trunnions. Bearings shall be corrosion resistant and have a low coefficient of friction.

3. Valves shall be able to pass a sphere not less than 80% of the diameter of the valve size.
4. Valve Operators

   - All valves regardless of size shall be provided with a Manual Gear Operator sized so that the maximum rim pull required is not more than 80 pounds.
   - Valves three inches (3”) through twelve inches (12") shall be rated at 175 pounds.
   - Valves fourteen inches (14") and larger shall be rated at 150 pounds when pressure is applied from the preferred direction. These valves have a preferred direction of shut-off, and it is the responsibility of the contractor to see that they are property installed.

Acceptable Manufacturer: Valves are to be Milliken, fig. #601-N, Victaulic Series 365, Val-Matic Cam-Centric® 5800 series, or approved equal.

B. Check Valves
Check valves shall be of the swing check type with iron body and bronze trim. Check valves shall be flanged end type or grooved end type with weighted arms.

Acceptable Manufacturer: Check Valves shall be Victaulic Series 317, or approved equal.

4.6 VALVE CHAMBER DRAIN VALVE

A backwater check valve shall be installed on the valve chamber drain line. The valve shall be installed as follows;

A 4-inch diameter PVC stub shall be glued into the 4-inch diameter coupler cast into the wet well wall at the valve chamber floor line. A 90 degree elbow shall be glued to this stub and directed toward the wet well floor. A (4" x 3') PVC stub shall be glued into the other end of the elbow. The check valve shall then be slipped on to the stub and attached with two (2) stainless steel clamps to be supplied by the vendor.

Acceptable Manufacturer: The valve shall be a “Tide-Flex” series TF-2, 4-inch (slip on) check valve, by Red Valve Co., EVA Type CPO-4, or Proco ProFlex™ Style 730.

4.7 PRESSURE SENSORS

Each installed pump shall have an in-line full ported pressure sensor installed on the pump side of the discharge line. The sensor shall be located in the valve chamber ahead of the plug and check

valve. Sensor specifications are provided in Section 6.9.

4.8 GRAVITY LINES ENTERING THE STATION

PVC (DR18) shall be used on sections of gravity lines running from:

- The last manhole preceding the station up to the station
- The outfall of the detention pipes up to the station. This outfall line shall be a minimum of 12-inches in diameter.

4.9 DETENTION PIPE

Detention pipe(s) shall be a minimum of Class II, O-ring type reinforced concrete pipe. In areas where there will be vehicular traffic Class III, O-ring reinforced concrete pipe shall be required as a minimum unless other factors dictate another pipe class. All detention pipe(s) will be epoxy lined with Raven Lining Systems Raven 405, Terre Hill Composites Multiplex Liner THC-610-SL-68, or approved equal.

The detention pipe ends shall be bulkheaded using pre-cast bulkheads with a soil-tight and water-tight gasket installed in the outfall side and epoxy lined as specified above.

4.10 QUICK CONNECT BYPASS

A bypass fitting shall be made available for connecting a portable pump to the forcemain to bypass the lift station. Said bypass shall be 6” stainless steel terminating in a 90 degree bend in accordance with the standard details. A Global type "F" male thread to male cam and groove adapter shall be attached to the 90 degree bend. A Male Cam Lock dust plug shall be supplied.

Connection to the forcemain shall be accomplished by a tee to the force main with appropriate restraint as shown in the standard details. A plug valve shall be located along the bypass piping between the forcemain and the cam lock connection. This connection point shall be contained within a 36” x 36” meter pit and a standard manhole frame and cover shall provide the access point.

4.11 FLOWMETER

A flowmeter shall be installed within a separate concrete vault as detailed in the standard details. See section 6.11 for additional information.

SECTION 5 - SUBMERSIBLE WASTEWATER PUMPS

5.1 MINIMUM STANDARDS

Pump selection shall be based on the following minimum standards:

- Single-phase pumps are not acceptable.
- Pumps less than three horsepower (3 Hp) are not acceptable.
- Non-clog pumps are the preferred type pumps
- City will only allow the use of grinder pumps upon receipt of a written request for variance and acceptable justification.
- All pumps, with the exception of grinder pumps, shall be capable of passing spheres of at least three inches (7.6 cm) in diameter. Pump suction and discharge piping shall be at least four inches (10.2 cm) in diameter, with the exception of grinder pumps, which shall require City concurrence for size of the pump suction and discharge piping.

5.2 PUMP SPECIFICATIONS

The pump(s) shall be non-clog solids handling submersible capable of handling raw, unscreened sewage. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump(s) shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the pump well. A simple linear downward motion of the pump shall accomplish sealing of the pumping unit to the discharge connection elbow. A sliding guide bracket shall be an integral part of the pump unit. No portion of the pump shall bear directly on the floor of the sump. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

A. Major Components
Major pump components shall be of gray stainless steel, Class 30 or ASTM A-48, Class 35B, with smooth surfaces devoid of blowholes and other irregularities. Where watertight sealing is required, O-rings made of nitrile rubber shall be used. All exposed nuts and bolts shall be of ASTM A167 304 or AISI type 316 stainless steel.

