

12.01 SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all parts, labor, materials and appliances and performing all operations for the installation of _____ submersible sewage pumping station(s), the details of which are shown on the Standard Plans.

12.02 GENERAL

The Contractor shall furnish a duplex heavy duty submersible non-clog sewage pumping system as manufactured by Hydr-O-Matic, Flygt, or an approved equal. The principal items of equipment shall include submersible, motor driven, nonclog sewage pumps, valves, internal piping, central control panels with circuit breakers, motor starters, liquid level control with explosion proof relays, all internal and external wiring, alarm controls, concrete wet well, concrete pad and electric service as hereinafter specified. All pumping stations furnished shall be of the same manufacturer. Backfilling around pumping stations shall be in accordance with these specifications.

12.03 SUBMERSIBLE SEWAGE PUMPS

Each pump shall be motor driven, heavy duty, ball bearing, non-clog sewage and trash pump. All openings must be large enough to permit the passage of a sphere of three inches in diameter.

Pumps furnished shall be so designed to accommodate a larger impeller in order to meet the future pumping condition indicated. Two pump impellers shall be furnished, one shall enable the pump to meet the initial condition and one to meet the future pumping condition. The pump casing, pump and motor shaft, conduit, wiring and controls shall be sized to meet the future condition. The pump motors shall be designed to be non-overloading throughout the entire pump range for the future pumping condition.

Each pump shall have the necessary characteristics and be properly selected to perform under the following conditions:

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Initial Condition Pump Station #

Pump Capacity (GPM)	_____
Total Dynamic Head (Ft.)	_____
Pump Speed (RPM)	_____
Minimum Pump Efficiency (%)	_____

Future Condition

Pump Capacity (GPM)	_____
Total Dynamic Head (Ft.)	_____
Pump Speed (RPM)	_____
Minimum Pump Efficiency (%)	_____
Minimum Horsepower	_____
Maximum Horsepower	_____
Motor Voltage	____ V ____/

Note: If the pump horsepower proposed by Contractor is greater than the maximum specified, then the cost to increase the electrical system of the pump station shall be borne by the Contractor.

A. Impeller

The impeller is to be corrosion resistant and of the enclosed type. The impeller is to be made of close-grained cast iron and be dynamically and hydraulically balanced before assembling in the pump. A wear ring shall be installed at the inlet of the pump to provide protection against wear to the impeller.

B. Casing

The casing shall be made of high strength cast iron and shall be large enough at all points to pass any size of solid which can pass through the impeller. Wear rings shall be installed.

C. Shaft

The pump shaft shall be constructed of solid 31655 or 17-4 PH (high grade stainless steel). Shaft sleeves are not acceptable.

D. Seals

Each pump shall be provided with a tandem double mechanical seal. The seals shall require neither maintenance nor adjustment and shall be easily replaceable. The lower mechanical seal shall be protected by a minimal shaft over-hang and pressure reducing vanes on the back of the impeller.

E. Base

The volute casing shall have feet to support the impeller entrance the proper distance above the bottom of the wet well unless otherwise approved by the Design Engineer.

F. Finish

The pump shall have a painted or enamel finish as standard with the manufacturer.

G. Nameplates

Each pump shall have a standard nameplate securely affixed thereto in a conspicuous place and also mounted in the electrical panel showing the serial number and the name of the manufacturer. In addition, the nameplate for each pump shall show the model or figure number, the capacity in gallons per minute at rates of speed in revolutions per minute and total dynamic head in feet. Care shall be taken to be legible at all times.

H. Guiding Rail Connection System

A guiding bracket shall be an integral part of the pump itself. This bracket will slide along a guide rail(s). The guide rails will be furnished and shall be of standard weight Sch 40 stainless steel pipe. The pump shall have a machined connecting flange which will connect to a discharge flange mounted on the wet well floor. Sealing of the connecting flange to the discharge flange is to be accomplished by a guided downward motion, without the use of nuts or bolts. Guiding rail connection system shall allow pump removal and replacement without personnel entering or dewatering the wet well or disconnecting any piping in the wet well. Individual pump and motor removal shall not interfere with continued operation of remaining pump(s).

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I. Motor

The pump motor shall be housed in an oil or air filled, watertight casing and shall have Class F insulated squirrel cage windings. Pump motors shall have a cooling system capable to allow for continuous operation in even non-submerged condition. The pump should be able to run dry under full load continuously for extended periods of time without damage.

