

ARTICLE 30

SANITARY SEWER PUMP STATION

Index	30.01	<u>GENERAL</u>
	30.02	<u>SITE</u>
	30.03	<u>BUOYANCY</u>
	30.04	<u>EXCAVATION AND BACKFILL</u>
	30.05	<u>GRADING</u>
	30.06	<u>HANDLING</u>
	30.07	<u>WET WELLS</u>
	30.08	<u>PIPE, VALVES AND FITTINGS</u>
	30.09	<u>PUMPS</u>
	30.10	<u>MOTORS</u>
	30.11	<u>SHOP PAINTING</u>
	30.12	<u>TELEMETRY SYSTEMS</u>
	30.13	<u>ELECTRICAL POWER AND CONTROL SYSTEM</u>
	30.14	<u>LIGHTS AND ALARMS</u>
	30.15	<u>ELECTRICAL GROUNDING SYSTEM</u>
	30.16	<u>STANDBY POWER GENERATOR SYSTEM</u>
	30.17	<u>FENCING</u>
	30.18	<u>TOOLS AND SPARE PARTS</u>
	30.19	<u>PUMP STATION WATER SYSTEM</u>
	30.20	<u>INSPECTION AND TESTING</u>
	30.22	<u>LIFT STATION SERVICES</u>
	30.21	<u>REQUIRED SUBMITTALS</u>
	30.22	<u>MINOR LIFTSTATION</u>

[BACK TO TABLE OF CONTENTS](#)

Section	30.01	<u>GENERAL</u>
---------	-------	----------------

This ARTICLE shall govern the design, construction and application of all wet pit sewage pumping stations, typical and minor, to include the wet well, influent piping from receiving manhole, effluent piping (to the wye), valves, valve boxes and covers, pumps and motors, hatches, bypass pumping appurtenances, control panel, flow meter, telemetry system, electrical service and wiring, and testing for a complete installation ready to operate. Design and layout of the system must be approved by the City Engineer or his Designee prior to construction. The system shall be designed and sized for peak flow.

Section	30.02	<u>LIFT STATION STANDARDS AND THIS ARTICLE</u>
---------	-------	--

The City maintains both Major and Minor Lift Station Standards and Details that shall be used in conjunction with ARTICLE 30 to establish the requirements for any lift stations to be dedicated to or constructed by the City. Any conflicts between ARTICLE 30 and the standard details shall be resolved in the more stringent criterion and/or requirement.

Section 30.03 SITE

Pump station sites shall be sized as delineated in the Typical City Details attached as part of this Manual. Owner/Developer shall dedicate pump station site by warranty deed or plat to the City. Dedicated easements shall also be required around the site as delineated in the Typical City Details attached as part of this Manual. In general, the site for the paved access road shall also be dedicated to the City by warranty deed or plat. Exceptions to this requirement may be allowed by the City Engineer or his Designee on a case by case basis in the form of an ingress/egress easement for the access road. The pumping station shall be readily accessible by maintenance vehicles during all weather conditions. All access to the pumping station shall be paved. The facility shall not be located in road rights-of-way. In a phased development, a stabilized access road may be accepted during the initial phase with paving to be accomplished in the later phase.

Wastewater pumping station structures and electrical and mechanical equipment shall be protected from physical damage by the 100 year flood by setting the top slab elevation a minimum of one foot above the 100 year flood elevation determined for the site and shall not be located within the flood way. Wastewater pumping stations shall remain fully operational and accessible during the 100 year flood event. Regulations of Local, State and Federal agencies regarding flood plain obstructions shall be considered.

Section 30.04 BUOYANCY

Buoyancy of the pump station structures shall be considered and adequate provisions shall be made for protection. Signed and sealed calculations shall be provided to the City by the Design Engineer.

Section 30.05 EXCAVATION AND BACKFILL

Excavation and backfill (including sheeting and bracing), dewatering, bedding and foundation, and furnishing and disposal of materials shall be as required in ARTICLE 6, Table 6-1.

Section 30.06 GRADING

The site shall be graded so as to direct runoff away from structures and appurtenances and electrical system. Pavement slopes shall not be less than 0.6% or exceed 2% within station confines. Earth grading extending from pavement for the first 10 feet shall not exceed 10: 1 cross slope and thereafter not exceed 3:1.

