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SECTION 2350

SANITARY SEWER LIFT STATION

2351 GENERAL REQUIREMENTS

2351.1 Scope

This specification shall govern the furnishing of all materials, labor, equipment, tools, and other services to construct a submersible lift station, complete with submersible non-clog pumps, motors, discharge elbows, access hatch, portable hoist, guide system, reinforced concrete wet well and emergency generator as specified in this section and as shown on the drawings.

2351.2 Abbreviations

Wherever the words, forms, or phrases herein defined or pronouns used in their stead occur in these specifications, in the contract or in the Advertisement of any document or instrument herein contemplated or to which these specifications apply, the intent and mean shall be interpreted as defined in the General Conditions of the Construction Contract.

2351.3 Codes, Specifications and Standards

Codes, specifications and standards referred to by title or number shall form a part of these standards. Latest revisions shall apply in all cases. Specific reference standards include:

- A. Water Pollution Control Construction Standards, Rule No. 655, ODEQ
- B. Wastewater Collection Systems Management, MOP 7, 5th Addition, WEF
- C. Code of Ordinances, City of Owasso

2351.4 Quality Assurance

- A. The pumping unit manufacturer shall test each pump for mechanical and electrical correctness.
- B. Field tests shall be completed as specified in this Section.

2351.5 Submittals

- A. Submittals shall be as specified in the General Conditions of the Construction Contract.
- B. Submit the following:
 - 1. Manufacturer's certificate certifying compliance with the referenced specifications and standards.
 - 2. Shop drawings with performance data and physical characteristics.
 - 3. Manufacturer's installation instructions.
 - 4. Manufacturer's operation and maintenance material and manuals.

5. Certified copies of test reports.

2351.6 Products

- A. The Contractor shall be responsible for the delivery, storage, and handling of products.
- B. All pumps, motors, and appurtenances shall be loaded and unloaded by hoists or skidding. Products shall not be dropped, skidded, or rolled against other products. Slings and hooks shall be padded in such a manner to prevent damage to products.
- C. Pumps shall be packaged in such a manner as to provide ample protection from damage during handing, shipment, and outdoor storage at the lift station site. All openings shall be capped with dustproof closures and all edges sealed or taped to provide a dust-tight closure.
- D. Damage products shall be removed promptly from the job site and replaced with undamaged products.

2352 PRODUCTS

2352.1 Pump Materials

- A. Pump materials shall meet the requirements of the latest editions of the following specifications:

<u>Material</u>	<u>Specification Designation</u>
Cast Iron	ASTM A-48, Class 30
Stainless Steel	ANSI Type 316L, 304, and 431
Bronze	ASTM B-144, Class 3B
Hot Rolled Steel	ASTM A 107-50-T Gr. 1015 .20 Cu.Min.
Cold Rolled Steel	ASTM A 108-50-T Gr. 1141 Turned, Ground & Polished
Ductile Iron Pipe	ANSI A21.51/AWWA C151
Internal Lining	Protector 401 Ceramic Epoxy, 40 mil thick

- B. Where applicable specifications are not designed herein, supply high class commercial grades of materials that meet the requirements specified and which are satisfactory to the Engineer.
- C. The following pump manufacturers are permitted: ABS, Flygt Corporation, Barnes Pumps, Inc., PACO Pumps, Inc., Hydromatic, Myers, Peabody Barnes or accepted equal.

2352.2 Pump Design

- A. Pumps shall be capable of handling raw, unscreened sewage and minimum size 3-inch spherical solids.
- B. The design shall be such that the pump unit will be automatically and firmly connected to the discharge piping when lowered into place on its mating discharge connection, which shall be permanently installed in the wet well.

- C. The pump shall be easily removable for inspection or service, requiring no bolts, nuts, or other fastenings to be disconnected. For this purpose, there shall be no need for personnel to enter the wet well.
- D. Each pump shall be fitted with a stainless steel lifting chain or cable of adequate strength and length to permit raising and lowering the pump for inspection and removal.
- E. The pump, with all its appurtenances and cable, shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65 feet.

