**CITY OF BILOXI**

**SPECIAL PROVISION NO. 907-649-1 CODE: (SP)**

**DATE: 08/15/2017**

**SECTION 649 – SEWAGE PUMPING STATION**

**649.01 - Description.** The work covered by this section consists of furnishing all labor, equipment and materials and performing all operations in connection with the installation, rehabilitation and/or demolition of solids handling, submersible pumps, pump station, wetwell, valve vault, piping and valves per details as indicated on the plans and as specified herein. The work includes clearing, grubbing, dewatering, bedding, pipe laying, backfilling, testing, fittings, and appurtenances required for a complete installation.

**649.01.1 - Manufacturer's Experience.** It is the intention of this Specification to cover minimum acceptable quality equipment for a complete installation. The Equipment Manufacturer shall have not less than 5 successful years experience in the design, construction and operation of equipment of the type specified at a minimum of 5 different collection system entities.

The City Engineer may require evidence, in the form of operating records, from these collection system entities to substantiate any claims concerning the ability of the proposed sewage pumping equipment to perform as required.

**649.01.2 - Supplier's/Manufacturer's Services**. A supplier's and / or manufacturer's representative for the equipment specified herein shall be made available at the job site in the event of failure or other malfunction of the equipment or basin to verify the problem and take whatever action is necessary for correction thereof. The cost of this service shall be included in the pump supplier's cost.

Upon completion of pump station installation, a supplier's and/or manufacturer's representative for the equipment specified herein shall be made available at the job site for start-up, check-out, and testing of all pumps, controls, and other associated pump station equipment to the satisfaction of the Construction Manager, Owner, and the Engineer. The cost of this service shall be included in the pump supplier's cost.

**649.02 - Materials.**

**649.02.1 - Pumping System.** Contractor shall furnish all labor, materials, equipment and incidentals required to provide duplex pumping system as specified herein. The system shall consist of compatible pumps and controls so as to insure suitability and assurance in matching the equipment together. Submersible pump and motor shall be MudBug, or Owner approved equal.

System shall consist of submersible sewage pumps (solids handling), level control switches, discharge plumbing and valve vault and aluminum hatch, pump mounting support, and cord sealing plate for conduit to panel; to be installed in concrete wetwell with an aluminum access cover. Structure and dimensions shall be as shown on drawings.

Each pump shall have a pumping capacity against a total head as shown on the drawings. Pump motor shall be 60 Hertz and to the horsepower, phase, voltage, and speed as shown herein and on the drawings.

Controls shall be detailed on the plans and per **SECTION 907-650-1** Duplex Pump Control Panel.

On sump level rise lower switch shall first be energized, then upper level switch shall next energize and start lead pump. With lead pump operating, sump level shall lower to low switch turn-off setting and pump shall stop. Alternating relay shall index on stopping of pump so that lag pump will start first on next operation and become lead pump. If sump level continues to rise when lead pump is operating, override switch shall energize and start lag pump. Both lead and lag pump shall operate together until low-level switch turns off both pumps. If level continues to rise when both pumps are operating, alarm switch shall energize and signal the alarm. If one pump should fail for any reason, the second pump shall operate on the override control and if level rises above override control, alarm shall signal. All level switches shall be adjustable for level setting, from the surface.

**649.02.2 Pumps.**  Each pump shall be a non-clog submersible type, model as shown on the drawings, or an Owner approved equivalent. All openings in pump shall be large enough to pass a 3½” diameter sphere. Discharge flange shall be sized as shown on the drawings. The parts exposed to abrasive wear; case, impeller and wear-plates; shall be of all Cast Iron Class 30.

**649.02.2.1 – Impeller.** The pump impeller shall be of all Cast Iron Class 30 and recessed type. Impeller shall be dynamically balanced. Impeller shall be driven by stainless steel key, and impeller shall be held in position with lock screw and washer. Impeller and motor shall have top lift-out of case so that the assembly can be removed without disturbing any piping.

**649.02.2.2– Pump Case.** The volute case shall be of Cast Iron Class 30 and have a flanged center line discharge. Discharge flange shall be standard flange with bolt holes straddling center line.

**649.02.2.3 Pump and Motor Casting.** All castings shall be of high tensile strength cast iron. Castings shall be treated with phosphate and chromate rinse and shall be painted before machining. All machined surfaces to be exposed to sewage water shall be re-painted.