Section 30.07 HANDLING

All parts and equipment shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation. Finished surfaces of all exposed pump openings shall be protected by wooded planks, strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

Section 30.08 WET WELLS

Wet wells shall be to the same requirements as sanitary sewer manholes with the following additional requirements:

- A) The base shall be monolithic with lower ring.
- B) The base slab and top slab shall be constructed to the dimensions specified in the Typical City Details attached as part of this Manual. The wall thickness and inside diameter of the wet well shall be constant over its full depth. Generally, the minimum acceptable inside diameter for a wet well shall be 6 feet, however sufficient space for installed equipment, required suction pipe submergence and spacing shall be provided. A minimum of 24 inches between shut off and lead pump start levels shall be provided. Low water level shall provide adequate submergence to prevent pump inlet from vortexing, air binding, or other operational problems.
- C) A minimum 5 foot depth from the lowest invert and the off Float shall be provided.
- D) The maximum high water level shall be less than the low pipe influent invert, with the high water alarm no higher than the mid-depth point of said pipe.
- E) Brick construction shall not be acceptable.
- F) Wet well shall be free from all detectable leaks. Any leaks detected shall be corrected prior to acceptance by the City.
- G) Coating per the Approved Manufacturer's List.
- H) All concrete sanitary wetwells shall be lined with spray on Green MonsterTM Liner at a 90 to 110 mil thickness or approved equal approved by the City.

Section 30.09 PIPE, VALVES AND FITTINGS

30.09.01 General

All exposed pipe shall have flanged joints with 316 stainless steel bolts with stainless steel plastic inserted nylock nuts. All buried pipes shall have restrained joints. All exposed metallic piping shall be coated with an approved material refer to Approved Manufacturer's List. The riser pipe from the pump base to the valve vault shall be fusion welded HDPE and shall be joined to the equipment with the proper fusion welded flange adapters and shall include support as specified in the Typical City Details attached as part of this Manual.

30.09.02 Pipe Material

All piping from valve box to one (1) joint past wye including bypass pumping extension shall be ductile iron pipe. Pipe material from receiving manhole to wetwell shall be HDPE of equal inside diameter to pipe entering receiving manhole.

Section 30.10 PUMPS

30.10.01 General

The equipment covered by these Specifications is intended to be standard pumping equipment of proven ability as manufactured by a reputable firm having at least 5 years experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods, and shall operate satisfactorily when installed as specified in the Typical City Details attached as part of this Manual.

Pumps shall be submersible and of a dual rail system - dual rail pumps with dual rails. Pump station shall be capable of pumping the peak design flow with any one pumping unit out of service. Pumps shall be capable of meeting all system hydraulic conditions without motors overloading. In addition, a minimum 5 HP motor shall be required. Head-capacity (performance) curves shall verify that pumps are operating at peak efficiency for application. The system head-capacity analysis shall provide the following and be subject to review by the City Engineer or his Designee:

- A) System operation under peak flow conditions, with one pump or multiple parallel pumping, as designed. If the receiving force main system is interconnected to additional pumping stations, hydraulic modeling conditions shall also include said pumping systems operating at rated capacity.
- B) Pumping capability with one pump running, all units operating in parallel and other combinations, if applicable.

- C) Design engineer shall provide Hydraulic Analysis for peak, average and low pressure conditions and verify that new station will not adversely impact existing stations.

All parts shall be so designed and proportioned as to have liberal strength and stiffness, and to be especially adapted for the work to be done. Ample space shall be provided for inspection, repairs, and adjustment. All necessary foundation bolts, plates, nuts, and washers shall be furnished by the equipment manufacturer, and shall be of Type 316 stainless steel. Brass or stainless steel nameplates giving the name of the manufacturer, voltage, phase, rated horsepower, speed, and any other pertinent data shall be attached to each pump. The nameplate rating of the motors shall not be exceeded.