2352.3 Pump Construction

- A. All major parts, such as stator casing, oil casing, sliding bracket, volute and impeller, shall be gray cast iron, Class 30, with smooth surfaces devoid of blow holes and other irregularities. All surfaces coming in contact with sewage shall be protected by an accepted epoxy coating. All exposed bolts and nuts shall be stainless steel.
- B. A wear ring system shall be installed to provide efficient sealing between the volute and impeller. Pumps whose design does not require a wear ring shall be considered equal if a means is provided to maintain close tolerance between the impeller and the volute.
- C. The impeller shall be gray cast iron of a non-clogging design capable of handling solids, fibrous materials, heavy sludge, and other matter found in normal sewage applications. The impeller shall be constructed with a long throughlet without acute turns. The impeller shall be dynamically balanced. Static and dynamic balancing operations shall not deform or weaken it. The impeller shall be slip fit to the shaft and key driven. Non-corroding fasteners shall be used.
 - 1. When double shrouded impellers are used, a wear ring system shall be installed to provide efficient sealing between the volute and impeller. The wear ring shall consist of a stationary ring made of nitrile rubber molded with a steel ring insert which is drive-fitted to the volute inlet and rotating stainless steel ANSI 304 ring which is drive-fitted to the impeller eye.
 - 2. The volute shall be of single piece design and shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller.
- D. Pump shall be provided with a mechanical rotating shaft seal system running in an oil reservoir having separate, constantly hydro-dynamically lubricated lapped seal faces. The oil reservoir should have drain and fill plugs allowing oil changes without disassembly. The (lower) seal unit between the pump and the oil chamber shall contain one stationary and one positively driven rotating tungsten-carbide ring.
- E. The (upper) seal unit between the oil sump and motor housing shall contain one stationary tungsten-carbide ring and one positively driven rotating carbon ring. Each interface shall be held in contact by a spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. Shaft seals which are lubricated by oil and not the pumped liquid may utilize carbon and ceramic, Type 21, to be considered equal. The shaft sealing system shall be capable of operating when the pump is submerged to depths of/or pressures equivalent to 65 feet. No seal damage shall result from operating the pumping unit out of its liquid environment for

extended periods of time. The pump shall be capable of operating for 24 hours in a dry condition without damage to the pump motor or mechanical seal.

- F. The pump shaft shall be stainless steel ANSI 431 or hard chrome plated carbon steel.
- G. The cable entry water seal design shall be such that precludes specific torque requirements to ensure a watertight and submersible seal. Epoxy filled terminal housing shall be considered equal providing individual wire leads are spliced in the motor terminal housing and the individual splice caps are filled with epoxy; such construction shall not require a terminal board to isolate the motor interior and the pump top.
- H. All mating surfaces of major parts shall be machined and fitted with nitrile O-rings where watertight sealing is required.
- I. Machining and fitting shall be such that sealing is accomplished by automatic compression in two planes and O-ring contact made on four surfaces. Square rings which provide the controlled compression of an O-ring and the ease of assembly of a flat gasket shall be considered equal.
- J. Tolerances of all parts shall be such that allows replacement of any part without additional machining required to ensure sealing as described above.
- K. Each unit shall be provided with an adequately designed cooling system. Thermal radiators integral to the stator housing, cast in one unit, are acceptable. Units which utilize an oil-filled motor and which operate considerably cooler than air-filled motors shall not require additional cooling to be considered equal. Thermal radiators integral to the stator housing, cast in one unit, are acceptable.
- L. Internal thermal sensors shall be required on each pump. Thermal sensors shall be required on each pump motor and be fitted with external dry contacts for monitoring. Thermal sensors shall be used to monitor stator temperatures. There shall be one for each phase group in the motors. These shall be used in conjunction with and supplemental to external motor overcurrent protection and they shall be located in the control panel. The internal thermal sensors shall show and/or sound an alarm and automatically shutdown the pump before motor damage occurs.
- M. Moisture sensing probes shall be installed in the mechanical seal cavity of each pump unit. These probes shall sense the intrusion of the pumped liquid into the seal cavity, send a signal to the panel mounted alarm device, and shut the pump down immediately. The alarm device shall be activated until the pump is removed from service/or repair. Maintenance crews shall be able to be to silence manually the alarm from the site.

2352.4 Guide System

- A. A sliding guide bracket shall be an integral part of the pump unit. The volute casing shall have a machined discharge flange to automatically and firmly connect with the cast iron discharge connection which, when bolted to the floor of the sump and discharge line, will receive the pump discharge connecting flange without the need of adjustment, fasteners, clamps, or similar devices.

- B. Installation of a pump unit to the discharge connection shall be the result of a simple linear downward motion of the pump unit guided by two guide rails, a T-bar, or other suitable guide system.
- C. Guide rails or pipes or other suitable guide system shall be constructed using stainless steel material or pipe (Schedule 40, Grade 304).

