

SECTION 11200 - WASTEWATER PUMP STATION

777 Pump Station

Langan Project No.: 190085123

Page 1

SECTION 11200 - WASTEWATER PUMP STATION

PART 1 - GENERAL

1.01 THE REQUIREMENTS

- A. Contractor shall furnish all labor, materials, equipment and performance of all work necessary or incidental to furnish and install a concrete lift station and valve box, or approved equivalent. The lift station shall be a completely factory-assembled unit, requiring only minor adjustments in the field. Basin dimensions shall be as noted on the contract drawings.

1.02 REFERENCE SPECIFICATIONS, CODES AND GOVERNING STANDARDS

- A. All incidental work performed, and materials installed by the Contractor are to be in strict accordance with the latest requirements of the applicable codes and standards.

- B. Referenced Standards

ASTM A36/A36M (Latest Revision):	Standard Specification for Structural Steel.
ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A283D (Latest Revision):	Standard Specification for Structural Steel.
ASTM A536-84 (Latest Revision):	Standard Specification for Ductile Iron Castings
ASTM C 913	Specification for Precast Concrete Water and Wastewater Structures
ASTM C 920 (Latest Revision)	Specification for Elastomeric Joint Sealants
ASTM D883 (Latest Revision):	Definitions of Terms Relating to Plastics.
ASTM D2467 (Latest Revision):	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ANSI B16.1 (Latest Revision):	Standard Specification for 125 lb. Standard Flat Face Cast Iron Flanges.
ANSI B40.1 (Latest Revision):	Gauges, Pressure and Vacuum
ANSI/NEMA 250 (Latest Revision):	Enclosures for Electrical Equipment
NEC 701 (Latest Revision):	National Electric Code article 701
NEMA Std MG1 (Latest Revision):	Motors and Generators
NEMA ICS7 (Latest Revision):	Industrial Control and Systems Adjustable Speed Drives
IEC 61000 (Latest Revision):	Electromagnetic Compatibility
UL 50 (Latest Revision):	Enclosures for Electrical Equipment
UL 98 (Latest Revision):	Disconnect Switches

1.03 SHOP DRAWING REQUIREMENTS

- A. The Contractor shall provide shop drawings for the complete lift station and shall include, but not necessarily be limited to:
 - 1. Structural and opening details.
 - 2. Equipment mounting and location details.
 - 3. Manufacturer's cut sheets for each item of equipment in the lift station.

SECTION 11200 - WASTEWATER PUMP STATION

777 Pump Station

Langan Project No.: 190085123

Page 2

4. Drawings showing dimensions of all major components and minimum required spacings.
5. Complete installation instructions including piping details, mechanical connections, and wiring diagrams.
6. Performance data covering all internal mechanical components.
7. Electrical control data covering the following details:
 - a. Circuit breaker data including function, reference designator, frame size, poles, rated current, and estimated load.
 - b. Motor starter data including function, reference designator, NEMA size, service voltage, phase, number of overload heaters, and coil voltage.
 - c. A control schematic diagram shall be provided that shows power and control circuits in sufficient detail to evaluate the control system design. Control schematic shall be color coded.
 - d. A wiring diagram, panel arrangement drawings, and panel support drawings shall be provided.
 - e. SCADA.
1. Test and Evaluation Reports: Submit written report showing that factory pump inspections and that tests have been successfully performed.
2. All other information necessary to enable the Engineer to determine whether the proposed equipment meets the specified requirements.
3. The main component of the submittals shall be the drawing(s) of the complete concrete lift station prepared by the Manufacturer. Cut sheets shall indicate capacities, dimensions, and materials of construction for all equipment in the concrete lift station.

1.04 DESIGN CRITERIA

- A. All components supplied shall conform to the size requirements as set forth within this section of the specification, to the requirements included in other Sections of this specification, and as appended to this document. The design (including, but not limited to, pumps, piping, appurtenances, and products) shall be signed and sealed by a New York PE.

1.05 DELIVERY AND HANDLING

- A. The Manufacturer of the prefabricated lift station shall coordinate with the owner, the Installation Contractor, and the Engineer so that the lift station is delivered to the jobsite on time for installation. Handling instructions shall be provided by the Manufacturer to ensure proper handling of the lift station structure. After delivery to the jobsite, the control panel shall be stored off the ground in a dry location until it is mounted and supplied with electrical service. All pump power and control cables, as well as float cables shall be protected from submergence until they are properly installed and sealed.