Two pumps shall be required for all stations discharging 2,000 gallons per minute or less. Additional pumps shall be required as necessary for larger flows. A minimum 5 minutes run time and no more than 8 successive starts of pumps must be maintained for peak flow conditions. Pumps shall alternate operation automatically. The pumps shall be capable of handling raw unscreened domestic wastewater and minimum 3 inch diameter solid spheres. Pump operation shall be controlled automatically by means of a SCADA Control System with a float back-up system. Pumps shall be mounted in the wet well as specified in the Typical City Details attached as part of this Manual. See approved Manufacturer's List attached as part of this Manual. For approved pumps and SCADA equipment.

30.10.02 Installation

Equipment shall be installed in accordance with approved shop drawings and manufacturer's instructions to operate as intended by the manufacturer. Shop drawings shall be sent to the Engineering Department for review prior to installation of equipment. Upper guide rail holders shall be located exactly as required.

- A) Shaft

The pump shaft shall be of Series 300 or 400 series stainless steel or carbon steel. When a carbon steel shaft is provided, the manufacturer shall demonstrate that any part of the shaft which will normally come in contact with the wastewater has proven to be corrosion resistant in this application. The shaft and bearings shall be adequately designed to meet the maximum torque required for any start-up or operating condition and to minimize vibration and shaft deflection. As a minimum, the pump shaft shall rotate on 2 permanently lubricated bearings. The upper bearing shall be a single row ball bearing. The lower bearing shall be a 2 row angular contact ball bearing, if required, to minimize vibration and provide maximum bearing life.

B) Impeller

The impeller shall be constructed of gray cast iron, ASTM A-48, class 30. All external bolts and nuts shall be of Type 304 stainless steel. Each pump shall be provided with a replaceable metallic wear ring system to maintain pump efficiency. As a minimum, one stationary wear ring provided in the pump volute or one rotating wear ring provided on the pump impeller shall be required. A two part system is acceptable.

C) Mechanical Seal

Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. Silicone carbide may be used in place of tungsten carbide for the lower seal. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the air-filled motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaceable. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to openings and penetration by pumping forces shall not be considered equal to tandem seal specified and required.

D) Guides

A sliding guide bracket shall be an integral part of the pump casing and shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the wet well with stainless steel anchor bolts and so designed as to receive the pump discharge flange without the need of any bolts or nuts. Sealing of the pumps to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided by no less than 2 Type 316 seamless tubular stainless steel guides per pump, which will press it tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection by means of a diaphragm or similar method of sealing shall not be accepted as an equal to a metal to metal contact of the pump discharge and mating discharge connection specified and required. Approved pump manufacturers, if necessary to meet the above specification, shall provide a sliding guide bracket adapter. The design shall be such that the pumps shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or fastenings to be removed for this purpose, and no need for personnel to enter the wet well. Each pump shall be fitted with a minimum ¼ inch 316 stainless steel cable, air craft rating, to remove the pumps from the wet well. The cable shall be of sufficient size to accommodate removal of the pump without breaking.

30.10.03 Pump Warranty

The pump manufacturer shall warrant the units being supplied to the City against defects in workmanship and material for a period of 5 years or 10,000 hours.

Section 30.11 MOTORS

30.11.01 General Requirements

All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA Standards and be UL listed where applicable. Pump motors shall be housed in an air-filled, water-tight casing and shall have Class F insulated windings which shall be moisture resistant. Motors shall be NEMA Design B, rated 155°C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or non-submerged condition. The pump shall be capable of running continuously in a non-submerged condition under full load without damage, for extended periods. The motor shall be capable of a minimum of 10 starts per hour. If required by the City, and before final acceptance, a field running test demonstrating this ability, with 24 hours of continuous operation under the above conditions, shall be performed for all pumps being supplied. Motors below 20 horsepower shall be rated 240/480 volt, 3 phase. Motors 20 horsepower and greater shall be 480 volt, 3 phase.

30.11.02 Heat Sensors

Each motor shall incorporate a minimum of 1 ambient temperature compensated overheat sensing device. This protective device shall be wired into the pump controls in such a way that if excessive temperature is detected the pump will shut down. This device shall be self-resetting.

30.11.03 Cables

Cables shall be designed specifically for submersible pump applications and shall be properly sealed. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top. Sealing systems utilizing epoxy potting compounds may be used. All cables shall be continuous without splices from the motor to the control panel, unless otherwise approved by the City.

The junction chamber, containing the terminal board, shall be perfectly leak proof.