B. Watertight Seals
All mating surfaces where watertight seating is required shall be machined and fitted with nitrile O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. This will result in controlled compression of nitrile rubber O-rings without requirement of a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease or other devices shall be used.

The cable entry water seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable

outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of the sealing the cable.

The assembly shall bear against a shoulder in the pump top. 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 materials gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

The junction chamber, containing the terminal board, shall be sealed from the motor by elastomer compression seal (O-rings). Where a sealed junction chamber is not used, the motor chamber shall be fitted with a moisture detection probe. The probe shall be connected to and activate a warning light in the control panel.

Connection between the cable conductors and stator leads shall be made with threaded compressed type binding post permanently affixed to a terminal board and thus perfectly leak proof.

An acceptable alternate design would be that the cable entry system shall consist of submersible plug assembly which allows the cable to be easily disconnected from the pump for service or replacement. Cable sealing shall be accomplished by a Nitrile compression grommet with both cylindrical and conical sealing surfaces, flanked by a stainless steel washer and an integrated strain relief. The plug assembly shall be fastened with stainless steel fasteners and shall be sealed by an o-ring.

The system shall be anti-wicking by design, and shall prevent any water that enters the cable through damage to the jacket from entering the motor. Cable entry designs which utilize potting compounds to provide a water tight seal, or those which do not allow the cable to be easily changed in the field shall not be considered equal.

C. Cooling System

The motor shall be capable of operating, completely submerged, partially submerged, or unsubmerged. For submerged (wet-pit) applications, the motor shall be self-cooling via the process fluid surrounding the motor.

For unsubmerged (dry-pit) or partially submerged applications, the motor shall include either an integrated oil cooling system or a closed-loop cooling system.

For an integrated oil cooling system, the system shall be utilized to enhance heat transfer, and allow the motor to operate at full rated power continuously without the need for de-rating or reduced duty cycle.

For a factory installed closed-loop cooling system, the system shall be of gray stainless steel, EN-GJL-250 (ASTM A-48, Class 35B), fabricated steel, or stainless steel, and adequately designed to allow the motor to run continuously under full load while in an unsubmerged (dry-pit) or minimally submerged condition without the need for de-rating or reduced duty

cycle. A cooling jacket shall surround the stator housing, and an environmentally safe nontoxic propylene glycol solution shall be circulated through the jacket by an axial flow circulating impeller attached to the main motor shaft. The coolant shall be pumped through an integrated heat exchanger in the base of the motor whenever the motor is running, allowing excess heat to be transferred to the process liquid.

Cooling systems that circulate the pumped medium through the cooling jacket, or those that use a toxic cooling liquid shall not be acceptable. The use of external heat exchangers, fans, or the supply of supplemental cooling liquid shall not be required. No external coolant supply or external cooling jacket shall be required for dry-pit applications.

D. Impellers
The impeller shall be constructed of gray stainless steel, ASTM A-48 Class 30 or 35B. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in normal sewage applications. The impeller shall be non-clogging and of the semi open (single shroud), enclosed (double shroud), or vortex design. The impeller shall be capable of passing a minimum 3-inch solid sphere. The fit between the impeller and shaft shall be a sliding fit with one key, and shall be securely fastened to the shaft by a stainless steel bolt which is mechanically prevented from loosening by a positively engaged ratcheting washer assembly.

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 stainless steel or stainless steel insert which is drive fitted to the volute inlet and rotating stainless steel ring which is drive-fitted to the impeller eye.

When single shrouded impellers are used, the volute shall be fitted with an adjustable replaceable front plate. The front plate shall be designed with a wave shaped inlet and an outward spiraling V-shaped groove on the side forcing the impeller to shred and force stringy solids outward from the impeller and through the pump discharge. The wear plate shall be mounted to the volute with three stainless steel securing screws and three stainless steel adjusting screws to permit close tolerance adjustment between the wear plate and impeller for maximum pump efficiency.

When vortex impellers are used, the impeller shall be an open multi vane design. The impeller shall have a slip fit onto the motor shaft and drive key, and shall be securely fastened to the shaft by a stainless steel bolt which is mechanically prevented from loosening by a positively engaged ratcheting washer assembly. The head of the impeller bolt shall be effectively recessed within the impeller bore to prevent disruption of the flow stream and loss of hydraulic efficiency. The impeller shall be dynamically balanced to the ISO 10816 standard to provide smooth vibration free operation

The volute shall be of single piece gray stainless steel, ASTM A-48, Class 35B design and shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller. The discharge flange design shall permit attachment to standard ANSI or metric flanges/appurtenances. Proprietary or non-standard flange dimensions shall not be considered acceptable.

E. Pump Motor

The pump motor shall be squirrel-cage, induction, and shell type NEMA type B design, housed in an air-filled watertight chamber. The stator winding and stator leads shall be insulated with moisture resistant Class H insulation materials, rated for 180ºC (356ºF). The motor shall be designed for continuous duty, capable of sustaining a minimum of ten (10) starts per hour. The maximum continuous temperature of the pumped liquid shall be 40ºC (104ºF), and intermittently up to 50ºC (122ºF). The service factor (as defined by the NEMA MG1 standard) shall be a minimum of 1.15. The motor shall have a voltage tolerance of +/- 10% from nominal, and a phase to phase voltage imbalance tolerance of 1%. The rotor bars and short circuit rings shall be made of cast aluminum.

