

**DIVISION IV**  
**GRAVITY SEWERS, FORCE MAINS, AND PUMP STATIONS**

**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, submersible and above ground.

**46.2 WET WELL AND VALVE VAULT**

Wet well and valve vault for pump stations shall be constructed as shown on the applicable STANDARD DRAWINGS and in conformance with the specifications outlined in Section 42. The interior surfaces of wet wells, including the tops, and valve vaults shall have a full height integrally attached high density polyethylene, polypropylene random copolymer, or fiberglass interior light colored liner. The thickness of the liner shall be as shown in the STANDARD DRAWINGS as approved by the DIRECTOR. Exterior joints shall be sealed using a heat shrinking polymer material as required and approved by the DIRECTOR.

**46.3 ACCESS FRAMES AND COVERS**

Both the wet well and the valve vault for pump stations shall be furnished with an aluminum access frame and cover, as applicable. 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 Appendix C.

**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. The last eighteen (18) feet of the influent pipe into the wet well shall be Ductile Iron Pipe, unless the nearest upstream manhole is closer than this distance. All pipe inside the wet well and the valve vault shall be as shown on the STANDARD DRAWINGS.

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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 the swing type and shall meet the material requirements of AWWA C500. The valves shall be iron body, bronze mounted, single disc, 150psi working water pressure, non-shock, and hydrostatically tested at 300psi. 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 a 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 seats 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 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 4-1/2-inch diameter dial, furnished with a clear glass crystal window, and a 1/4-inch shut-off (damper) 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 pounds per square inch (PSI), with a 0-60psi ranges.

Pressure gauges shall not be installed until after the substantial completion date unless otherwise requested by the CITY. See Appendix C.

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**46.6 STANDBY POWER GENERATOR SYSTEM**

46.6.1 GENERAL

A standby power generator system, trailer mounted or installed onsite as required by the DIRECTOR, shall be donated to the CITY by the DEVELOPER for each pump station 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 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 (if set is installed onsite), 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 shall be manufactured in such a manner so as to conform to the latest applicable IEEE, ANSI, ISA, NEMA, and EEIA 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. The DEVELOPER shall also post a two (2) year maintenance bond in accordance with Section 11.2.4.

46.6.2.3 TESTS

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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 may include operating the diesel generating set for eight (8) hours while carrying normal pump 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 operating all pumps simultaneously for the specified duration, including pump start-up, without exceeding the safe operating temperature.

46. 6. 2. 5     ENGINE

The engine shall be water cooled, four stroke cycle, compression ignition, and 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 and priming pumps, 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 percent under steady state conditions. The engine shall start and assume its rated load within 10 seconds, including transfer time, if the set is installed onsite.

46. 6. 2. 6     GENERATOR

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The generator shall be three-phase, 60 hertz, single bearing, synchronous type, and 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 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 or minus 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, 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 and overcrank conditions. An emergency shut down lever switch shall be provided on the air intake.

Metering Equipment: Metering equipment shall include 3-1/2-inch meters (dial or digital type frequency meter, 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 meters.

Fault Indicators: Individual press-to-test fault indicator lights for low oil pressure, high water temperature, low water level, overspeed, overcrank, and for the 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, trip

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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 7 day/24 hour timer control. The CONTRACTOR shall provide the CITY with a fifty (50) foot commercial grade electrical extension cord capable of connecting the charger to a 120 volt source.

**46. 6.2. 9 BATTERY**

The battery shall be lead-acid type with sufficient capacity to provide 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, shall be furnished with proper cables and connectors, rack, and standard maintenance accessories. The battery shall be provided with a 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 appurtenances.

**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 a maximum ambient temperature of 110 degree F. 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 50 percent glycol-water solution.

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**46. 6. 2.13 FUEL SYSTEM**

For onsite installations, an above ground main fuel 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 the pump intake. The emergency system shall include a float switch, fuel level gauge, and standard control panel. Size shall be determined in accordance with Section 6.2.17.

For onsite installations, 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 110 percent the volume of the largest fuel tank. A minimum 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. The CITY may consider the use of a Florida Department of Environmental Protection approved double wall tank design in lieu of the above.

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**

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

The enclosure shall be constructed of 14 gauge sheet metal reinforced to be vibration free in the operating mode.

Hinged doors shall be provided to allow complete access.

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Each door shall have at least two satch-bearing points.