PART 2 - PRODUCTS**2.01 PUMPING STATION**

- A. Configuration: Duplex (see drawing)
- B. Assembly: Shop
- C. Basin Material: Concrete
- D. Pump type: Submersible non-clog

2.02 CONCRETE WET WELL

SECTION 11200 - WASTEWATER PUMP STATION

777 Pump Station

Langan Project No.: 190085123

Page 3

- A. Wet Well Wall: The wet well wall must be designed to withstand wall collapse or buckling based on the following assumptions and third-party specifications:
- B. Hydrostatic Loading of 62.4 lbs. per cubic foot
- C. Saturated soil weight of 120 lbs. per cubic foot
- D. Soil Modulus of 700 lbs. per square foot
- E. Pipe stiffness values as specified in ASTM D3753
- F. The wet well must be constructed to withstand or exceed two times the assumed loading on any depth of the wet well.

2.03 WET WELL APPURTENANCES

- A. Float Bracket shall be fabricated from 300 series stainless steel with four compression style cord grips to maintain float level position. It shall be factory installed with at least 0.375 inches in diameter 300 series stainless steel fasteners. The wet well wall penetrations shall be sealed with silicone sealer.
- B. The slide rail assembly shall include pump quick disconnect discharge elbow, sealing flange with rail guide, upper guiderail bracket, lifting cable and guiderails.
 - 1. The pump quick disconnect (QDC) discharge elbow, made of cast iron, designed to mount directly on the wet well floor, shall be supplied for each pump. It shall have a standard ANSI B16.1 125 lb. flange, flat faced and drilled on the discharge side, with a machined mating pump connection. The design shall be such that connection between the pump and QDC is made without the need for any nuts, bolts or gaskets.
 - 2. The sealing flange with rail guide shall be mounted on each pump discharge. It shall have a machined mating flange, which matches the QDC discharge elbow. Sealing of this pump and discharge piping connection shall be accomplished by a simple linear downward motion of the pump along the guiderails culminating with the entire weight of the pumping unit supported by the QDC discharge elbow.
 - 3. The upper guiderail bracket, made from 304 Stainless steel, shall align and support the two guiderails at the top of the wet well. It shall bolt directly to the hatch frame (or aluminum upper guiderail bracket in wet wells) and incorporate a beveled stainless-steel insert for secure rail installation.
 - 4. The lifting cable shall be 300 series stainless steel with a diameter of at least 3/16" and a nominal breaking strength of at least 2500 pounds.
 - 5. The guiderails shall be 1 inch schedule 40 stainless steel pipe. There shall be two guiderails per pump to insure proper alignment with the QDC discharge elbow and stationary piping.
- C. The valve box system shall include two Check Valves and two Gate Valves as sized per plans. Emergency flushing connection and associated elbows, tees, and reducers as shown on the plans. All material in the valve shall be of like material as much as possible and/or suited for the appropriate use.
- D. The access hatch shall have a recessed handle and locking pin. The hatch shall be held open in the vertical position by means of a hold open arm of corrosion resistant design. The cover shall be mounted to the wet well with a least six 300 series stainless steel fasteners of at least 0.375 inches in diameter.
- E. All piping internal to the lift station shall be DIP class 53 and shall be installed prior to delivery by the Manufacturer.

2.04 SUBMERSIBLE PUMPS

- A. SCOPE

SECTION 11200 - WASTEWATER PUMP STATION

777 Pump Station

Langan Project No.: 190085123

Page 4

These specifications cover the design, performance and installation of submersible pumps intended for wet well applications. The pump assembly, including the liquid end and motor shall be of the design and production of only one manufacturer, and shall be in full compliance with these specifications.

B. GENERAL CONDITIONS

Furnish and install two (2) heavy duty Electric Submersible centrifugal non-clog Pump(s), designed for handling raw, wastewater and suitable for wet well.

C. PERFORMANCE AND DESIGN REQUIREMENTS

1. Furnish and install two (2) submersible wastewater non-clog pump(s).
2. Each pump shall be equipped with an 30 HP, submersible electric motor connected for operation on 460 volts, 3-three phase, 60 hertz, 4 wire service, with 50 feet of submersible cable (SUBCAB) suitable for submersible pump applications.
3. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval.
4. The pump shall be supplied with a grey cast iron 4-inch discharge connection and be capable of delivering 585.82 GPM at 121.48 TDH (60% efficiency).
5. Minimum Shut off head: 122 feet.
6. Each pump shall be fitted with 3/16" lifting chain or stainless-steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.
7. Manufacturer: Flygt, Inc or approved equal.