Section 30.12 SHOP PAINTING

Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter. All pumps and motors shall be shop coated with a corrosion resistant paint proven to withstand an environment of raw wastewater. All nameplates shall be properly protected during painting.

Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the City up to the time of the final acceptance test.

Section 30.13 TELEMETRY SYSTEMS

Telemetry systems shall be provided on all public stations. The system shall be the newest version of the radio transmission unit Hyper Server Module from Data Flow Systems. System shall be able to monitor/calculate such information as flow rates, cycle times and ambient/run system pressures as well as proving control for the station.

Section 30.14 ELECTRICAL POWER AND CONTROL SYSTEM

30.14.01 General

This Section specifies the electrical power and control system requirements for wastewater pump stations. These requirements apply to duplex pump panels. Similar requirements shall apply when more than 2 pumps are involved except for the quantity of control equipment and panel size shall be increased accordingly. The manufacturer of the control panel shall provide data to indicate that the manufacturer has a minimum of 3 years experience in the building of pump control panels.

Lightning arrester, surge suppressor, pump disagree sensors, emergency disconnect switch, telemetry system, flow meter and totalizer, emergency generator plug, red alarm light, and convenience outlet shall be provided as specified in the Typical City Details attached as part of this Manual.

30.14.02 Control Panel

A pump station control panel shall be provided for each wastewater pump station. (See approved Manufacturer's List attached as part of this Manual.) The control panel shall be factory assembled and tested prior to installation at the pump station. Contractor shall provide for coordination between pump manufacturer and panel manufacturer to assure that the control panel as a whole, as well as the individual components, comprise a system which is intimately compatible with the pumps. The following equipment shall be included in the panel for duplex pump stations: Main breakers (2), pump circuit breakers (2), 20 amp panel circuit breaker, starters (2), alternator, elapsed time meter for each pump, run lights (2), HOA switches (2), pump disagree timer, phase voltage monitor relay, SCADA RTU with a radio telemetry unit, and an Auto-dialer. All switches, main circuit wiring, breakers and other devices shall be clearly and neatly labeled inside the control panel. Quantities will be required to be increased for stations with more than two pumps. See the Typical City Details attached as part of this Manual. A single line wiring diagram shall be included within the panel with a copy provided for the City's records.

30.14.03 Pump Alternator

An 8 pin plug-in solid state alternator (see approved Manufacturer's List attached as part of this Manual) shall be provided to change the pump starting sequence on each pumping cycle. A 3 position alternator test switch shall be provided to control the alternation operation. Switch positions to include the "Auto" to provide normal automatic sequence, "Off" position to disable alternator, and "Test" position with a spring return to allow the alternating of the pump sequence to check alternator operation.

30.14.04 Motor Starter and Selector Switches

The panel shall contain 2 motor starters. The motor starter shall be across the line magnetic starter with individual overload protection on each power leg with reset installed through the inner door unit. (See approved Manufacturer's List attached as part of this Manual.) Local Power Company Regulations shall govern.

Selector switches shall be installed on the face of the inner door unit. Selector switch shall be a heavy duty oil tight "Hand-Off-Auto" 3 position switch to control the operation mode of each pump motor starter.

30.14.05 Motor Circuit Protectors

Each pump motor shall be protected by a 3 pole motor circuit protector. (See approved Manufacturer's List attached as part of this Manual.) The Motor Circuit Protector shall be operated by a toggle-type handle and shall have a quick-make, quick-break, over center switching mechanism that is mechanically trip-free from the handle so that the contacts cannot be held closed against a short circuit and abnormal current, causing the Motor Circuit Protector to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal ON and OFF positions. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close, and trip simultaneously. Motor Circuit Protector must be completely enclosed in a high-strength, glass polyester molded case. Ampere ratings shall be clearly visible. Contacts shall be of non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. A manual push-to-trip button shall be provided for manual exercising of the trip mechanism. Each pole of these Motor Circuit Protector's shall provide instantaneous short circuit protection by means of an adjustable magnetic-only element.

30.14.06 Power Supply and Main Disconnect

Power supply to the control panel shall be either 240 volt, 3 phase, 4 wire or 480 volt, 3 phase, 4 wire. Minimum service shall be 100 amp. Single phase power shall not be accepted.