**649.02.2.4 – Painting.** The pumps shall be painted after assembly in accordance with the recommendations of the manufacturer.

**649.02.2.6 – Spare Parts.** A suggested spare parts list for pumps, drive systems, and special tools shall be furnished to the Owner by the pump supplier.

**649.02.2.7 – Pedestal Mount.**  The pump manufacturer shall provide a common pump and motor base, constructed of 3/8 inch thick, minimum thickness, fabricated steel, suitably reinforced to support the full weight of the pump and motor. The pedestal base shall include support legs of sufficient length to provide clear access to the suction port of the pump without impeding the flow of liquids and solids into the pump suction.

**649.02.3 – Motors.**  This specification details the mechanical and electrical requirements for squirrel-cage induction motors, both single and three phase, designed for wet well submersible applications in water and sewage. It is the intent of this specification to define submersible premium quality motors which will provide efficient operation with high mechanical integrity under adverse operating conditions for maximum life and minimum life cycle costs. This specification covers sewage wet well applications defined by the National Electric Code as Class 1; Division 1, hazardous locations section 501-8(a) requiring explosion proof construction.

Motors covered by this specification shall conform to the latest applicable requirements of NEMA, IEEE, ANSI and NEC standards; shall be designed for continuous submerged duty in water and sewage, and minimum 15 minute duty continuous in air under full load operating conditions. Motors shall be three (3) phase rated 230/460, volts, based upon 40°C ambient conditions. Motor construction shall be designed to withstand 200 psi water pressure at all seal locations. Motors shall be furnished with Class F rated insulation materials or better; shall be rated as Class F, 1.15 service factor, Class 1 Groups C&D. Motors will be CSA (Canadian Standards Association) and U.L. (Underwriters Laboratories) approved and name plated accordingly and shall be manufactured in the United States of America. The ability to provide any/all replacement parts, engineering design support, complete dynamometer testing, and U/L rerate capability shall be provided domestically.

**649.02.3.1 – Bearing and Lubrication.** Bearings shall be ball, single row, deep groove, Conrad type, and shall have a Class 2 internal fit conforming to AFBMA Std. 20; shall be selected to provide minimum L10 rating life of 17,500 hours. The motor shall be designed to limit the bearing temperature rise to a maximum of 60°C under full load conditions. Motors shall be greased by the manufacturer with a premium moisture resistant polyurea thickened grease containing rust inhibitors and suitable for operation over a temperature range of -25°C to +120° C.

**649.02.3.2 – Shaft Seal.** Two independently-mounted mechanical face type seals shall be provided. The inner and outer seals shall be separated by an oil filled chamber. The oil shall act as a barrier to trap moisture and provide sufficient time for a planned shutdown. The oil shall also provide lubrication to the internal seal. Standard John Crane Type 21, Sealol type 43, or Sealol type 42, U/L approved seals shall be provided. The inner seal shall be provided with carbon rotating face and ceramic stationary face. The outer seal shall be provided with a solid tungsten carbide rotating face and a silicon carbide or tungsten carbide stationary face. The outer seal construction shall be designed for easy replacement. In compliance with U/L Standards for explosion proof motors, a flame path shall be provided by a labyrinth slinger in the bottom flange in order to prevent the ignition of ambient gases. Under such conditions the seal design shall allow for pressure relief across either seal face.

**649.02.3.3 – Moisture Protection System.** Dual (2) moisture sensing probes are to be provided that extend into the oil chamber located between the outer and inner seal and used to detect the presence of moisture should the outer seal fail. The moisture protection system shall also be designed to detect water in the motor chamber and provide a warning signal prior to water levels reaching the bearing or wound stator assemblies.

**649.02.3.4 – Cap/Cable Assembly.** The power cable and cap assembly shall be designed to prevent moisture from wicking through the cable assembly even when the cable jacket has been punctured. Power and control cable entry into the lead connection chamber shall be epoxy encapsulated for positive moisture sealing. Compression type fittings or connectors shall not be considered equal. A Buna-N power and control cable grommet shall be provided in addition to the epoxy to the epoxy sealed leads.