2352.5 Motor

- A. The pump motor shall be housed in an air-filled, watertight casing and shall have moisture resistant Class F 155C insulation. Oil-filled motors shall be considered equal providing they are the standard design of a U.S. manufacturer and do not utilize a heat shrunk, pressed in stator assembly. The motor shall be NEMA Design B and designed for continuous duty, capable of sustaining a minimum of 10 starts per hour. No motor winding damage shall result from operating the pumping unit out of its liquid environment for extended periods of time.
- B. Pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable. Unless otherwise noted, provide adequate cable to complete the installation shown on the drawings.

2352.6 Electrical Controls

- A. Lift station controls shall consist of a telemetry package for monitoring purposes including a remote terminal unit, modems, radios, network devices, cables and any antenna tower requirements. All components must be suitable for continuous operation in the existing environment including suitable protection devices. The package must contain its own standby power battery supply system and charger. Monitoring points shall include:

Pump run	Pump flow	Seal fail	High temp
AC power fail	Generator run	Pump run time	High wet well
High dry well	Tamper/intruder detect		

- B. Automatic control center shall be equipped with individual disconnects, 3-pole manual transfer switch, 4-pole standby generator receptacle to match generator plug, across-the-line starters, alternator, automatic transfer to non-operating pump in event of overload in operation pump, motor overloads complete with isolated contact for telemetering, overload reset, hand-off-automatic pump operation selector switch, 120 volt transformer for alarm light and duplex 120 volt convenience outlet, a normally closed float with connections for high-level alarm, motor fail (2) and motor run (2), all components housed in NEMA 4 dead front construction for pole mounting enclosures. A spare single pole 20A circuit breaker shall be provided to power telemetry panel (TP). 120 VAC power shall be brought to the terminal board in addition to alarm and motor run signals. A thermostatically controlled heater and lightning protection will also be included in the motor control center. Also furnish and install four liquid level sensors consisting of mercury switches in a smooth, chemical resistant polypropylene casing, suspended on its own cable. The control center shall be installed in a location as shown on the drawings. Control panel shall be provided with a keyed locking arrangement. No

splicing of electrical cables shall be permitted. All cables and wires must terminate inside the control panel.

- C. The lift station shall contain the electrical system consisting of all wiring, conduits, conductors, red warning lights, and audio alarm. Power connection to the motor shall be by watertight thread rubber gasket type fitting designed to allow easy disconnect or as recommended by the manufacturer of the pumps and accepted by the Engineer. All connection conduit junction boxes, electrical wiring, light fixtures, etc., inside the pump wet well shall be explosion-proof. All electrical work shall conform to the National Electric Code.

2352.7 Alarms

- A. Lift stations shall have a visual and audible alarm.
- B. Alarms shall activate under the following conditions:
 - 1. When the water level rises above the invert of the lowest gravity sewer entering the manhole.
 - 2. When the lead pump is called for and does not respond.

2352.8 Electric Hoist

The hoist shall be an electrically-operated hoist for pump removal. It shall be capable of lifting the weight of the largest pump with a safety factor of 2. The main voltage will be as required for the service location and power voltage but not more than 115/1/60. For pumps less than 20 horsepower, hoists shall be mounted on a pedestal type jib crane with a 360-degree rotation, rotation stops and a manual trolley. The jib crane shall be of sufficient height and span to access removal of all pumps. For pumps 20 horsepower and larger, hoists shall have a motorized trolley mounted from a monorail beam centered over the operating area. Equipment shall be compatible for outdoor use and be similar or equal to that manufactured by Americrane and Hoist, LLC; Gaffey, a division of Crane Equipment Services, or equal.

2352.9 Emergency Generator

- A. Lift stations shall be equipped with a reserve power generator.
- B. The engine-powered generator shall be operated with natural gas, if available.
- C. The generator shall be designed to automatically start and operate the pumps(s) and other equipment in the lift station under design flow conditions.
- D. The generator shall be equipped with a weather-tight removable cover.
- E. The generator shall be fitted with a power fail contact and a “generator RUN” contact compatible with the SCADA system.