D. PUMP DESIGN CONFIGURATION AND CONSTRUCTION

1. The pump shall be supplied with a cast iron 4-inch discharge connection.
2. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection.
3. There shall be no need for personnel to enter the wet-well.
4. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact.
5. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.
6. No portion of the pump shall bear directly on the sump floor.
7. Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
8. Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile rubber O-rings. Fittings 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.
9. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

E. COOLING SYSTEM

Motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required.

F. ELECTRIC MOTOR

1. 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.
2. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). 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%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.
3. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 30 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The motor and pump shall be designed and manufactured by the same manufacturer.
4. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.
5. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

G. ELECTRICAL CABLE

1. Length: 50 feet.
2. Furnish single cylindrical elastomer grommet for sealing and strain relief.
3. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

H. MECHANICAL SEALS

1. Design: Tandem mechanical, oil-filled reservoir.
2. Materials:
 - a. Rotating Faces: tungsten-carbide
 - b. Stationary Faces: tungsten-carbide
 - c. The following seal types shall not be considered acceptable or equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a

SECTION 11200 - WASTEWATER PUMP STATION

777 Pump Station

Langan Project No.: 190085123

Page 6

common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

- d. The motor shall be able to operate dry without damage while pumping under load.
- e. Seal lubricant shall be FDA Approved, non-toxic, non-hazardous.

I. BEARINGS

- 1. Design: Two bearings, upper single and lower two row, ball.
- 2. Comply with ABMA 9.
- 3. Lubrication: Oil.
- 4. Load: Radial.
- 5. Minimum L-10 Life: 50,000 hours.
- 6. Sleeve or Single row lower bearings are not acceptable.

J. PUMP SHAFT

- 1. Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T.
- 2. Shaft sleeves will not be acceptable.

K. IMPELLER (ADAPTIVE)

- 1. The impeller(s) shall be of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron), dynamically balanced, semi-open, multi-vane, back-swept, non-clog design.
- 2. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on a replaceable insert ring.
- 3. The impeller shall have vanes hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater.
- 4. The screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater.
- 5. The impeller shall be capable of momentarily moving axially upwards a distance of 15mm/0.6-in. to allow larger debris to pass through and immediately return to normal operating position.

L. VOLUTE/SUCTION COVER

- 1. The pump volute shall be a single piece grey cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller.
- 2. Minimum inlet and discharge size shall be as specified.
- 3. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s).
- 4. The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed.
- 5. The insert ring shall be cast of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron) and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

M. PROTECTION

SECTION 11200 - WASTEWATER PUMP STATION

777 Pump Station

Langan Project No.: 190085123

Page 7

1. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125°C (260°F) the thermal switches shall open, stop the motor and activate an alarm.
2. A leakage sensor shall be available as an option to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will send an alarm and, if desired, stop the motor. **USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED.**
3. The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS is designed to be mounted in any control panel.

N. EXPLOSION-PROOF PUMPS

1. The pump system including the pump, motor and power cable shall be approved for use in areas classified as hazardous locations in accordance with the NEC Class I, Div. 1, Group C and D service as determined and approved by a U.S. nationally recognized testing laboratory (U.L., FM, CSA) at the time of the bidding of the project.
2. As required by Factory Mutual (FM) the motor shall be capable of operating in pumped media up to **104 DEGREES F.**
3. Motor thermal switches shall monitor and protect the motor from excessive temperature.
4. An internal Float Switch shall be available, in the motor chamber.
5. Service of explosion-proof submersible units shall be performed by qualified FM experienced personnel.
6. The pump manufacturer must provide training schools to qualify personnel in the proper service and repair of explosion-proof pumps.

