

SECTION 46

WASTEWATER PUMP STATIONS

46.1 GENERAL

This section includes the specifications for equipment, materials, site work, fences and appurtenances for the installation of wastewater pump stations.

46.2 WET WELL AND VALVE VAULT

Wet well and valve vault shall be constructed as shown on the STANDARD DRAWINGS and in conformance with the specifications outlined in Section 42.

46.3 ACCESS FRAMES AND COVERS

Both the wet well and the valve vault shall be furnished with an access frame and cover. Equipment furnished shall include the necessary aluminum access frames, complete with hinged and slide bar equipped covers, stainless steel upper guide holder and level sensor cable holder. The frames shall be securely mounted above the pumps. Doors shall be of aluminum checkered plate. The access cover and frame with stainless steel hardware shall be sized as shown on the DRAWINGS. (See approved manufacturers' list in appendix).

46.4 PUMPS AND CONTROLS

Pumps and miscellaneous accessories shall be as specified in Section 47. Controls and miscellaneous accessories shall be as specified in Section 48.

46.5 PIPING, VALVES AND ACCESSORIES

46.5.1 PIPING

Influent piping to the wet well shall meet the requirements of Sections 40 and 45 except that the influent pipe to the wet well shall be a minimum eighteen (18) feet section of Ductile Iron Pipe. All pipe inside the wet well and the valve vault shall be as shown on the STANDARD DRAWINGS.

46.5.2 PLUG VALVES

Plug valves shall meet the requirements of Section 45.8.

46.5.3 CHECK VALVES

Check valves for ductile iron pipelines shall be swing type and shall meet the material requirements of AWWA C500. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, nonshock, and

hydrostatically tested at 300 psi. Ends shall be 125 pound ANSI B16.1 flanges.

When there is no flow through the line the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.

Check valves shall have bronze seat and body rings, extended bronze hinge pins and stainless steel nuts on the bolts of bolted covers.

Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight. If pump shut off head exceeds seventy-seven (77) feet, then an air cushioned assembly shall be installed.

46. 5. 4 PRESSURE GAUGES

Pressure gauges shall be installed on each discharge pipe as indicated on the STANDARD DRAWINGS. Each pressure gauge shall be direct mounted, stainless steel case, stainless steel sensing element, liquid filled, with a four and one-half (4½) inch diameter dial and furnished with a clear glass crystal window, one-quarter (¼) inch shut-off (isolation) valve. All gauges shall be weatherproofed. The face dial shall be white finished aluminum with jet black graduations and figures. The face dial shall indicate the units of pressure measured in psi, with a 0-60 psi ranges.

Pressure gauges shall not be installed until after the substantial completion date unless otherwise requested by the CITY. (See approved manufacturers' list in Appendix).

46. 6 STANDBY POWER GENERATOR SYSTEM

46. 6. 1 GENERAL

A standby power generator system shall be installed at pump stations as required by Section 22.5 for electrical power during the loss of normal power.

46. 6. 2 GENERATOR SET

46. 6.2. 1 GENERAL

The generator set shall consist of a diesel engine directly coupled to an electric generator, together with the necessary controls and accessories to provide continuous electric power to the lift station for the minimum duration of a forty-eight (48) hour failure of the normal power supply.

A complete engine generator system shall be furnished and installed with fuel transfer pump, fuel day tank, battery, battery charger, muffler,

radiator, control panel, remotely mounted automatic transfer switch (part of the control panel), and all other accessories required for an operational system. All materials and parts of the generator set shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment. The set shall be of a standard model in regular production at the manufacturer's place of business. Units and components offered under the Specifications shall be covered by the manufacturer's standard warranty on new machines.

46. 6.2. 2 REQUIREMENTS

The emergency generator set and accessories shall be of a type that complies with the latest edition of the National Electrical Code and all applicable state and local building codes.

The material and workmanship used in the manufacture of this equipment shall be of the highest quality consistent with the current standards for like equipment, and the equipments shall be manufactured in such a manner so as to conform to the latest applicable IEEE, ANSI, ISA, NEMA, and EEA Standards

The equipment supplier shall be liable for any latent defects due to faulty materials or workmanship in the equipment which may appear within one (1) year from the date of equipment start-up.

46. 6.2. 3 TESTS

Equipment shall be completely assembled and tested at the factory prior to shipment. Certified copies of the data obtained during these tests shall be submitted to the CITY.

Final tests shall be conducted at the site, after installation has been completed, in the presence of the CITY'S representative. The emergency generator manufacturer shall furnish a service representative to operate the engine during the tests, to check all details of the installation and to instruct the CITY'S representatives in proper equipment operation.