2352.10 Piping Materials

A. Pipe

1. Ductile iron pipe shall meet the requirements of ANSI A21.51/AWWA C151. Minimum thickness class shall be as follows:

<u>Size Range</u>	<u>Pressure Class</u>
12" and smaller	350
14" - 24"	250
30" and larger	150

2. Pipe joints shall be flanged ductile iron. Push-on type joints may be approved in special circumstances and shall meet the requirements of ANSI/AWWA A21.11/C111. Restrained joints shall be Lok-Ring, Lok-Fast, Lok-Tyte, or equal.

B. Fittings

1. Fittings shall be gray iron or ductile iron and shall meet the requirements of ANSI A21.11/Awwa C110 or A21.53/C153. Design and manufacture fittings for a pressure rating of 150 psig. Fitting joints shall be mechanical joints or restrained push-on joints. Joints shall meet the requirements of ANSI/AWWA A21.11/C111. Thrust blocking or restrained joints may be as required or necessary.

C. Valves

1. Plug valves shall be DeZurik, Series 100, Homestead Ballcentric, or equal. Eccentric plug valves shall be non-lubricated with resilient sealing plug surface, or epoxy coating surfaces having screwed, flanged, or mechanical joint ends as shown on the plans or as detailed in the valve list in the specifications. Port areas shall be at least 80% of full pipe area. Valve shall have permanently lubricated, stainless steel bearings in the upper and lower stem journals. Valve seats shall have high nickel content on all surfaces contacting the plug face. To demonstrate proof of design and cycle life, manufacturer shall submit test data per AWWA C504. The valves shall provide drip-tight shutoff in either direction up to 150 psig. Flanged valves shall be faced and drilled to ANSI B.16.1, Class 125 standard. Flanges of valves through 12 inches shall have face-to-face dimensions of AWWA standard gate valves.
2. Single disc, swing check valves, 4 inches and larger, shall be iron body, bronze-mounted, swing check, bolted cover, flanged ends, as specified in Section 2300, suitable for use in a horizontal position. Flanges shall be drilled and faced for ANSI 21.15.
3. Valves shall be equipped with arms for manual opening ability for back flushing. The arms shall trip and external switch to indicate flow.

2352.11 Concrete Wet Well and Valve Vault

- A. The Contractor shall furnish and install a monolithic concrete or precast manhole type wet well as indicated on the drawings. Pump and related equipment shall be installed and/or mounted per the manufacturers recommendations.
- B. A concrete valve vault shall be furnished and installed to house the valves and appurtenances.
- C. Precast manhole sections shall conform to requirements of ASTM Specifications C478.
- D. Contractor may offer wet well sections conforming to ASTM C-76, Class IV, Wall B pipe sections.
- E. A means of supporting valves and pipe works shall be included, and shall consist of either concrete cast pedestals or screw jack saddles.

2353 CONSTRUCTION

2353.1 Inspection

All pumps, motors, and appurtenances shall be inspected by the Engineer prior to installation in the work. Damaged or unsuitable products shall be removed promptly from the job site and replaced with new, undamaged and suitable products.

2353.2 Installation

- A. Submersible pumps shall be installed in accordance with the drawings and manufacturer's written instructions.
- B. The discharge elbow of each pump shall be securely anchored to the wet well base and properly aligned with the guide system and upper guide bracket.
- C. The discharge piping shall be properly anchored and supported inside the manhole.
- D. All electrical work shall be done by a qualified electrician and shall conform to the National Electric Code.

2353.3 Testing

- A. Each pump shall be fully tested in accordance with manufacturer's written instructions. Certified copies of the test results shall be furnished with each pumping unit. Test voltage and amperage shall be measured and recorded.
- B. Monitoring system: All components of the telemetry shall be tested and verified as to functionality and compatibility with the SCADA system.

2353.4 Warranty

- A. The pump manufacturer shall warrant the pumps furnished against defects in workmanship and materials for a minimum period of two years under normal use,

operation, and service. In addition, the manufacturer shall replace certain parts which shall become defective through normal use and wear or a progressive schedule of cost for a period of five years; parts included are the mechanical seal, impeller, pump housing, wear ring, and ball bearings. The warranty shall be in published form and apply to all units.

- B. The manufacturer shall provide as part of his bid price the services of a factory trained representative for a period of one day at each lift station to perform initial start-up of the pumping station, to instruct operating personnel in the operation and maintenance of the equipment, and to demonstrate satisfactorily the performance of each piece of equipment.
- C. All equipment supplied and installed under this item of the specifications shall meet the requirements of the Occupational Safety & Health Act of 1970.

2354 APPLICABLE STANDARD DETAILS

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