2.05 CONTROLS

- A. All provided wiring, including signal wire and control wire, shall be a minimum length of 30 ft. Splices are not acceptable.
- B. The float switches shall be provided by the Manufacturer and installed and wired by the Contractor. The float switches shall be individually suspended in the wet well with weight kits. The float switch cables shall be suspended from a float bracket mounted to the top of the wet well. A sufficient length of cable shall be provided to avoid the need for splices.
- C. The Control Panel shall operate the pumps by 4 Mechanical float switches (provided by the Manufacturer) with the following sequence of operation: Pumps off, Lead pump on, Lag pump on, and High-Level alarm. Additional features in the panel shall include the following;
 1. Weatherproof Audible/Visual alarm
 2. SCADA control.
 3. Intrinsically Safe relays
 4. Motor over Temperature Protection circuitry
 5. Pump Running lights and alarm indicator lights on the outer door.
 6. Nema 12 painted steel wall enclosure with 3Pt. pad-lockable handle.
 7. Main multi9 circuit breaker.
 8. 24VDC uninterruptible power supply with battery backup.
 9. Mini-Cas SF/HT modules by GAF or equal, installed outer door mounted.
 10. 30mm LED push-to-test pilot lights and Non-illuminated switches, outer door mounted
 11. Inner door swing panel

SECTION 11200 - WASTEWATER PUMP STATION

777 Pump Station

Langan Project No.: 190085123

Page 8

12. Incoming power block
13. Motor circuit breakers
14. IEC rated motor starters w/adjustable overloads
15. Control transformer w/primary circuit breaker
16. Hand/Off /Auto (HOA) Switch, alarm on off test, & alarm silence)
17. Required control relays
18. U.L. 698A Listing—Total fault current rating will be 5KAIC
19. Aux. dry alarm contacts
20. Terminal blocks & ground lugs as required
21. Wire trough w/cap
22. Engraved labels
 - a. Control and Alarm fuses
 - b. Alarm piezo w/silence circuitry
- D. A thermal magnetic circuit breaker shall be properly sized to protect the control circuit conductors, motor starter and the motor against overcurrent due to short circuit or grounds.
- E. Motor starters shall be provided for each of the pumps.
- F. An alternator shall operate the pumps in a First-on/First-off (FOFO) sequence and can be configured to sequence the pumps every start, or operate a specific pump first every cycle.

2.06 SCADA CONTROL

- A. The lift station controller shall be supplied with a cellular modem and connected to a full featured web hosted Supervisory Control and Data Acquisition (SCADA) system allowing real-time monitoring and override control of the lift station.
- B. The system shall allow secure operator connection and access to the lift station controller using internet accessible devices and license supporting an unlimited number of simultaneous users.
- C. The system shall provide a dynamic graphic representation of the lift station system, viewing and adjustment of system parameters (Setpoints-Operators/override control), alarming, alarm logging, alarm notification via text (SMS), E-mail, and voice messaging, real-time and historical trending, historical data logging and storage, reports for equipment-level-flow and secure remote accessibility. The most recent 2 years of lift station data shall be available.
- D. The SCADA system shall be self-configuring based on the configuration of the LSC controller.
- E. Controller:
 1. The Lift Station Controller (LSC) shall be a PC3000XC Controller as manufactured by GAF or equal.
 2. The Lift Station Controller (LSC) shall be an off-the-shelf, preprogrammed, dedicated to the application, microprocessor-based controller capable of monitoring process variable inputs and automatically control one to three constant speed or variable speed pumps or can be configured for monitoring only purposes.
 3. The LSC shall be provided with a battery back-up system allowing operation of controller and any loop powered sensors to continue to operate for a **minimum of 4 hours** during a 120 Volt service power interruption.
 4. The LSC shall have a built-in **replaceable** battery system to keep volatile memory active for approximately 10 years.
 5. The LSC shall come standard with herein specified predefined inputs and outputs having a total I/O compliment:

SECTION 11200 - WASTEWATER PUMP STATION

777 Pump Station

Langan Project No.: 190085123

Page 9

- a. As a minimum, in its base configuration, the controller shall be capable of accepting the following input status signals:
 - 1) Pump 1 & 2 Running
 - 2) Pump 1 & 2 HOA In Auto
 - 3) Pump 1 & 2 Seal Failure
 - 4) Pump 1 & 2 Overtemp
 - 5) Pump 1 & 2 Overload
 - 6) Backup Active
 - 7) High Level Float
 - 8) Low Level Float (shall be configurable for NO or NC)
 - 9) Control Power Failure (shall be configurable for NO or NC)
 - 10) Generator Running
 - 11) Phase Failure (shall be configurable to disable pumps)
 - 12) Station Intrusion
 - 13) Flow Pulse
 - b. As a minimum, in its base configuration, the controller shall be capable of providing the following output status signals:
 - 1) Pump 1 & 2 Call
 - 2) Pump 1 & 2 Failure
 - 3) Pump 1 & 2 Pump Fault Reset
 - 4) Common Alarm (from power monitor, surge protection device, 24V power supply, SCADA, PLC)
 - 5) Alarm Horn
 - 6) Alarm Horn Silence
 - 7) Backup Reset
 - 8) High Level Alarm
 - 9) Low Level Alarm
 - c. As a minimum, in its base configuration, the controller shall be capable of monitoring the following (4-20 mA) process signals:
 - 1) Wet Well Level
 - 2) Station Flow
6. The LSC shall be capable of operating pumps in an AUTO or MANUAL mode. In automatic mode, a built-in alternator shall be available to equalize motor starts, stops and run time. The alternator shall have the capability of being put into fixed sequence mode at any time. Alternation shall also have the capability to alternate cyclically or following an adjustable period of time.
 7. Communications protocol shall be configured based on MODBUS RTU open standard protocol.
 8. When enabled, this communication feature shall allow the controller to communicate over optional telemetry equipment including: Phone Line, VHF/UHF/900/Spread Spectrum, Satellite Radio, Fiber Optic and Cellular communication mediums.
 9. A CAN port shall be provided to interface with optional CAN-based remote I/O.

10. The LSC shall have built-in diagnostics allowing for on-site troubleshooting of equipment without the need for a Laptop, special programs or specialized training. Diagnostics shall be viewable from the front of the display. The following minimum set of diagnostics shall be available via a self-test command:
 - a. Run and OK status
 - b. Network Status and Usage
 - c. Average Logic Scan rate
 - d. Application Memory Usage
 - e. Loaded Firmware Versions
 - f. Loaded Protocols
 - g. Removable media access
11. The LSC shall be compliant with CE, UL, UL-C and for use in applications requiring Class 1, Division 1 - A, B, C & D classifications.
12. The operator interface shall display the current level in feet and represent the level in bar graph form, which dynamically updates based on the level in the wet well.
13. An active/dynamic graphical representation of each pump and its status shall be displayed on the same screen along with flow in gallons per minute.
14. Pump graphic shall change state to indicate – “Off”, “Called”, “Running”, and “Failed/Out of Service.”
15. The operator interface shall have a display area not less than 3.5” with 160 x 128 pixel resolution and be UL rated for NEMA Type 1, 3R, 12, 4 & 4X environments.
16. The front panel shall be manufactured from a UV resistant polyester substrate.

2.07 POWER SUPPLY AND WIRING

- A. The incoming service shall be 460 volt, 4 wire, 3 phase, 60 cycle.
- B. All wiring shall be minimum 600-volt (UL) type MTW or AWM and have a current carrying capacity of not less than 125% of the full load current.
- C. The conductors shall be in complete conformity with the National Electric Code, state, local and NEMA electrical standards.
- D. To ensure the safety of all personal working with this equipment, as well as providing a simple means of tracing wires when troubleshooting, all wiring shall be color-coded in strict accordance with the wiring diagrams furnished by the equipment supplier.

2.08 OPEN-CHANNEL GRINDER

- A. Type: Wall mounted, twin shaft.
- B. Connect with the manhole channel by sliding down two AISI 304 stainless steel rails mounted inside the manhole.
- C. Operates submerged.
- D. Electrical Characteristics: See manufacturers recommendations.
- E. Materials:
 1. Casting: Ductile Iron
 2. Cutters: Hardened alloy steel
 3. Shafts: Hardened alloy steel, 2-inch hexagonal heat treated, AISI 4140, tensile strength rating no less than 170,000 psi.
- F. Drive:

1. Reducer:
 - a. grease lubricated cycloidal design Cyclo Series 6000,
 - b. reduction shall be 29:1
 2. Motor:
 - a. IP68 Submersible, 5HP (4 KW), 230/460V 3 Phase;
 - b. service factor shall be 1.15 with NEMA premium efficiency standards;
 - c. explosion-proof motor rated for Division 1, Class 1, Group D and Class 1, Group C&D;
 - d. with 50 ft cable;
 - e. contain moisture-resistant class F 155EC/311EF insulation;
 - f. with Squirrel cage induction;
 - g. NEMA design B for continuous operation.
 3. Motor shaft: AISI 416 stainless steel.
- G. Channel frames, guide rail system shall be made of AISI 304 stainless steel.
- H. Motor Controllers:
1. Enclosures shall be NEMA 4X Fiberglass, suitable for wall mounting.
 2. Doors shall have hinges and corrosion resistant latches.
 3. Enclosure shall house the control devices, relays, terminal blocks, and grinder reversing motor starter.