Field tests shall include operating the diesel generating set for eight (8) hours, carrying normal lift station loads. The CONTRACTOR shall refill the main fuel tank at the completion of the tests.

46. 6.2. 4 RATINGS

The rating of the generator shall be as shown on the DRAWINGS. These ratings must be substantiated by the manufacturer's standard published curves. Special ratings shall not be acceptable. The set shall be capable of supplying the specified usable KW for the specified duration, including

the power required for the pump start-up, without exceeding its safe operating temperature.

46. 6.2 5 ENGINE

The engine shall be water cooled, four stroke cycle, compression ignition diesel. It shall meet specifications when operating on No. 2 domestic burner oil. The engine shall be equipped with fuel, lube oil and intake air filters; lube oil coolers, fuel transfer pump, fuel priming pump, and gear-driven water pump.

The engine and generator shall be torsionally compatible to prevent damage to either engine or generator.

An engine instrument panel shall be installed on the generator set in an approved location. The panel shall include oil and fuel pressure and water temperature gauges. A mechanically driven engine hour meter shall also be provided.

The engine governor shall be of the isochronous electronic type. Frequency regulation shall not exceed plus/minus 0.25% under steady state conditions. The engine shall start and assume its rated load within ten (10) seconds, including transfer time.

46. 6.2. 6 GENERATOR

The generator shall be a three-phase, 60 hertz, single bearing, synchronous type, built to NEMA Standards. Epoxy impregnated Class F insulation shall be used on the stator and the rotor.

The excitation system shall employ a generator-mounted volts per hertz type regulator. Voltage regulation shall be plus/minus two (2) percent from no load to full load. Readily accessible voltage drop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of plus/minus five (5) percent.

46. 6.2. 7 ENGINE GENERATOR CONTROL PANEL

A generator mounted NEMA 3R type 304, vibration isolated, 14 gauge stainless steel control panel shall be provided. Panel shall contain, but not be limited to, the following equipment:

Control Equipment: Control equipment shall consist of all necessary exciter control equipment, generator voltage regulators, voltage adjusting rheostat, and speed control equipment and automatic starting controls, as required to satisfactorily control the engine/generator set. In addition an automatic safety shut down shall be provided for low oil pressure and/or

high temperature conditions in the engine. An emergency shut down lever switch shall be provided on the air intake.

Metering Equipment: Metering equipment shall include three and one-half (3½) inch meters (dial or digital type frequency meter, two [2] percent accuracy voltmeter, and ammeter and ammeter-voltmeter phase selector switch). The control panel shall also include the engine water temperature, lube oil pressure and hour meter.

Fault Indicators: Individual press-to-test fault indicator lights for low oil pressure, high water temperature, low water level, overspeed, overcrank, and for day tank high and low fuel level shall be provided.

Function Switch: A four position function switch marked "Auto", "Manual", "Off/Reset", and "Stop" shall be provided.

46. 6.2.8 BATTERY CHARGER

The battery charger shall be so designed that it shall not be damaged and shall not trip its circuit protective device during engine cranking or it shall be automatically disconnected from battery during cranking period. The charger shall be mounted in the emergency generator control panel. The charger shall have a seven (7) day/twenty-four (24) hour timer control.

46. 6.2.9 BATTERY

The battery shall be lead-acid type with sufficient capacity to provide ninety (90) seconds total cranking time without recharging. The battery shall be adequately rated for the specific generator set. The battery shall be encased in hard rubber or plastic and shall be furnished with proper cables and connectors, together with rack and standard maintenance accessories. The battery shall be provided with a forty-eight (48) month warranty for the replacement of the battery if found to be defective.

46. 6.2.10 BASE AND MOUNTING

A suitable number of spring-type vibration isolators with a noise isolation pad shall be provided to support the set and its liquids.

46. 6.2.11 UTILITY CONNECTIONS

All connections to the generator set shall be flexible.

46. 6.2.12 COOLING SYSTEM

The generator set shall be equipped with an engine mounted radiator sized to maintain safe operation at one hundred ten (110) degree F maximum ambient at the pump station altitude. A blower type fan shall be used

directing the air flow from the engine through the radiator. The entire cooling system shall be filled with fifty (50) percent glycol-water solution.

46. 6.2.13 FUEL SYSTEM

An above ground, main fuel oil storage tank with float switch and fuel level indication shall be furnished and installed by the CONTRACTOR. The emergency system shall include low fuel level contacts for remote alarm. If necessary to guard against loss of prime to pump, a check valve shall be mounted on pump intake. The emergency system shall include a float switch, fuel level gauge and standard control panel.