Non-fusible safety service main disconnects shall be installed at all stations. In all 240 volt systems, disconnects shall be installed between the meter and the panel and on all 480 volt systems disconnect shall be installed ahead of the meter. LED power available indicators shall be supplied on all legs.

30.14.07 Circuit Breakers

A) General

The control-panel shall include main circuit breakers and generator breaker with mechanical interlock, a circuit breaker and magnetic starter for each pump motor, and 20 amp, 120 volt circuit breakers as required.

B) Main Breakers

The panel shall have an inter-lock system between the normal power main breaker and the emergency breaker to ensure only one breaker is in the “on” position at a time. Both breakers shall be equal in size. (See approved Manufacturer's List attached as part of this Manual.)

C) Circuit Breakers

All circuit breakers shall be heavy duty molded case breakers. The handle on the circuit breakers shall be operational through the inner door. (See approved Manufacturer's List attached as part of this Manual.)

D) Padlock Attachment

A Square D HPAFK (or approved equal) handler padlock attachment shall be installed on all motor circuit breakers.

30.14.08 Emergency Power Receptacle

This item shall only be required on stations that do not have a permanent standby generator system. The panel shall have an external mounted generator receptacle of the required size. (See approved Manufacturer's List attached as part of this Manual.)

30.14.09 Wiring

All power wires shall be THW or THWN 75°C insulated stranded copper conductors, and shall be appropriately sized for the given load application. All control circuit wire shall be type THW, size 14, stranded type. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers. Wiring on the rear of the inner door shall be neatly bundled with nylon ties and include sufficient loop across the hinges to prevent wire damage, with each end of conductor marked (I.D.). Colors shall be red for 24 volt, white for neutral, black for 120 volts.

30.14.10 Terminal Points

Terminal points of all terminal strips shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All wiring shall be permanently shown on electrical schematic diagrams.

30.14.11 Engraved Nameplates

All circuit breakers, control switches, indicator pilot lights, and other control devices shall be identified with permanently affixed legend plates and lamicoi-d-type engraved nameplates where applicable.

30.14.12 Surge Protector

A surge protector shall be included and wired to protect motors and control equipment from lightning induced line surges. All surge protectors shall be UL approved and installed per respective power company requirements and manufacturers' specifications, surge protectors shall be attached to the main disconnects.

30.14.13 Elapsed Time Meters

Elapsed time meters shall be 115 volt non-reset type and shall totalize pump running time in hours and tenths of hours to 99999.9 hours.

30.14.14 Convenience Receptacle

On the face of the inner door unit, there shall be installed a 20 amp, 120 volt, duplex convenience receptacle. It shall be provided with it's own single pole, 20 amp circuit breaker for protection. Ground fault interrupt type shall be required.

30.14.15 Control Terminal Blocks

Control terminal blocks shall be of the clamp screw type, rated for 600 volts. Amperage rating shall accommodate the control circuit amperage. An additional 10 space terminal strip shall be installed in the cabinet for future use, in addition to the required number of terminals for alarms or signals as specified in the Typical City Details attached as part of this Manual.

30.14.16 Control Power Transformers

There shall be a control power transformer with a minimum size of 500 volt (AC) to provide 120 volt (AC) power for: coils for starters, 20 amp duplex receptacle, indicator pilot lights, alarm horn, alarm light, pump alternator, elapsed time meters etc. The secondary side shall have one leg fused and the other grounded. This control power transformer is required only on 480 volt control panels.

The signal required by the float switches and relays shall be 24 volt (AC). This shall be provided by a 24 volt (AC) control power transformer properly sized with a fused secondary.

30.14.17 Control Relay

The level control relays shall operate from 24 volt (AC). They shall be enclosed, plug-in 8 pin type with octal-style screw terminal sockets.

30.14.18 Electrical Schematic

There shall be permanently affixed to the interior side of the exterior enclosure door an electrical schematic diagram and a copy supplied to City personnel at start-up. The schematic diagram shall include the rated amperage and voltage for all components.