The motor cable shall be properly sealed at its entry into the motor so as to allow no moisture into the motor housing. The pump motor shall be capable of at least 10 starts per hour on the average. The pump motor shall be supplied with a moisture sensing device capable of relaying its signal to the control panel. The pump motors and power supply must be explosion proof and suitable for use in NEC—Class 1, Division 1, Group D locations.

J. Tools

For the pumps, special tools necessary for maintenance and repair of pumps shall be furnished by the Contractor.

K. Pump Characteristic Curves

Pump characteristic curves shall be furnished showing capacities, heads, efficiencies, and brake horsepower throughout the entire range of pumping. These shall be submitted as part of the shop drawing submitted to the Design Engineer.

L. Spare Pump and Motor

The Contractor shall supply one pump and one motor in addition to the two supplied for the installation into the wet well for each pumping station.

The pump and motor shall be the same make, model, and size as those supplied for installation into the wet well for each pumping station.

12.04 WET WELL

A. General

A concrete wet well shall be built in conjunction with each pump station as shown on the plans.

B. Pre-cast Concrete Units

The wet well structure shall be made of pre-cast reinforced concrete pipe of the size shown on the plans and shall conform to ASTM C-76, Class 2. Joints shall be of the rubber "O-Ring" design and provide integral (one piece) pre-cast bottom section.

C. Sanitary Sewer Wetwell Waterproofing

The Contractor shall apply a waterproofing system to the inside and outside of the concrete wet well. The material to be used for this operation shall be as specified in these specifications.

The waterproofing system shall be applied and allowed to dry in accordance with the manufacturer's directions. All steps, lids, frames and castings and sewer pipe entering or leaving the wet well shall be protected during application to prevent their being coated.

Interior Waterproofing

If any leaks in the wet well walls are detected twenty-four (24) hours after application of the first coat of the waterproofing system, they shall be sealed by application of a quick-set sealer. This sealer shall be a mixture of Portland Cement - Type One and "Ipanex R", "Waterplug" or equal. The quick-set sealer shall be applied in accordance with the manufacturer's directions. After the patched areas dry, they shall be covered with another coat of the waterproofing and allowed to dry. If any leaks are apparent after that time, the Contractor shall repatch them. The above steps shall be repeated until all leaks are sealed.

After all leaks are stopped and there are no leaks apparent after twenty-four (24) hours upon application of the first coat of the waterproofing system or twelve (12) hours after application of a patch, the Contractor shall apply over the dry surface a finish coat.

Exterior Waterproofing

The exterior surfaces of the wet well shall be thoroughly covered with mastic at a rate of one (1) gallon per twenty-five (25) square feet. The exterior surfaces shall be thoroughly cleaned before application of the mastic. The mastic shall be as specified in Section 7.02 A2 of these specifications.

D. Waterstops

A waterstop shall be installed in the wall of the wet well for all piping connections. This includes inlet sewer piping and outlet discharge piping. The waterstops shall be a Kor-N-Seal as manufactured by National Pollution Control Systems or equal.

E. Vents

The intake and outlet vents shall be cast iron or ductile iron pipe constructed as detailed on the plans.

F. Electrical

The electrical components of the wet well level control and alarm system shall be 24 volts, corrosion proof, water proof and explosion proof.

12.05 PUMPING STATION PIPING, VALVES AND FITTINGS

A. The piping shall conform to the sizes and configurations shown on the plans and the following materials specifications.

1. Cast Iron Fittings

Cast iron fittings shall be designed in accordance with the standards set forth in ASA Specifications A21.2, A21.6, A21.8 or to Federal Specification WW-P-421.a. The pipe shall be designed to withstand a minimum working pressure of 150 psi and a minimum hydrostatic test pressure of 300 psi. The pipe shall also be designed for a laying depth of six feet.

2. Ductile Iron Pipe and Fittings

Ductile iron pipe shall be in accordance with the latest revision of ASA Specifications A21.50 and A21.51. The pipe and fittings shall be designed to withstand a minimum working pressure of 150 psi and a minimum hydrostatic test pressure of 300 psi.

3. Galvanized Steel Pipe

Galvanized steel pipe shall meet the requirements of ASTM Specification A120. Standard weight galvanized pipe and standard weight malleable iron fittings or American Standard 125 pound cast iron fittings shall be furnished unless otherwise specified.