A concrete fuel containment system shall be provided to prevent the accidental release of fuel to the environment. The containment area shall be of sufficient size to contain one hundred ten (110) percent the volume of the largest fuel tank. A minimum two (2) inch drain and valve shall be provided for drainage of the containment area. An approved epoxy coating shall be applied to the concrete area.

Fuel oil piping, including mounting of any required fuel tanks, shall be furnished and installed by the CONTRACTOR.

46. 6.2.14 EXHAUST SYSTEM

The generator set supplier shall provide a critical-type silencer, with flexible exhaust fittings, properly sized and installed, according to the manufacturer's recommendation. The silencer shall be mounted so that its weight is not supported by the engine.

Exhaust pipe size shall be sufficient to ensure that measured exhaust back pressure does not exceed the maximum limitations specified by the generator set manufacturer. The exhaust system shall include a flexible, seamless, stainless steel connection between the engine exhaust outlet and the rest of the exhaust system. The exhaust system shall be a part of generator enclosure.

46. 6.2.15 WEATHERPROOF ENCLOSURE

Enclosure and all other items shall be designed and built by engine manufacturer as an integral part of the entire generator set and shall be designed to perform without overheating in the ambient temperature specified.

Enclosure shall be constructed of fourteen (14) or sixteen (16) gauge sheet metal suitable reinforced to be vibration free in the operating mode.

Four (4) hinged doors shall be provided to allow complete access without

their removal.

Each door shall have at least two (2) latch-bearing points.

Side and rear panels shall be completely and simply removable for major service access. Roof shall be peaked to allow drainage of rain water.

Baked enamel finish with primer and finish coat shall be painted before assembly. All fasteners shall be rust resistant.

Unit shall have sufficient guards to prevent entrance by small animals. Padlocks shall be provided.

Batteries shall be designed to fit inside enclosure and alongside the engine. Batteries under the generator are not acceptable.

Unit shall have coolant and oil drains outside the unit to facilitate maintenance. Each drain line shall have a high quality valve located near the fluid source.

Fuel filter shall be inside the base perimeter and located so spilled fuel cannot fall on hot parts of engine or generator. A cleanable primary fuel strainer shall be used to collect water and sediment between tank and main engine fuel filter.

Crankcase fumes disposal shall terminate in front of the radiator to prevent oil from collecting on the radiator core and reducing cooling capacity.

46. 6.2.16 AUTOMATIC TRANSFER SWITCH

The automatic transfer switch shall be part of the control panel described in Section 48.

The transfer switch shall be provided with the following features:

Complete protection, close differential voltage sensing relays monitoring all three phases (pick-up set for ninety-five [95] percent of nominal voltage, drop-out set for eight-five [85] percent nominal voltage).

Voltage sensing relay on emergency source (pick-up set for ninety-five [95] percent of nominal frequency).

Time delay on engine starting--adjustable from one (1) second to three hundred (300) seconds (factory set at three second).

Time delay normal to emergency transfer--adjustable from zero second to three hundred (300) seconds (factory set at one second). The

CONTRACTOR shall request time delay settings in accordance with the priority rating or their respective loads.

Time delay emergency to normal transfer--adjustable thirty (30) seconds to thirty (30) minutes (factory set at five minutes), and time delay bypass switch shall be provided on door of the switch cabinet.

Unload running time delay for emergency engine generator cooling down--adjustable from zero (0) to five (5) minutes (factory set at five minutes) unless the engine generator control panel includes the cool down timer.

46. 6.2.17 WARRANTY

Products shall be guaranteed to be free from defects in material and workmanship under normal use and service for a period of one (1) year after start-up.

46. 7 FLOW MONITORING SYSTEM

46. 7. 1 GENERAL

When indicated on the DRAWINGS or as required by Section 22.4, a flow monitoring system capable of indicating, recording, and totalizing wastewater flows shall be provided. The system shall include magnetic flowmeter/transmitter, electronic recording receiver, and miscellaneous related accessories as specified herein. It shall be the CONTRACTOR's responsibility to provide and install such equipment resulting in a completely operational flow monitoring system.

46. 7. 2 MAGNETIC FLOWMETER/TRANSMITTERS

The magnetic flowmeter shall be of the low frequency electromagnetic induction type and shall produce a DC pulsed signal directly proportional and linear to the liquid flowrate. The meter shall be designed for operation on 120 VAC \pm 10%, 60 Hz \pm 5% with a power consumption of less than 20 watts for sizes through twelve (12) inches.

The metering tubes shall be constructed of stainless steel. All magnetic flowmeters shall be designed to mount directly in the pipe between ANSI Class 150 flanges and shall consist of a flanged pipe spool piece with laying length of at least one and one-half (1½) times the meter diameter. Meters shall have polyurethane liners with stainless steel electrodes.