30.14.19 Phase Monitor

For all 240 volt stations an eight pin plug-in type phase monitor shall be provided for protection of electrical components due to phase loss. Adequate dummy pin protection shall be provided to prevent accidental interchanging of the eight pin phase monitor with the eight pin alternator. All 480 volt stations shall have surface mount type phase monitors.

30.14.20 Battery Backup

A 12 volt (DC) battery shall be supplied on all lift stations to insure operation of the SCADA system in the case of a power outage. Refer to the Typical City Details attached as part of this Manual.

30.14.21 Operation

The control panel shall respond to a pressure transducer coupled with SCADA control system as well as redundant liquid level float switches to automatically start and stop pumps as well as sound an alarm upon high or low wet well levels.

The control panel shall operate 2 electrical submersible pumps at the power characteristics stipulated. The control function shall provide for the operation of the lead pump under normal design conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump shall automatically start to handle this increased flow. As the flow decreases, pumps shall be cut off at elevation as shown on the plans. Pumps shall alternate positions as lead pump at the end of timing cycle. A failure of the alternator shall not disable the pumping system. The alternator shall include a safe, convenient method of manual alternation and also have provisions to prevent automatic alternation without disturbing any wiring. Should the "pump off" regulator fail, the system shall keep the station in operation and provide a visual indication of the regulator failure.

Normal operations shall be governed by the pressure transducer coupled with the SCADA control system. Upon abnormal wet well levels all pump control operations shall automatically revert to the redundant float type liquid level control system. These control components shall be mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle. A float type liquid level control system shall continuously monitor wet well liquid level and control

operation of the low-level cutoff for the pumps and shall operate off a 24 volt circuit. Alternate methods of liquid level measurement in the wet well may be considered on a case by case basis.

30.14.22 Housing

The duplex pump panel shall be housed in a NEMA 3R, Type 304, 14 Gauge stainless steel enclosure. Enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel. The outer door shall include a 3-point latch and stainless steel door handle as manufactured by Hoffman or approved equal.

There shall be, permanently affixed to the interior side of the exterior enclosure door, both a nameplate and a 10 inch x 12 inch pocket for log sheet storage. The nameplate shall contain the following information: voltage, phase, rated horsepower, speed, date manufactured and pump and control panel manufacturer's name, address and telephone number, pump data, including impeller data, operating point and head, KW input, and amperes at the operating point and at least 2 other points on the pump curve.

The control panel enclosure shall be Underwriters Laboratories (UL) 50 type 4X Listed.

30.14.23 Testing and Warranty

After fabrication in the control panel manufacturer's plant, an operational test shall be performed to check out the entire panel before delivery. Three phase source voltage to which the panel is intended for shall be used for the testing. The control panel manufacturer shall maintain a service organization in the State of Florida that is available for service. The manufacturer shall furnish a 5 year warranty against defects in materials and workmanship covering parts and labor on all items supplied under this Section.

Section 30.15 LIGHTS AND ALARMS

30.15.01 Indicator Lights

Heavy duty, oil tight, indicator lights as specified in the Typical City Details attached as part of this Manual shall be installed on the face of the inner door unit.

30.15.02 High Level Alarm

Two mercury float ball switches shall be provided as high and low level backup alarm switches to the telemetry system and to the red alarm signal light. A vapor proof red light and horn shall be mounted on top of the control panel enclosure for high level alarm. Also, there shall be an alarm silence push button on the inner door and a silence relay which will silence the horn and automatically reset when these signals are restored to normal. The push button shall be heavy duty oil tight. The red globe shall be the screw-on type.

Section 30.16 ELECTRICAL GROUNDING SYSTEM

30.16.01 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:

- A) Wet well cover.
- B) Valve vault cover.
- C) Control panels.
- D) Generator.
- E) Utility company transformer.
- F) Main disconnect switch.
- G) Fence.

30.16.02 Material and Installation

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

Section 30.17 STANDBY POWER GENERATOR SYSTEM

30.17.01 General

A standby power generator system shall be installed at pump stations as required by this Manual for electrical power during the loss of normal power. Standby power generators shall be provided at all stations having the following characteristics:

- A) 35 or greater total combined brake horsepower.
- B) Peak design capacity of 1,000 gpm or more.

- C) Arterial stations receiving flow from at least one other service area.
- D) Service area includes critical users as determined on a case by case review.
- E) Station with three or more pumps.

