing to compensate thrust and radial forces.

2.02 MECHANICAL ACCESSORIES (NOT USED)

2.03 ELECTRICAL ACCESSORIES

A. Motor High Temperature and Seal Leak Protection Relay

- a. The pump manufacturer shall provide a pump monitoring unit for each pump supplied, which shall be mounted in the pump control panel, and shall be wired to the pump sensors.
- b. The stator shall be provided with one thermal switch in each phase winding which shall open at 125 °C (260 °F) to stop the motor and trigger an alarm.
- c. The seal chamber shall be provided with a water leak sensor to detect water intrusion in seal chamber. Seal leak sensor shall activate when the presence of water reaches about 25%. When activated, the seal leak sensor will stop the motor and trigger an alarm.
- d. Operating Principle: Current sensing.
- e. Operating Temperature: -20 to 65 °C.
- f. Supply Voltage: 120V AC.
- g. Relay Contact Rating: 10 Amperes at 120V AC.
- h. Relay Contact Arrangement:
 - i. for Motor High Temperature: Single Pole Double Throw.
 - ii. for Pump Seal Leak: Single Throw Double Throw.
- i. Indicating LED lights: One for each alarm condition.
 - i. LED light Off: under normal conditions.
 - ii. LED On: under alarm condition.

2.04 SPARE PARTS (NOT USED)

PART 3. EXECUTION

3.01 EQUIPMENT DELIVERY, HANDLING AND STORAGE

- A. The equipment shall be delivered to the following address: 4615 East Evans Road, San Antonio, Texas, 78259, which is the address of Eastside Service Center.
- B. CONTRACTOR shall protect the submersible pumps and accessories according to manufacturer recommendations.

- C. CONTRACTOR shall provide heavy equipment, tools and qualified operators to handle the submersible pumping units according to manufacturer recommendations.
- D. During the installation work is being performed, the CONTRACTOR shall protect the submersible pumping units and accessories as recommended by manufacturer.

3.02 INITIAL INSPECTION

- A. SAWS Personnel shall inspect the new submersible pumping units and related accessories to verify everything is new and free of defects as required in Quality Assurance under this Section.
 - 1. Initial inspection includes CONTRACTOR opening the submersible pumping unit container for visual inspection of pump body, verification of free rotation of impeller, and inspection of power cables.
 - 2. Opening boxes for inspection of accessories.
- B. Should evidence shows non-compliance with the Quality Assurance requirements, CONTRACTOR shall be responsible for replacing such defective items and provide with new, at no additional cost to SAWS.
- C. Once the initial inspection is passed by all SAWS personnel, the installation work shall proceed.
 - 1. SAWS personnel includes: Lift Station Maintenance, O&M Engineering and Purchasing.
- D. Provide a list of all serial numbers of each submersible pumping unit and accessories for tracking purposes. Such list shall include contact information for the respective manufacturers associated with submersible pump and each accessory part and serial number.

3.03 INSTALLATION

- A. CONTRACTOR shall be responsible for the following:
 - 1. Assure the installation, startup and testing is done according to manufacturer specifications, and that Manufacturer will grant warranty as specified in this Contract Document.
 - a. If CONTRACTOR is not certified by the manufacturer to perform the installation, startup and testing, CONTRACTOR shall provide a certified manufacturer representative to perform removal, installation, startup and testing.
 - b. Such certification shall be submitted as part of the Bid Package.
 - 2. Coordinate shutdowns, lock-out and tag-out procedures and comply with SAWS safety requirements and procedures.
 - 3. Assure existing submersible pumping unit (up to One (1) unit) is removed properly as to prevent conflicts with installation of new submersible pumping unit and accessories.
 - a. Remove up to One (1) existing submersible pumping units. Removal work includes:
 - i. Disconnect and remove of existing submersible pumping units and accessories.
 - ii. CONTRACTOR shall return to SAWS any accessory, part, component or material removed, if indicated by Lift Station Maintenance; otherwise, it will be

the responsibility of the CONTRACTOR to haul and dispose the removed items at no additional cost to SAWS.

4. Install one (1) new submersible pumping unit. Installation work includes:
 - a. Transportation to installation site, unload, test, connect and install One (1) new submersible pumping unit and accessories.
5. Account and perform for all incidental work at no additional charge to SAWS. Incidental work includes:
 - a. Work not described or accounted in this specification, but work that is necessary to accomplish removal and installation of submersible pumping units and accessories.
 - b. Specialized personnel, heavy equipment, tools, materials, parts and components needed to accomplish removal and installation work.
 - c. Safety requirements to protect personnel and equipment.
 - d. Additional work required to accomplish startup, testing and operation.
 - i. Including replacement of defective parts, components or accessories.
6. Assure the following:
 - a. The submersible pump slides gently through existing guiderail system.
 - b. The power cables are connected correctly.
 - c. Impeller rotates to correct direction.
 - d. High temperature and seal leak protection relay is installed and connected correctly on pump control panel and functions properly.
7. Startup new submersible pumping unit and verify proper flow and motor current draw.
8. Clean the working area that was affected by the removal and installation work.