4. Valves

The specification for gate valves, knife valves, plug valves, ball valves, butterfly valves, pinch valves and standard check valves is located under Section 8, Forcemains.

5. Valve Operators and Valve Boxes

The specification for valve operators and boxes is located under Section 8, Forcemains.

6. Pipe Supports

Pipe supports shall be used to support all piping and valves. Pipe supports shall be of the adjustable type designed to support cast iron pipe.

7. Pressure Gauges

Pressure gauges shall be installed in the discharge line of each pump within the valve chamber. The gauges shall be 3-inch diameter (minimum) and read pump discharge pressure in "feet of water". Liquid filled gauges shall incorporate a flexible diaphragm seal between the sewage discharge line and the pressure gauge. The diaphragm seal shall be either the inline-saddle type design with a minimum diaphragm surface of 5 square inches or the complete flow-thru type design with flange connection. Inline saddle diaphragms and housing parts exposed to the sewage shall be 316 ss. The flexible cylinder protecting the sensing liquid on the flow-thru design shall be Buna N and the flanges shall be 316 ss. The inside diameter of the flow-thru assembly shall be the same as the adjacent discharge piping. Use Model R or RP by Ametek, Model Iso-Spool (flanged) or Iso-Ring (wafer) by Ronninger-Peter or equal. Gauge shall be mounted on a tap equipped with a valve to allow complete isolation and removal of the gauge without station shut down.

B. Installation of Piping, Valves and Fittings

1. Cast Iron or Ductile Iron Piping, Valves and Fittings

Cast iron or ductile iron piping, valves and fittings shall be used for all piping larger than 4-inch diameter from the pumps until the pipe

exits the valve chamber. Cast iron flanged piping, valves, and fittings shall be used for all interior exposed piping unless otherwise approved by the Engineer. Pipe, valves and fittings shall be carefully laid to line and grade. Care shall be taken to keep the pipe clean and free from dirt and other foreign materials. Piping laid in the ground shall have bearing over its entire length. Piping along floors, walls or ceilings shall be adequately supported by saddles, posts, wall brackets, pipe hangars or other approved devices. The exact location, number and design thereof shall be subject to the approval of the Engineer.

2. Galvanized or Wrought Iron Piping

Galvanized steel pipe fittings shall be used for all interior piping less than 4 inches in diameter.

3. Pipe Taps

Wherever indicated or required, pipe or fittings shall be tapped to receive small pipe or special fittings.

12.06 SEWAGE FLOW METER

A. Scope of Work

The Contractor shall furnish and install where shown on the plans and in accordance with these specifications, an ultrasonic flow measuring device complete with flow transmitter, indicating, recording and totalizing capable of 4-20 milliamp output. The flow meter must be suitable for use in NEC, Class 1, and Division 1 locations. The ultrasonic level measuring device flow meter shall be installed through the top of the wet well. The ultrasonic level measuring device shall be capable of providing pump on/off signals to the control panel and be manufactured by Milltronics.

12.07 ELECTRICAL WORK

A. Factory Wiring and Equipment

1. General

The pumping station control panel shall be completely wired at the factory except for the power feeder lines in accordance with National Electrical Code and carry an Underwriters Laboratory certification upon delivery. It shall be adjusted and ready for

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operation. All wiring in the station shall be color coded and numbered as indicated on the wiring diagram portion of the shop drawings. All wiring outside the panel shall be in rigid conduit. It is the Contractor's responsibility to ensure that electrical equipment complies with all federal, state, and local requirements. (A large, clear, color coded and numbered wiring diagram shall be provided in triplicate with each unit. Wiring diagram shall comply with the latest Township requirements).

All conduit ends are to be sealed to eliminate water and/or gases moving from one section of the pump station system to another; i.e., wet well to pump control panel.

2. Pump Motors

Pump motors shall be supplied with the pump by the pump manufacturer as an integral part of the pump assembly. The horsepower shall be such that the motor will be non-overloading throughout the entire pump range. The motors shall have squirrel cage windings and rated at 240 volts, 60 cycle, 3 phase and shall be NEMA Code "G" design or better. Motors shall be as manufactured by U.S. Motors, General Electric, Westinghouse or equal. Each motor shall have a nameplate showing the motor serial and identification numbers, manufacturer's name, horsepower, voltage, etc.

3. Pump Controls and Alarms

a. Control Panel

The electrical control equipment shall be mounted within a NEMA 4 dead front enclosure.