**649.02.3.5 – Enclosure and Shaft.** The motor enclosure including: frame, end brackets, flange and cap assembly shall be cast iron, ASTM type A-48, Class 25 or better. Motor frame construction will not have fins and will be a smooth surface to prevent the clogging of solids and provide for easy cleaning. The top end bracket will include integrally cast provisions for vertical lifting capability. All mating frame fits to have rabbet joints with large overlap as well as O-ring seals for a water tight seal. O-rings shall be Buna-N (nitrile). Viton O-rings may be supplied as an option and are required for ambient conditions of 61° C and higher. Motor shaft shall be 416 stainless steel (303, 304, 410 stainless steel 17-4 PH, Carpenter 20, all types of Monel or Nitronic 50 stainless steel may be provided). All external hardware including the motor nameplate shall be made of stainless steel. Motor rotor construction shall be die cast aluminum or fabricated copper or their respective alloys. Rotors on frames 213T and above shall be keyed to shaft and rotating assembly dynamically balanced to NEMA limits per MG1-25.05. Balance weights if required, shall be secured to the rotor resistance ring or fan blades by rivets. Machine screws and nuts are prohibited. All exposed motor parts including frame, brackets, flange, and cap assembly shall receive an alkyd primer and epoxy ester finish coat of high grade paint to resist rust and corrosion.

**649.02.3.6 – Electrical.** All motors shall successfully operate under power supply variations per NEMA MG1-14.30. Motors shall be designed to limit the maximum surface temperature to NEC specifications for Division 1: Class 1, Group D, or Class 1, Group C & D for hazardous locations. All motors shall be NEMA design B. Motors shall have copper windings. Motor insulation system shall be Class F minimum, utilizing materials and insulation systems evaluated in accordance with IEEE 117 classification test. Motor leads shall be non wicking types, Class f temperature rating or better and permanently numbered for identification. Entire wound stator assembly shall receive a minimum of 2 coats of varnish applied using a dip and bake process. All motors to include 2 normally closed automatic reset thermostats connected in series and embedded in adjoining phases as required by Underwriters Laboratories for motors of 1 HP or higher. Each completed and assembled motor shall receive a routine factory test per NEMA and IEEE standards.

Each set of motor leads shall be tie wrapped and hung neatly and separate from each other and floats. Transducers shall be placed in still well. Still well shall be 2” Schedule 80 PVC, one continuous piece unless greater than 20 lf. Pipe shall rest on or near the bottom of wet well and fasten to wet well lip. Pipe is to be drilled at least every 6 inches on both side of pipe from bottom of pope up ¾ of the way to the top of the pipe with 5/16 inch holes. Terminations need to be wire to wire inside the J-Box mounted on the wet well. Do not use termination strip and pull the transducer through the J-Box all the way back to control box with on splice and only 3 feet of rolled up slack in wet well once transducer has been set to proper height.

All conduits and fittings exiting the ground or concrete are to be rigid including conduit for ground wire and security light. Only security light conduit may be switched to PVC, EMT, or carflex after reading 3’ above ground.

At least 3 conduits are to be run between control box and J-Box and wet well. All float wires are to be run in one conduit. All motor wires are to be run in one (or more) conduits and all transducer wires shall be run in a separate conduit. Pipe size chosen for each should not exceed ¾ fill of conduit capacity.

* + 1. **– Concrete Wetwell and Valve Vault.**

The concrete wetwell shall be built with precast concrete materials and accessories shown on the plans. The barrel of the wetwell shall be constructed of sections of reinforced concrete pipe conforming to ASTM 3 Specification Designation C76, Class II. Concrete for pipe shall be Type II Portland Cement with 100 percent calcareous aggregate. The diameter, height, opening and other details shall be as shown on the Plans. Joints shall be made with rubber gaskets or an approved equal. All joints shall be wrapped tightly with Infi-Shield External Gator Wrap or approved equal. The wrap shall be overlapped a minimum of six inches (6”). Each section shall have not more than two holes for the purpose of handling. These holes shall be plugged with a non-shrink grout immediately after installation and covered with a minimum 9” x 9” patch of “Gator Wrap” or approved equal.