Generators shall be complete with all controls, automatic switchgear and shall produce 240 volts (AC), or 480 volts (AC), 3 phase, 4 wire power. Generator and controls shall be installed in an approved enclosure.

30.17.02 Generator Set 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 (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.

30.17.03 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 equipment 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 1 year from the date of equipment start-up.

30.17.04 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, in the presence of the City's representative, shall be conducted at the site after installation has been completed. 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 8 hours, carrying normal lift station loads. The Contractor shall refill the main fuel tank at the completion of the tests.

30.17.05 Ratings

The rating of the generator shall be as specified in the Typical City Details attached as part of this Manual. 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.

30.17.06 Engine

The engine shall be water cooled, four stroke cycle, compression ignition diesel, LP or natural gas. 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, where applicable. 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 $\pm 0.25\%$ under steady state conditions. The engine shall start and assume its rated load within 10 seconds, including transfer time.

30.17.07 Generator

The generator shall be a 3 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 $\pm 2\%$ 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 $\pm 5\%$.

30.17.08 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:

A) 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. An emergency shut down lever switch shall be provided on the air intake.

B) Metering Equipment

Metering equipment shall include 3½ inch meters (dial or digital type frequency meter, 2% 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.

C) Fault Indicators

Individual press-to-test fault indicator lights for low oil pressure, high water temperature, low water level, over speed, over crank, and for day tank high and low fuel level shall be provided.

D) Function Switch

A four position function switch marked “Auto”, “Manual”, “Off/Reset”, and “Stop” shall be provided.

30.17.09 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 7 day/24 hour timer control.

30.17.10 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 and shall be furnished with proper cables and connectors, together with rack and standard maintenance accessories. The battery shall be provided with a 48 month warranty for replacement if found to be defective.

30.17.11 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.

30.17.12 Utility Connections

All connections to the generator set shall be flexible.

30.17.13 Cooling System

The generator set shall be equipped with an engine mounted radiator sized to maintain safe operation at 110°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 50% glycol-water solution.

30.17.14 Fuel System

An above ground, vaulted, main fuel oil storage tank with float switch, and fuel level indication, LP or natural gas tank 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.

Above ground vaulted fuel oil tanks shall be equipped with an overflow containment system supplied by the tank manufacturer.

Fuel oil piping, including mounting of any required fuel tanks, shall be furnished and installed by the Contractor and shall have double wall containment for all piping. The Contractor shall be required to permit the fuel system through the County and FDEP.

30.17.15 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. The exhaust system shall not exceed residential noise limit requirements.

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.

30.17.16 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 14 or 16 gauge sheet metal suitably reinforced to be vibration free in the operating mode. Four hinged doors shall be provided to allow complete access without their removal. Each door shall have at least 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.

30.17.17 Automatic Transfer Switch

The automatic transfer switch shall be part of the control panel. The transfer switch shall be provided with the following features:

- A) Complete protection, close differential voltage sensing relays monitoring all 3 phases (pick-up set for 95% of nominal voltage, drop-out set for 85% nominal voltage).
- B) Voltage sensing relay on emergency source (pick-up set for 95% of nominal frequency).

- C) Time delay on engine starting--adjustable from 1 second to 300 seconds (factory set at 3 seconds).
- D) Time delay normal to emergency transfer--adjustable from 0 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.
- E) Time delay emergency to normal transfer--adjustable 30 seconds to 30 minutes (factory set at 5 minutes), and time delay bypass switch shall be provided on door of the switch cabinet.
- F) 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.

30.17.18 Warranty

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

Section 30.18 FENCING

All pump station sites shall be fenced. However, exception to this requirement on a case by case basis and subject to sufficient landscape screening. 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 as specified in ARTICLE 20 and the Typical City Details attached as part of this Manual.

Chain link fence shall be 6 feet high, in accordance with this Manual. One 12 foot double swing drive gate (two 6 foot leaves),hinged to swing through 180° from open to close to open, with center drop rod assembly latch (no post) and gate hold backs for both leaves shall be installed, complete with latches, locking device, stops keeper, hinges, fabric and braces. Gate shall open outward from station. 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 and gate 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.