The control panel shall include a circuit breaker and magnetic starter for each pump motor actuated by the ultrasonic level control system. The magnetic starters shall be Square "D" and have thermal overload protection on all three phases. The control assembly shall provide a convenient means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle.

Control panel shall be equipped with a step-down

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transformer to supply 120/240 volts for control and auxiliary circuits. Primary side of auxiliary power transformers shall be protected by a thermal/magnetic air circuit breaker specifically sized to meet power requirements of the transformer. A 120-volt, 20-amp, duplex receptacle shall be provided with ground fault circuit interruption.

Pump run indicator lights shall be mounted on the control panel.

The control panel shall also incorporate an hour meter to register the elapsed running time for each pump. Meters shall be resettable and utilize a digital readout.

A time delay relay shall be provided for the pump motor controls to insure that both motors will not start at the same time.

Controls for the pump motors shall be designed to protect the electric motors from low line voltage, single phase startup and phase reversal. A phase sequence and under voltage relay shall be installed in the control panel. The unit shall be connected to the pump station alarm circuitry to provide a 0.5 second time delay to prevent nuisance tripping of the relay caused by a momentary transient drop in the line voltage. Upon resumption of normal line conditions, the unit shall automatically restore the motors to a running condition.

b. Wet Well Level Control and Alarm System

Controls for pump operation for wet well level control and alarm system shall be furnished and installed to perform as described herein. The Wet Well Level Control and Alarm System is required to meet Class 1, Division 1, Group D requirements.

At the normal High Water Level, one of the two pumps will start. Pumping will continue until the fluid level has lowered to the normal Low Water Level when the pumps will stop.

When the fluid level has again reached the normal High Water Level, the other pump will start and complete its cycle in the same manner as the first pump. In the case of suction,

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lift stations pump alteration shall be conducted automatically on a daily cycle not every pump cycle.

If the fluid level continues to rise above the normal High Water Level and reaches the Standby Pump On Level, the second or standby pump will start and both pumps will continue to run until the fluid level descends to the normal Low Water Level. If the fluid level continues to rise above the Standby Pump On Level, a High Water Alarm Level will indicate an abnormal condition. High Water Level, Low Water Level, and Standby Pump On Level shall utilize the ultrasonic level control system. The High Water Alarm Level shall utilize the ultrasonic level control system with a backup signal actuated by a mercury float type switch.

Conversely, if the pumps should continue to run so as to drop the fluid level below the Low Water Level, the Low Water Alarm Level will indicate the abnormal condition and the operating pump(s) will stop. The pump controls will automatically be restored to normal operation if the fluid level again rises. The Low Water Alarm Level shall utilize the ultrasonic level control system with a backup signal actuated by a mercury float type switch.

The mercury float type switches shall consist of suspended plastic watertight casings, each containing a mercury switch, so arranged that the buoyancy of the rising fluid causes them to lie on their sides thus activating the mercury switch. All level control circuits in the wet well shall be 24 volt and in explosion-proof housings.

4. Alarm Contacts for Rapid Telemetry (or Alarm Monitoring) and Exterior Alarm Light

The pump station shall be provided with alarm contacts terminal board control panel by the pump station manufacturer for energizing of the telemetering and alarm light relays.

- a. Telemetering (dry) contacts shall be provided for the following conditions:

High Water Alarm Level
Low Water Alarm Level
Water in the Pump Motor

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Power Failure
Sewage Pump No. 1 On
Sewage Pump No. 2 On
Security

- b. Exterior alarm light and horn contacts shall be provided and the light and horn energized for the following conditions:

High Water Alarm Level
Low Water Alarm Level

5. Electric Heater

A single-phase electric strip heater shall be provided in the pump panel with an adjustable thermostat.

6. Telemetry Equipment

Telemetry equipment will be supplied and installed by the agency performing operation and maintenance for the facility. Battery back-up must be included.

B. Site Electrical Requirements

1. General

The Contractor shall supply and install all site electrical wiring and equipment necessary to operate the facilities of the sewage pumping station in accordance with all federal, state, and local requirements and as described in these specifications and shown on the plans.

2. Contractor Responsibility

It shall be the Contractor's responsibility to have utility installations and hookups for electrical service.

3. Exterior Station Alarm

An exterior station alarm shall be supplied to provide a visual alarm indication activated by contacts in the lift station control panel. It shall be mounted within the exterior electrical enclosure. A vapor tight, 100-watt light fixture with red globe and guard shall be

mounted on the top of the exterior electrical enclosure to indicate visually when an alarm condition exists.