The pump motor cable, installed, shall be suitable for submersible pump application. Cable sizing shall conform to NEC specifications for pump motors.

The motor shall have a NEMA Class A temperature rise for submerged service, providing cool operation under all operating conditions.

The motor shall be FM approved for use in NEC Class I, Division I, Groups C & D hazardous locations. The surface temperature rating shall be T3C. The motor shall meet the requirements of NEMA MG1 Part 30 and 31 for operation on PWM type Variable Frequency Drives.

F. Thermal Sensors
Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with three (3) thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase). These shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel.

G. Pump Shaft
Each pump shall be provided with an oil chamber for the shaft sealing system. The drain and inspection plug, with positive anti-leak seal, shall be accessible from the outside.

The pump shaft shall rotate on two (2) permanently lubricated ceramic bearings. The upper bearing shall be a single row deep groove ball bearing and the lower bearing a two row angular contact ball bearing. L-10 bearing life shall be a minimum of 50,000 hours at flows ranging from ½ of BEP flow to 1½ times BEP flow (BEP is best efficiency point).

The pump shaft shall be AISI 420 stainless steel. The pump shaft and motor shaft shall be an integral, one piece unit adequately designed to meet the maximum torque required at any normal start-up condition or operating point in the system. The maximum shaft deflection shall not exceed .05 mm (.002 inch) at the lower seal during normal pump operation.

H. Mechanical Seals
Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. Seals shall run in an oil reservoir. Lapped seal faces must be hydro-dynamically lubricated at a constant rate. The lower seal unit, between the pump and oil chamber, shall contain one stationary and one positively driven rotating silicon carbide or tungsten carbide ring. The upper seal unit, between the oil sump and motor housing, shall contain one hard metal ring and one carbon ring, or angled to the shaft lip type seal in grinder pump applications. Each interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The seal system shall not rely upon the pumped media for lubrication and shall not be damaged when the pump is run dry. Lubricant in the chamber shall be environmentally safe nontoxic material.

The following seal types shall not be considered equal: Seals of proprietary design, or seals manufactured by other than major independent seal manufacturing companies. Seals requiring set screws, pins, or other mechanical locking devices to hold the seal in place, conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces, any system requiring a pressure differential to seat the seal and ensure sealing.

I. Seals Failure Early Warning System
The integrity of the mechanical seal system shall be continuously monitored during pump operation and standby time. An electrical probe shall be provided in a sensing chamber positioned between the primary and secondary mechanical seals for detecting the presence of water contamination within the chamber. The sensing chamber shall be filled with environmentally safe nontoxic oil. A solid-state relay mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe, continuously monitoring the conductivity of the liquid in the sensing chamber. If sufficient water enters the sensing chamber through the primary mechanical seal, the probe shall sense the increase in conductivity and signal the solid state relay in the control panel. The relay shall then energize a warning light on the control panel, or optionally, cause the pump shut down. This system shall provide an early warning of mechanical seal leakage, thereby preventing damage to the submersible pump, and allowing scheduled rather than emergency maintenance

Acceptable Manufacturer: Sewage pumps are to be manufactured by the Flygt Company, SULZER, or approved equal.

SECTION 6 - PUMP STATION APPURTENANCES

6.1 SLIDE RAILS

All pump-lifting slide rails shall be made of 316 Schedule 40 stainless steel pipe. Slide rails shall be installed and sized per manufacturer’s instructions. The slide rails shall be firmly braced to the wet pit wall with stainless steel support brackets. Maximum spacing between brackets shall be every 15 feet.

6.2 LIFTING CHAIN

Pump lifting chain, clevises and shackles shall be made of 316 stainless steel. The chain shall be sized to accommodate the installed pump weight, but shall not be sized smaller than 3/16" stainless steel diameter links. The chain shall be a minimum of 5’ longer than the station depth.

6.3 BOLTS

All field-installed bolts, nuts, and washers used inside either the pump or valve chamber shall be made of 316 stainless steel.

6.4 FASTENERS

All concrete fasteners used for installation of braces brackets or boxes shall be stainless steel wedge type stud anchors. Anchor holes shall be drilled to the manufacturers recommended depth. Pump base anchor studs shall be sized as follows:

- 4" pumps and smaller = 5/8" minimum
- 6" and 8" pumps = 1" minimum
- Pumps larger than 8" shall be installed with stainless steel anchors sized per the pump manufacturer instructions.

6.5 FLOATS, SUBMERSIBLE TRANSDUCER AND SETTINGS

A. General

Floats shall be located near the flow of the incoming sanitary lines but not directly in the turbulence of the incoming flow. Floats shall be connected to pump controller

Submersible transducer in a stilling well shall also be used to monitor the pumps. Transducer shall have 4- 20 mA output. Transducer shall have a 0-15 psi range.

Sewage shall not rise to the level of the incoming gravity lines or the detention pipes during normal pump operation.

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PUMP STATION - DETAILS

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