Roof shall be constructed 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 keyed to City specifications.

Batteries shall be designed to fit within the 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 that spilled fuel cannot fall on hot parts of the 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 for onsite installed generator sets 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 95 percent of nominal voltage, drop-out set for 85 percent nominal voltage).

Voltage sensing relay on emergency source (pick up set for 95 percent of nominal frequency).

Time delay on engine starting--adjustable from 1 second to 300 seconds (factory set at 3 second).

Time delay normal to emergency transfer--adjustable from zero second to 300 seconds (factory set at 1 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 30 seconds to 30

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minutes (factory set at 5 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 0 to 5 minutes (factory set at 5 minutes) unless the engine generator control panel includes the cool down timer.

**46. 6.2.17 TRAILER**

Portable generator sets shall be mounted, as a minimum, on a single axle (3500 lbs for less than 40 KW and 6000 lbs for 40 KW or larger) Fla. D.O.T. approved trailer. The trailer shall be constructed of high strength steel members and include hydraulic brakes, Interstate Commerce Commission required lighting, fenders, ball coupler, highway rated commercial tires, front jack stand, rear stabilizer jacks, 50 gallon (less than 40 KW) or 100 gallon (40 KW or larger) fuel tank (full at delivery time), fuel level gauge, fill/vent cap, fuel supply port, and fuel return port.

**46. 6.2.18 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 flow meter and 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 flow meter shall be of the low frequency electromagnetic induction type and shall produce a DC pulse signal directly proportional and linear to the liquid flow rate. The meter shall be designed for operation on 120 VAC  $\pm$  10 percent, 60 Hz  $\pm$  5 percent with a power consumption of less than 20 watts for sizes through 12-inches.

The metering tubes shall be constructed of stainless steel. All magnetic flow meters shall be designed to mount directly in the pipe between ANSI

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Class 150 flanges and shall consist of a flanged pipe spool piece with a laying length as recommended by the manufacturer. Meters shall have polyurethane liners with stainless steel electrodes.

The electronics portion of the magnetic flow meter 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 outdoor 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 1 percent of rate from 10 to 100 percent of flow for maximum flow velocities of 3 to 31 feet per second.

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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 30 feet of water for up to 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 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 4 to 20 MADC. Electrical zero and span adjustments shall be provided. Power requirements shall be 120 VAC  $\pm$  10 percent, 60 Hz. A power supply shall be provided for two-wire transmitters. Accuracy shall be  $\pm$  0.5 percent of span, with repeatability of  $\pm$  0.2 percent of span.

The receiver shall be provided with an indicating 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 gasket type door with glass window. A 12-inch circular chart shall be provided, with 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 two (2) years after start-up.

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**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 FENCING**

**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). Aluminized fabric shall be considered as an alternative.
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 gauge steel wire. The fabric shall be of uniform quality and 6 foot high with a 2 inch mesh size.

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

End, corner, and pull posts - 3 inches O.D., Schedule 40.

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

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

Post braces and top rail - 1 5/8 inches 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

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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, 12 inches in diameter for line, gate, and corner posts. The fence shall be graded smooth and at final grade before setting posts.

After the post has been set, aligned, and plumbed, the hole shall be filled with 3000 PSI. 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, a galvanized 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 30 degrees or more. The chain link fence shall be constructed with a top rail and bottom tension wire.

**GATES**

Swing gates shall be two 6-foot minimum width double hung gates as indicated on the STANDARD DRAWINGS and hinged to swing through 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 8 feet wide shall have truss rods or intermediate braces. Leaves 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.

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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. A maximum of three (3) inches shall be allowed between the bottom of the fabric and final grade.

**46.9 REQUIRED SUBMITTALS**

Submittals shall be provided to the CITY, if not contained within the STANDARD DRAWINGS, of 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, including valves, fittings, wet well construction, etc.
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 (8 1/2) 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, and 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 and completely identify all devices mounted on the door and in the panel.
6. The weight of each pump.

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7. Three sets each of Operation and Maintenance Manuals for the pump station, generator set, and other related equipment.
8. 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 (as applicable)
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. Additional test run time made necessary by faulty or incomplete WORK or equipment malfunctions shall be taken so that the

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requirements of this MANUAL are met 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 objectionable 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.

The CONTRACTOR shall furnish the water for the test run either through the use of a fire hydrant meter or water truck.