The electronics portion of the magnetic flowmeter shall include both a magnet driver to power the magnet coils and a signal converter. The signal converter shall be integrally mounted. The converter shall include a separate customer connection section to isolate the electronics compartment and protect the

electronics from the environment. A separate terminal strip for power connection shall be supplied. The electronics shall be of the solid state, feedback type and utilize integrated circuitry. The input span of the signal converter shall be continuously adjustable between 0-1 and 0-31 fps for both analog and frequency outputs. The converter shall not be affected by quadrature noise nor shall it require zero adjustment or special tools for start-up.

Input and output signals shall be fully isolated. The converter output shall be 4 to 20 mA DC into 0 to 900 ohms.

Meter shall be suitable for outdoors installation and shall be furnished complete with grounding rings and installation hardware including studs, nuts, gaskets, and flange adapter hardware.

The converter shall include an integral zero return to provide a constant zero output signal in response to an external dry contact closure.

Converter shall also include digital type switches for direct adjustment of scaling factor in engineering units along with integral calibration self-test feature to verify proper operation of the electronics.

The meter shall be hydraulically calibrated at a facility located in the United States and the calibration shall be traceable to the National Bureau of Standards. A computer printout of the actual calibration data giving indicated versus actual flows at a minimum of three (3) flow rates shall be provided with the meter. A certification letter shall accompany the computer printout of the calibration data for each meter referencing the meter's serial number. The accuracy of the metering system shall be one (1) percent of rate from ten (10) to one hundred (100) percent of flow for maximum flow velocities of three (3) to thirty-one (31) feet per second.

Complete zero stability shall be an inherent characteristic of the meter system to eliminate the need to zero adjust the system with a full pipe at zero flow.

The meter housing shall be splash-proof and weather resistant design. The meter shall be capable of accidental submergence in up to thirty (30) feet of water for up to forty-eight (48) hours without damage to the electronics or interruption of the flow measurement.

46. 7. 3 ELECTRONIC RECORDING RECEIVER

The electronic recording receiver shall be of the solid state, null-balance, servo operated potentiometer type.

The instrument shall contain a differential amplifier, a TORQ-ER driving motor to position the pen, and a Flux Bridge contactless solid state position feedback device for balancing. The instrument shall be capable of receiving one process variable input. Inputs shall be provided with electrical isolation. The instrument

shall accept an input signal of four (4) to twenty (20) mA DC. Electrical zero and span adjustments shall be provided. Power requirements shall be 120 VAC \pm 10%, 60 Hz. A power supply shall be provided for two-wire transmitters. Accuracy shall be \pm 0.5% of span, with repeatability of \pm 0.2% of span.

The receiver shall be provided with an indicating five (5) inch segmental scale.

The electronic recording receiver shall be housed in a cast aluminum case suitable for panel mounting. The case shall have a gasketed door with glass window. A twelve (12) inch circular chart shall be provided, with seven (7) day/rev. and chart rotation. An eight (8) digit electronic totalizing counter shall also be provided.

46. 7. 4 WARRANTY AND SERVICE

WARRANTY

Products shall be guaranteed to be free from defects in material and workmanship under normal use and service for a period of one (1) year after start-up.

SERVICE

Service shall be available for insitu repair of the products. Manufacturer's Repair personnel shall be based in Florida to insure a reasonable response time of not more than two (2) working days.

46. 8 CHAIN LINK FENCE

46. 8. 1 GENERAL

The CONTRACTOR shall furnish and erect the chain link fence and gate in accordance with these specifications and in conformity with the lines, grades, notes and typical sections shown on the DRAWINGS and the STANDARD DRAWINGS.

46. 8. 2 MATERIALS

The fabric, posts, fastenings, fittings and other accessories for chain link fence shall meet the requirements of AASHTO M 181 with the following changes:

1. The weight of coating of wire fabric shall be 1.2 ounces of zinc per square foot (Class B).
2. The galvanizing of steel materials shall be hot-dipped galvanized.

3. The weight of coating on posts and braces shall be 1.8 ounces of zinc per square foot, both inside and outside to meet the requirements of AASHTO M 111.

The base metal of the fabric shall be a good commercial quality 9 Gage Steel wire. The fabric shall be of uniform quality, and shall be six (6) foot high with a two (2) inch mesh size.

All posts and rails shall be in accordance with the following schedule:

End, corner and pull posts - 2 3/8" O.D., Schedule 40.

Line posts and gate frames - 2" O.D., Schedule 40.

Gate Posts - 3" O.D., Schedule 40.