All posts shall be set 3 feet deep in concrete footings, 12 inches in diameter for line posts, gate and corner posts. After the post has been set, aligned and plumbed, the hole shall be filled with 3,000 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.

Section 30.19 TOOLS AND SPARE PARTS

One set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

The pump and control panel manufacturer(s) shall provide a suggested list of spare parts for the equipment being supplied for the pump station. The cost of the spare parts shall not be less than \$5,000.00 based upon the manufacturers published suggested list price for the parts. The City will review the recommended list and will either approve or modify the list as they deem necessary. Any modifications made to the list will be made so that the cost remains within the above required limit. All spare parts are required to be provided to the City prior to final inspection and start-up of the station.

Section 30.20 PUMP STATION WATER SYSTEM

All wastewater pump stations shall be provided with a water system with adequate capacity and pressure for station wash down and other requirements. The station water system shall be completely separated from the potable water supply by means of a metered, reduced pressure type backflow preventer

Section 30.21 INSPECTION AND TESTING

A factory representative knowledgeable in pump operation and maintenance shall inspect and supervise a test run at the pumping station in the presence of the City Engineer or his Designee. The City shall be provided 24 hour notice before this inspection is to commence. A minimum of 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 this 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 this Manual have been met by the equipment as installed, and shall include, but not be limited to, the following tests:

- A) That all units have been properly installed.
- B) That the units operate without overheating or overloading any parts and without objectionable vibration.
- C) That there are no mechanical defects in any of the parts.
- D) That the pumps can deliver the specified pressure and quantity.
- E) That the pumps are capable of pumping the specified material.
- F) That the pump controls perform satisfactorily.

Section 30.22 LIFT STATION SERVICES

The necessary utility services (electrical power, telephone, water) shall be provided by the Owner/Developer and accounts for such services shall be transferred to the City of Ocoee prior to issuance of a Certificate of Completion for facilities that are to be dedicated to the City.

Section 30.23 REQUIRED SUBMITTALS

Submittals shall be provided to the City, for any lift stations to be taken over by the City, in triplicate and include the following:

- A) As-Built Drawings providing a detail showing fencing, gates, all important details of construction, dimensions, anchor bolt locations, and the flow meter and valve pit relative to the lift station, including but not limited to all elevations, such as inverts, floor elevations and finished grades, etc. All the above improvements shall be included inside the fenced-in area. The approach road and driveway shall also be shown. The Drawing shall be fully dimensioned and in State Plane coordinates.
- B) Descriptive literature, bulletins, and/or catalogs of the equipment, both hard copy as well as electronic "PDF" files.
- C) 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 8½" by 11" 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.
- D) Complete layouts, wiring diagrams, telemetry 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.
- E) A drawing showing the layout of the pump control panel shall be furnished. The layout shall indicate all devices mounted on the door and the panel shall be completely identified.
- F) The weight of each pump.
- G) Complete motor data shall be submitted including:
 - 1) Nameplate identification.
 - 2) No-load current.

- 3) Full load current.
- 4) Full load efficiency.
- 5) Locked rotor current.
- 6) High potential test data.
- 7) Bearing Inspection report.

Section 30.24 MINOR LIFT STATION

The City has developed a minor wastewater pump station for small service areas to promote the City's effort to extend centralized sewer and mitigate certain impacts to development for land owners. This application of this station is limited as stated below and is only applicable to stations that will be dedicated to the City. The City established the application of a minor lift station, by specifically specifying pump make, model, and size, wetwell type and size, and all the stations applicable appurtenances. The modification and/or substitution of any critical element of the minor station shall not be allowed.

The approved application of the Minor Lift station shall be subject to all of the following conditions:

1. Developments that cannot feasibly gravity flow to an existing City sewer collection manhole or pump station; and
2. Developments provide an acceptable lift station site with collection and discharge routing access to either be by fee simple dedication(s) or granted easement(s); and
3. Developments connecting to a manhole or existing forcemain where pumping from the minor lift station discharge is not less than (4) feet per second at peak system pressures and ultimate service shall not require runtime of greater than 60% during peak hour; and
4. Station shall ultimately realize service to three (3) or more developments; and
5. Ultimate volume-metric service to the station shall be 10 or greater equivalent residential units (ERU) but no more than 40 ERUs.