3.04 SAFETY

- A. CONTRACTOR shall be responsible to coordinate all safety requirements as required by SAWS Safety Department.
- B. Should Lock-Out Tag-Out need to be performed for the installation, CONTRACTOR is responsible for coordinating with SAWS Safety, Operations and Maintenance Personnel to ensure the installation is done in a safe manner.
- C. Should any hot work be required, CONTRACTOR is responsible to provide a hot work permit application to SAWS Safety department for review and approval.
 1. Such Hot Work Permit shall be approved by SAWS 48 hours prior starting the hot work.
- D. CONTRACTOR shall assure all personnel under his direct and indirect control that is involved in the work indicated in this Section shall wear basic Personal Protective Equipment as directed by SAWS Safety Department.

3.05 STARTUP AND TESTING

- A. CONTRACTOR shall be responsible for following safety procedures and practices for the protection of the personnel performing the startup and testing so as for the protection of the equipment.
- B. Prior to installation and connection, the CONTRACTOR shall perform the following inspections, tests and measurements; including, but not limited to:
 - 1. Check every inch of the power and sensor cables for damage which could allow short circuits or water intrusion.
 - 2. Check the pump for external damage. Inspect the hardware for tightness and for damage related to rough handling.
 - 3. With the motor power cable being disconnected, check the impeller manually for free rotation.
 - 4. Check the rated power voltage system at the pump control panel and compare to rated voltage system of pump motor.
 - 5. Check the overload setting of the motor overload relay to insure it is compatible with the horsepower and current draw characteristics of the motor.
 - 6. Perform a standard ground insulation resistance test with a proper Megger. Measure resistance between phases and each phase to ground. Compare measurements with information in Operation and Maintenance manual. Measure the winding temperature at which the ground insulation resistance was performed.
 - 7. Measure the motor winding resistance and compare to the information in the Pump Operation and Maintenance Manual.
 - 8. Check continuity and resistance from the ground lead to exposed metal surfaces on the submersible pumping unit.
 - 9. Measure the panel supply voltage at the motor starter line leads.
 - 10. Measure continuity and resistance of motor sensor leads for motor high temperature and seal leak. Compare to manufacturer information in operation and maintenance manual.
- C. With the power cable connected to motor starter perform the following inspections, tests and measurements; including, but not limited to:
 - 1. Connect cable leads at junction box. Ensure all connections are tight properly and protected properly.
 - 2. Install and connect the high temperature and seal leak protection relay in pump control panel.
 - 3. Verify motor starter energizes and de-energizes manually and automatically.

4. Verify proper rotation of impeller by manually jogging the start circuit momentarily and observing the impeller rotation. If rotation is wrong, switch any two of the phase conductors. Do not switch the ground cable.
 5. Install the pump through existing guiderail system. Ensure the pump slide gently through the guiderail system and connects properly to discharge base.
 6. As pump is being lowered through the guiderails, the CONTRACTOR shall assure the power cables are gently lowered and hanged in a manner that power cables are not forced bended to prevent fatigue in insulating jacket and cable entry seal to motor housing.
 7. Install conduit seal as to prevent gases entering the electrical junction box.
 8. Place the selector switch in automatic and assure the pump operates automatically.
- D. When the pump operates manually and automatically, perform the following inspections, tests and measurements; including, but not limited to:
1. Measure the motor draw current on each phase. This must be less than the motor nameplate current. If the current exceeds the motor nameplate, stop the motor and investigate the reason for high current.
 2. Measure current imbalance.
 3. Measure voltage supply Phase-to-Phase (A-B, B-C, C-A).
 4. Measure discharge pressure at header pressure gauge (if a pressure gauge exists).
 5. Check for vibrations and noise.
 6. Check pump discharge connection seating.
 7. Compare wet well level draw rate with other existing pump of same horsepower rating.
- E. On completion of initial startup and testing, the pump manufacturer shall furnish Lift Station Maintenance with a written report with the findings and all the data measured during the startup and testing regarding to the pump, motor and pump accessories. This report shall be strictly coordinated and engaged with the startup and testing of the new pump.
- F. The startup and testing report shall be signed and dated by the pump manufacturer authorized representative. A copy of the report shall be included in the Operation and Maintenance Manual.

PART 4. MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT

- A. The equipment, material, labor, tools, delivery, transportation, specialized personnel, testing, testing devices, etc. required by this Section shall be considered subsidiary to the individual bid items provided on the Bid Proposal.

END OF SECTION 11316