Post braces and top rail - 1 5/8" O.D., Schedule 20.

Tension wire shall be 0.177 inch coiled spring wire tensioned along the bottom of the fabric and shall be coated similarly to the wire fabric.

Miscellaneous fittings and hardware shall be zinc coated commercial quality or better steel or zinc coated cast or malleable iron as appropriate for the article.

Post caps, designed to provide a drive fit over the top of the tubular post to exclude moisture, shall be provided.

46. 8. 3 INSTALLATION

POST SETTING

All posts shall be set three (3) feet deep in concrete footings, twelve (12) inch diameter for line posts, gate and corner posts.

After the post has been set, aligned and plumbed, the hole shall be filled with 2500 p.s.i. concrete. The concrete shall be thoroughly worked into the hole so as to leave no voids. The exposed surface of the concrete shall be crowned to shed water.

End, corner, pull and gate posts shall be braced to the nearest post with horizontal brace used as a compression member and a galvanized three-eighth (3/8) inch steel truss rod and truss tightener used as a tension member. Corner posts and corner bracing shall be constructed at all changes of fence alignment of thirty (30) degrees or more. All chain link fence shall be constructed with a top rail and bottom tension wire.

GATES

Swing gates shall be a minimum of two (2) six (6) foot wide double-hung gates as indicated on the STANDARD DRAWINGS and hinged to swing through one hundred eighty (180) degrees from closed to open and shall be complete with latches, locking device, stops, keeper, hinges, fabric and braces. Gates shall be the same height as the fence and the gate fabric shall be the same as the fence fabric. Gate leaves less than eight (8) feet wide shall have truss rods or intermediate braces and gate leaves eight (8) feet or more in width shall have intermediate braces and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist.

PLACING FABRIC

The fabric shall not be placed until the posts have been permanently positioned and concrete foundations have attained adequate strength. The fabric shall be placed by securing one end and applying sufficient tension to remove all slack before making permanent attachments at intermediate points.

The fabric shall be fastened to all corner, end and pull posts by substantial and approved means. Tension for stretching the fabric shall be applied by mechanical fence stretchers.

46.9 REQUIRED SUBMITTALS

Submittals shall be provided to the CITY in triplicate and include the following:

1. Shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.
2. Descriptive literature, bulletins, and/or catalogs of the equipment.
3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on eight and one-half (8½) inch by eleven (11) inch sheets, at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to maximum manufacturer recommended pump capacity. Catalog sheets showing a family of curves will not be acceptable.
4. Complete layouts, wiring diagrams, elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the pump control system. Suitable outline drawings shall be furnished for approval before proceeding with manufacture of any equipment. Standard preprinted sheets or drawings simply marked to indicate applicability will not be acceptable.

5. A drawing showing the layout of the pump control panel shall be furnished. The layout shall indicate all devices mounted on the door and in the panel shall be completely identified.
6. The weight of each pump.
7. Complete motor data shall be submitted including:
 - Nameplate identification
 - No-load current
 - Full load current
 - Full load efficiency
 - Locked rotor current
 - High potential test data
 - Bearing Inspection report

46. 10 ELECTRICAL GROUNDING SYSTEM

46. 10. 1 GENERAL

A grounding system shall be installed as per National Electrical Code, Local Codes and Ordinances. The DRAWINGS shall clearly show the Electrical Grounding System. An underground perimeter cable grounding system shall be installed with connections to at least the following equipment:

1. Wet Well Cover
2. Valve Vault Cover
3. Control Panels
4. Generator
5. Utility Company Transformer
6. Main Disconnect Switch
7. Fence

46. 10. 2 MATERIAL AND INSTALLATION

The DRAWINGS shall show details of material and installation to construct a completely functional and operational Electrical Grounding System.

46. 11 INSPECTION AND TESTING

A factory representative knowledgeable in pump operation and maintenance shall inspect and supervise a test run at the pumping station covered by this MANUAL. A minimum of one (1) working day shall be provided for the inspections. Additional time made necessary by faulty or incomplete WORK or equipment malfunctions shall be provided as necessary to meet the requirements in the MANUAL at no additional cost to the CITY.

Upon satisfactory completion of the test run, the factory representative shall issue the required manufacturer's certificate.

The test run shall demonstrate that all items of the MANUAL have been met by the equipment as installed and shall include, but not be limited to, the following tests:

1. That all units have been properly installed.
2. That the units operate without overheating or overloading any parts and without objectional vibration.
3. That there are no mechanical defects in any of the parts.
4. That the pumps can deliver the specified pressure and quantity.
5. That the pumps are capable of pumping the specified material.
6. That the pump controls perform satisfactorily.