12.08 FACTORY TESTS

The submersible sewage pumps shall be given running tests to check for proper motor and pump operation, correct shaft and impeller rotation and watertightness. Pump shall be run submerged for 30 minutes, simulating actual service conditions after which the motor housing will be checked for moisture either visually if plugs are present, or through the use of a moisture probe, if plugs are not present.

A certificate of factory testing shall be provided to the Design Engineer and Township Engineer.

12.09 SHOP DRAWINGS

The Contractor shall submit, as prescribed under Section "General Requirements", six (6) copies of complete shop drawings including the shop drawing for the control panel and color coded electrical schematic drawings (ladder diagrams) for all electrical components and details of all equipment to be furnished under this section. These shop drawings shall be submitted and approved by concurrence of Township Engineer before installation of these items.

12.10 OPERATION AND MAINTENANCE INSTRUCTIONS

Written instructions for the operation and maintenance of the pump station equipment shall be furnished in quadruplicate for each piece of equipment In this section. The instructions shall be easy to understand with directions specifically written for this project describing the various possible methods of operating the equipment.

The instructions shall include procedures for tests required, pump curves, adjustments to be made, and trouble and safety precautions to be taken with the equipment.

Maintenance instructions shall include test and calibration charts, exploded views of assembled components, spare parts lists and wiring diagrams.

These instructions shall be submitted to the Design Engineer and Township Engineer for approval at the same time the shop drawings are submitted.

12.11 RECORD DRAWINGS

Any changes that are made in equipment, controls, wiring, etc. from that shown in the plans and specifications shall be made only by approved shop drawings. After such changes are made, the Contractor shall submit to the Township Engineer record drawings which show these changes in equipment installation.

12.12 AS-BUILT WIRING DIAGRAM

A large, clear, color coded and numbered wiring diagram shall be prepared showing the as-built wiring of the complete pump station installation including all control and alarm wiring. Provide four (4) copies for each pump station.

12.13 EQUIPMENT INSTALLATION AND START UP FOR SEWAGE PUMP STATIONS

A. General

All equipment shall be installed in a neat, workmanlike manner, acceptable to the Design Engineer with concurrence of the Township Engineer and in conformance with all applicable local, State and Federal codes and requirements.

B. Factory Trained Start-Up Personnel

The Contractor shall furnish the services of an experienced factory trained field engineer representing the pump station supplier to start up all equipment. He shall be employed by the Contractor in such capacity to interpret the manufacturer's installation guide and instructions, to supervise the installation and start-up of such equipment and to instruct the operating and maintenance personnel for a reasonable period of time. (A minimum of four (4) hours of instruction per pump station.) The representative of the pump station supplier shall be responsible to insure that all pumps, motors, equipment, controls, alarms, wiring, flow meter and all associated components are properly installed and functioning properly.

C. Systems Start Up

It shall be the Contractor's responsibility to coordinate work between his subcontractors, equipment suppliers and utility companies to insure that all components of the system function properly as described herein.

When the system or a major component of the system is entirely installed and ready for testing, the Contractor shall notify the Township Engineer

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and operating/maintenance personnel, in writing, of the time and date the start-up testing will be done. The Contractor, subcontractor, and equipment supplier's representatives shall be present for final start-up testing. During the start-up test, the Contractor shall operate all equipment in such a manner to demonstrate that all components are functioning properly.

If the equipment fails to perform, it will be the responsibility of the Contractor to arrange for repair or replacement of the defective parts and scheduling of a new start-up session.

Should the equipment pass its initial start-up testing but fails during the one year guarantee period, the Contractor shall coordinate the necessary repairs or replacements with the subcontractors and suppliers.

12.14 GUARANTEE

In addition to the Contractor's guarantee, the Contractor shall also furnish the manufacturer's guarantee(s) covering all material and equipment furnished. Such guarantees shall be in written form and furnished to the Owner. The guarantees shall be for a one year period commencing on the date of acceptance of the completed sewage pumping station(s) as determined by the Design Engineer with concurrence of the Township Engineer. The guarantee(s) shall cover the structure and all equipment, materials and workmanship of the pump station and all associated components as specified herein. The guarantee shall provide for the replacement of defective materials and/or workmanship, together with the restoration of any related materials or workmanship that are disturbed as a result of such imperfections in the work. All guarantees shall be submitted in triplicate.