2.09 FLOWMETER

A. Flow Sensor Build Requirements:

1. The electromagnetic flow measurement sensor shall consist of ANSI 150 psi. corrosion resistant painted carbon steel flanged flow sensor which uses Faraday's law of electromagnetic induction from DC pulsation on built-in magnetic field generating coils located on the outside of the corrosion resistant painted flow tube and enclosed in a fully welded watertight corrosion resistant painted coil housing.
2. The flow tube shall not contain any constrictions, other than for electrodes, on its interior that reduce the full bore diameter more than ¼ inch.
3. The sensor flow tube shall be produced from 304 stainless steel pipe, 316L stainless steel electrodes and a vulcanized hard rubber liner for compatibility with sludge.
4. Flow Sensor shall be factory calibrated in an NIST traceable wet flow calibration facility and wet tested to deliver $\pm 0.25\%$ reading accuracy for sizes from ¼ inch up to 12 inch diameters, and $\pm 0.5\%$ reading accuracy up from 14 inch to 20 inch diameters, $\pm 1\%$ reading accuracy from 24 inch to 40 inch diameters, and $\pm 2\%$ reading accuracy in sizes above 40 inches diameter. Accuracies will be NIST Traceable and a test certificate with 2 calibration test point results shall be provided.
5. Flow Sensor Operating Temperature shall be: Media Temperature -25°C to 110°C (-13°F to +230°F), Ambient Temperature -30°C to 80°C (-22°F to + 176°F).

PART 3 - EXECUTION

3.01 COORDINATION

SECTION 11200 - WASTEWATER PUMP STATION

777 Pump Station

Langan Project No.: 190085123

Page 12

The furnishing of a complete pre-fabricated pump station and delivering pumping station to the site of its installation. The Manufacturer is additionally responsible for installation and commissioning services as detailed in the below section.

3.02 INSTALLATION

- A. The Manufacturer shall prepare and submit three (3) copies of a complete operations and maintenance (O&M) manual for the complete lift station. The O&M manual shall include routine maintenance requirements and spare parts lists for each major item of equipment in the lift station. The names and telephone numbers of companies where spare parts and/or trained service technicians are available shall also be included for each item of equipment.
- B. Installation of the equipment shall be done in accordance with the written instructions provided in the manual as specified.
- C. Installation of the Pump Station shall be per MANUFACTURER's recommendations and requirements.
- D. The CONTRACTOR shall be responsible for handling ground water to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding.
- E. Remove packing material. User instructions MUST be given to the OWNER. Hardware supplied with the unit, if required, will be used at installation. The basin will be supplied with an 8" composite hub for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled or laid on its side for any reason.
- F. Installation shall be accomplished so that 1" to 4" of access way, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavated hole must be large enough to allow for the concrete anchor.
- G. A 6" inch (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8" or more than 3/4" shall be used as bedding material under each unit.
- H. A concrete anti-flotation collar, as detailed and sized on the drawings, shall be required and shall be pre-cast to the pump station or poured in place. Each pump station with its pre-cast anti-flotation collar shall have a minimum of three lifting eyes for loading and unloading purposes.
- I. If the concrete is poured in place, the unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 12" sleeve is required over the inlet prior to the concrete being poured.
- J. The electrical enclosure shall be furnished, installed and wired to the pump station by the CONTRACTOR. An alarm device is required on every installation, there shall be NO EXCEPTIONS. Alarm panel shall be located per the contract drawings.
- K. The CONTRACTOR shall mount the alarm device in a conspicuous location, as per national and local codes. The alarm panel will be connected to the pump station by a length of pump cable as shown on the contract drawings. The power and alarm circuits must be on separate power circuits. The pump stations will be provided with 50 feet of useable, electrical supply cable to connect the pump to the alarm panel.
- L. The Manufacturer shall provide the services of a factory-trained representative to provide guidance during installation, to start-up the equipment, and to instruct the Company's operating personnel in the operation and maintenance of the equipment provided.
- M. The contractor shall be responsible for wiring the pumps, floats, and sensors to the junction box and control panel and properly sealing conduits in accordance with NEC requirements to prevent atmosphere from classified areas (i.e., from wet well) from entering the control panel.