The valve vault, concrete slab and miscellaneous concrete items shall be constructed of concrete having the minimum compressive strength required at 28 days of 3,000 pounds per square inch. Field specimens and laboratory tests shall be made in accordance with the standards of the American Society of Testing Materials. The minimum amount of water shall be used to produce a workable mix and shall not exceed 6 U.S. gallons per sack of cement.

**649.02.4.1 – Concrete Wetwell Surfacing and Lining.** Provide and apply a minimum of 120 mils. of resinous (epoxy) surfacing/lining materials to the interior of the sewage pumping station wetwell. 100% Solids Epoxy Materials shall be in accordance with the Warren Environmental System P301/S301 (WES), COR-GARD® with ½” permacast MS-10,000 mortars, Strong Seal Epoxy Topcoat System, Strong Seal Urethane Coating System, SprayWall Urethane (SprayROQ) or approved equal. Strong Seal QSR is approved for patching and MS-2-(A & C) is approved for rehab in a non-corrosive environment only. The material sprayed onto the surface of the manhole shall be a 100% solids, low odor, amine cured epoxy. Application and minimum physical standards shall be as specified in Subsection 604.03.9 – 100% Solids Epoxy Liner.

**649.02.4.2 – Covers.** Covers shall be aluminum access hatch with externally operating locking devices. Access covers shall be sized for the wet well and/or the valve vault; the covers shall be manufactured by Halliday Products, Inc., Bilco, U. S. Foundry, Inc. or an Owner approved equivalent. Locking devices and hardware shall be a non-corrosive locking bar with a stainless steel handle and hardware; said hardware shall be furnished with the access door. Design loading shall be 150 pounds per square foot, minimum.

**649.02.5 – Submittals.** A Schedule of Values, Operation and Maintenance Manuals, Installation Instructions, and Shop Drawings shall be submitted in accordance with these specifications.

The Contractor shall submit a Schedule of Values for the lump sum pump station item(s) to the City Engineer or authorized representative for review and approval within 10 days of award of contract. Once approved, the Schedule of Values will serve as the basis for monthly payments to the Contractor for this lump sum work.

The Schedule of Values shall contain a detailed breakdown, line-by-line, of the costs of the various components of any pump station work, including complete demolition, station rehabilitation and/or construction of entirely new facilities. The breakdown will include all individual labor and material line items. The breakdown of each lump sum bid item must cover the cost of construction required by the Contract Drawings and Documents for that item. The sum of the values for the construction activities associated with a particular lump sum bid item must equal the total lump sum bid amount for that item.

Shop Drawings for all pumps, drive motors and accessories shall be submitted to the Program Manager for distribution. The review and approval by the design engineer requires that the complete submittals include all make, size, style, model, capacity, weight and all other data required to show compliance with the requirements of the Plans and Specifications. The design engineers shall supply sufficient number of operating points along the pump system curve to indicate the operating condition(s) expected within the system. These should include a minimum of five (5) design points, including static head (0 gpm flow), a minimum of three (3) operating points along the system curve (static head plus headloss to yield total dynamic head), as well as the shut-off head condition. The design curves should also indicate the point at which the pump curve and the system curves intersect. This data is provided in the table below. Shop Drawings shall include performance curves of the pump unit showing capacity of pump at its motor speed or range of speeds from shut‑off heads to minimum head, recommended head and capacity range for continuous operation of the pump, pump efficiencies, brake horsepower, NPSH requirements and solids handling capabilities. Shop Drawings shall include motor data noting horsepower, voltage, current, enclosure type, NEMA design, dimensions and all other data as required to show compliance with Specification requirements. Shop Drawings shall cover all items directly associated with the pump assembly.

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| Gallons per Minute (GPM) | Total Dynamic Head (TDH) in feet |
| 0 |  |
|  |  |
|  |  |
|  |  |
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|  |
| --- |
| RPM = XXXX |

\*\*Design Engineer to fill in the table and RPM above and remove this text from final spec.\*\*

Shop Drawings for wetwell, valve vault, control panel and elevated platform (where applicable) shall also be submitted to the City Engineer or authorized representative for distribution. The review and approval by the design engineer requires that the complete submittals include all items described in the specifications and the drawings for them. Information included with these submittals shall include but not be limited to the following: wetwell and valve vault structural drawing(s), wetwell and valve vault accessories, proposed wetwell gravity sewer invert(s) and force main invert elevations based on “cut sheet” calculations of the proposed gravity sewers, control panel features, control panel drawings, control panel equipment list, control panel accessories, control panel schematics, and any additional information to ensure compliance with these specifications and the contract drawings.