SECTION 11200 - WASTEWATER PUMP STATION

777 Pump Station

Langan Project No.: 190085123

Page 13

- N. See Section 260533.13 for conduit material requirements and installation.
- O. During start-up and commissioning, the contractor is responsible for providing clean water, pressure gauges, hoses, and all other equipment and/or material necessary for the startup and testing of the Pumping Station.

3.03 BACKFILL REQUIREMENTS

- A. Proper backfill is essential to the long-term reliability of any underground structure. Several methods of backfill are available to produce favorable results with different native soil conditions. The most highly recommended method of backfilling is to surround the unit to grade using Class I or Class II backfill material as defined in ASTM 2321. Class 1A and Class 1B are recommended where frost heave is a concern; Class 1B is a better choice when the native soil is sand or if a high, fluctuating water table is expected. Class 1, angular crushed stone, offers an added benefit in that it doesn't need to be compacted.
- B. Class II, naturally rounded stone, may require more compactive effort, or tamping, to achieve the proper density. If the native soil condition consists of clean compactible soil, with less than 12% fines, free of ice, rocks, roots and organic material, it may be an acceptable backfill. Soil must be compacted in lifts not to exceed one foot to reach a final Proctor Density of between 85% and 90%. Heavy, non-compactible clays and silts are not suitable backfill for this or any underground structure such as inlet or discharge lines.
- C. Another option is the use of a flowable fill (i.e., low slump concrete). This is particularly attractive when installing pump stations in augured holes where tight clearances make it difficult to assure proper backfilling and compaction with dry materials. Flowable fills should not be dropped more than four feet from the discharge to the bottom of the hole to avoid separation of the constituent materials.
- D. Backfill of clean, native earth, free of rocks, roots, and foreign objects, shall be thoroughly compacted in lifts not exceeding 12" to a final Proctor Density of not less than 85%. Improper backfilling may result in damaged access ways. The pump station shall be installed at a minimum depth from grade to the top of the 1 1/4" discharge line, to assure maximum frost protection. The finish grade line shall be 1" to 4" below the bottom of the lid, and final grade shall slope away from the pump station.
- E. All restoration will be the responsibility of the CONTRACTOR. The properties shall be restored to their original condition in all respects, including, but not limited to, curb and sidewalk replacement, landscaping, loaming and seeding, and restoration of the traveled ways, as directed by the ENGINEER and/or OWNER.

3.04 START-UP AND FIELD TESTING

- A. The MANUFACTURER shall provide the services of qualified factory trained technician who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the OWNER'S personnel in the operation and maintenance of the equipment before the stations are accepted by the OWNER.
- B. CONTRACTOR is responsible for all equipment and materials necessary to perform testing. This includes, as a minimum, a portable generator and power cable, water in each basin (filled to a depth sufficient to verify the high-level alarm is operating), and opening of all valves in the system. These steps shall be completed prior to the qualified factory trained technician arrival on site.
- C. Upon completion of the installation, the authorized factory technician will perform the following test:
 - 1. Make certain the discharge shut-off valve in the station is fully open.
 - 2. Turn ON the alarm power circuit and verify the alarm is functioning properly.

SECTION 11200 - WASTEWATER PUMP STATION*777 Pump Station**Langan Project No.: 190085123**Page 14*

3. Turn ON the pump power circuit. Initiate the pump operation to verify automatic "on/off" controls are operative. The pump should immediately turn ON.
4. Consult the Manufacturer's Service Manual for detailed start-up procedures.
- D. Upon completion of the start-up and testing, the MANUFACTURER shall submit to the ENGINEER the start-up authorization form describing the results of the tests. Final acceptance of the system will not occur until authorization forms have been received and any installation deficiencies corrected.
- E. Test pump controller for all features and functions; including all alarm points, all controls, and all operational modes. Alarms and controls that are routed through the SCADA RTU must also be tested at the factory.

PART 4 – OPERATION AND MAINTENANCE**4.01 MANUALS**

- A. The MANUFACTURER shall supply four copies of Operation and Maintenance Manuals to the OWNER, and one copy of the same to the ENGINEER.

4.02 WARRANTY

- A. All items contained within this section shall be warrantied for 1 year from date of delivery.

END OF SECTION 11200