Instruction manual(s) for the operation of the pump station shall be compiled by the Contactor. Two (2) operation and maintenance manuals, all clean and unused, shall be delivered to the Program Manager for distribution to the Owner. These shall be complete in every aspect and cover all pumps, motors ancillary equipment and accessories at the start-up, operation and maintenance of the pump station. Each operation and maintenance manual will include parts lists of components, complete service procedures and a troubleshooting guide.

**649.03 Construction Requirements.** All excavation and backfill for the pump station wetwell and valve vault shall be performed in accordance with MDOT Section 203 and Special Provision No. 907-203-1**.** All equipment specified under this Section shall be installed in accordance with the manufacturer’s recommendations.The pump station equipment, concrete wetwell, and concrete valve vault shall be installed in compliance with the pump station details as shown on the construction drawings.All precast concrete section work for the pump station wetwell and valve vault shall be performed in accordance with MDOT Section 604 and Special Provision No. 907-604-1.All concrete work for the concrete foundation pad of the concrete wetwell and valve vault shall be performed in accordance with MDOT Section 604 and Special Provision No.907-604-1.

**649.03.1 – Testing.**

**649.03.1.1 – Factory Testing.** The pump shall be visually inspected to confirm that it is built in accordance with the specification as to horsepower, voltage, phase and hertz.

The motor and seal housing chambers shall be hi-potted to test for moisture content and/or insulation defects.

Pump shall be allowed to run dry to check for proper rotation.

Discharge piping shall be attached; the pump submerged in water and amp readings taken in each leg to check for an imbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked with a bridge to determine if an unbalanced resistance exists. If so, the stator will be replaced and retested.

**649.03.1.2 – Field Testing.** The Contractor shall be responsible for providing water to the pump station for pump station testing.

Upon completion of pump station installation, a supplier's and/or manufacturer's representative for the equipment specified herein shall be made available at the job site for start-up, check-out, and testing of all pumps, controls, and other associated pump station equipment to the satisfaction of the Construction Manager, Owner, and the Engineer. The cost of this service shall be included in the pump supplier's cost.

**649.04 - Method of Measurement.** Measurement for sewage pumping stations, including demolition work, construction of new facilities and for pump station rehabilitation will be measured complete in place. Partial payments may be made to the Contractor based on the Schedule of Values submitted as required in Section 649.02.5. Excavation, dewatering, backfilling, thrust blocks, pipe, valves, fittings, pumps, floats, hatches, wire, stainless steel bolts/nuts/fittings, concrete slabs, “Gator Wrap”, sheathing and shoring, removal of items from the wetwell, cleaning of existing wetwell, replacement of pump station lid/top (if applicable) and any other items shown on the lift station drawings for which a separate pay item has not been provided will not be measured separately, but shall be absorbed as a part of the lump sum item of the pump station demolition, construction or rehabilitation, furnished and installed. The cost of all testing and startup shall be included in the measurement for these lump sum items. Any fence and gate removal, new fencing and gates, concrete (around the station and/or for access driveways) with limestone base course and epoxy coating of wet well shall also be included as part of the lump sum item for pump station demolition, construction or rehabilitation, furnished and installed. The limits of said work shall be as delineated on the drawings.

All equipment testing, factory and field, equipment start-up, bypass pumping, pressure testing, plugging and blocking will be considered subsidiary obligations of the Contractor and will not be measured for separate payment.

“Size II Stabilizer Aggregate” for pipe bedding, if ordered by the Construction Manager or City Engineer or his authorized representative, will be measured by volume in cubic yards in accordance with 907-304-1 or 907-203-1.

**649.05 Basis of Payment.** This work will be paid for at the contract unit price(s) of lump sum, complete in place, which shall be full compensation for completing the work. Materials or work for which a pay item is not included and are necessary to complete the work under this section shall be furnished or performed and shall be considered incidental to the completed construction.

Payment will be made under:

907-649-A: Pump Station – New Construction -per lump sum

907-649-B: Pump Station Rehabilitation -per lump sum

907-649-C: Pump Station Demolition -per lump sum