

# City of Cumming

## Department of Utilities Water Pollution Control Division



## Manual of Technical Specifications and Construction Details for Wastewater Pumping Stations and Force Mains

*For the City of Cumming*

### ***Wastewater Collection System***

*Within the Corporate City Limits and the City's Water and Sewer Service Area*

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# CITY OF CUMMING

## Pump Station Specifications

**Sec. 70-200      *Pump Stations are Prohibited:***

The City will consider allowing pump stations or grinder pump systems only in areas where gravity sewer is not feasible. The City will determine the feasibility of gravity sewer in each case and may not base its decision on cost to the developer/owner(s).

**Sec. 70-201      *Registered Professional Engineer Required:***

All reports, plans, and studies that are submitted to the City of Cumming must be approved by and carry the seal of a professional engineer who is qualified to design sewerage conveyance systems and treatment facilities in the State of Georgia.

**Sec. 70-202      *State of Georgia requirements:***

- (A) Approval of EPD:** The Georgia EPD issued the City “delegation of authority” to review and approve all sanitary sewer extensions except for those that meet certain criteria. These require approval by the Georgia Department of Natural Resources, Environmental Protection Division (EPD), Engineering and Technical Support Program. Please contact the City of Cumming Department of Utilities for more information.
- (B) Sanitary Sewer Extension Submittal Form:** Certain sewer system improvements require a Sanitary Sewer Extension Submittal Form that must be submitted to the EPD. This form is available from the City of Cumming Department of Utilities. Please call (770) 781-2020 for more information.

**Sec. 70-203      *City of Cumming Planning and Zoning Requirements:***

It is the developer/owner(s)/contractor’s responsibility to contact the City’s Planning and Zoning Department and to comply with all requirements pertaining to the site where the pump station is to be built. It is the sole responsibility of the developer/owner(s)/ contractor to guarantee compliance with variances, stream set-back requirements, and right-of-way requirements. The City accepts no responsibility for noncompliance with any requirement set forth by federal, state, or local agencies.

**Sec. 70-204      *City of Cumming Utilities Department Requirements:***

It is the responsibility of the developer/owner(s) to obtain, at no expense to the City of Cumming, all easements and properties associated with a pump station, force main, and gravity collection system.

**Sec. 70-206      *Legal Documents and Requirements:***

*NOTE: (See Appendix A for sample documents. All documents must be original and must be obtained from the Department of Utilities)*

**(A) Title Opinion**

- (1) Current Title Opinion:** the developer/property owner's attorney must provide the City of Cumming with a current title opinion before the City will accept any associated deeds or easements.

**(B) Ownership of Pump Station Properties**

- (1) Warranty Deed:** pump stations constructed by private entities, developers, or individuals shall be conveyed to the City in fee simple and the City shall be supplied with an acceptable Warranty Deed. Pump stations, force mains, and other related infrastructure constructed by the City may be constructed on property which the City owns in fee simple, has an easement, has a license, or leasehold from the landowner including but not limited to the U. S. Army Corps of Engineers.
- (2) Quitclaim Deed:** all banks and lending institutions that hold a security deed on the property associated with the pump station must provide a Quitclaim Deed to the owner of the property. A copy of the recorded Quitclaim Deed must be provided to the City.

**(C) Sewer Easements**

- (1) Sewer Easement:** the property owner must provide a minimum 20 ft wide perpetual sewer easement over, under, and through property(ies) containing sewer lines. All Sewer Easements must include **Meets and Bounds**.
- (2) Consent and Subordination:** all banks and lending institutions that hold a security deed on the property must provide a document consenting to and becoming subordinate to all Sewer Easements. All Sewer Easements must include **Meets and Bounds**.

**(D) Access Easements**

- (1) Access Easement:** the property owner must provide a minimum 20 ft wide perpetual access easement over, under, and through property(ies) containing sewer lines. All Access Easements must include **Meets and Bounds**.
- (3) Consent and Subordination:** all banks and lending institutions that hold a security deed on the property must provide a document consenting to and becoming subordinate to all Access Easements. All Access Easements must include **Meets and Bounds**.

**(E) One Year Warranty Period With Performance Bond**

- (1) Performance Bond:** the developer/contractor shall obtain a Performance Bond for a minimum period of one year after the City accepts the Warranty Deed for the Pump Station. The total aggregate penal sum of the Performance Bond shall be at a minimum equal to the total cost of all pumps, control panels, generators, automatic transfer switches, SCADA system, SCADA antenna, and crane.
- (2) Contract:** the developer/contractor shall enter into a contractual agreement with the City of Cumming guaranteeing all equipment and workmanship for one year after the City accepts the Pump Station and Warranty Deed.

**Sec. 70-206 Minimum Pump Station Requirements:**

**Note: The brand of pump and related equipment that is accepted by the City is limited to Flygt (or equivalent as approved by the Water Pollution Control Superintendent). It is mandatory that those persons or groups responsible for choosing the brand of equipment for any portion of a pump station project receive approval, in writing, from the Superintendent.**

**(A) SUBMERSIBLE PUMPS:**

- (1) General:** Pumps must be submersible, non-clog type and be equipped with a submersible electric motor supplied with adequate submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. All pumps shall operate from three-phase power.
- (2) Pump design:** The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall be directly on the sump floor.
- (3) Pump construction:** Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

- (4) **Pump seals:** sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit. Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.
- (5) **Pump cooling system:** Each unit shall be provided with an adequately designed cooling system. The water jacket shall encircle the stator housing; thus, providing heat dissipation for the motor regardless of the type of installation. Impeller back vanes shall provide the necessary circulation of the cooling liquid through the water jacket. The cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provisions for external cooling and seal flushing shall also be provided. The cooling system shall provide for continuous pump operation in liquid temperature of up to 104° F. Restrictions below this temperature are not acceptable.
- (6) **Cable Entry Seal:** The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, planked by washers, all having a closed tolerance fit against the cable outside diameter and compressed by the body containing a strain cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a terminal board , which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.
- (7) **Motor:** The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 155°C (311°F). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board, shall be hermetically sealed from the motor by an elastomer O-ring seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. Wire

nuts or crimping type connection devices are not acceptable. The motor and pump shall be designed and assembled by the same manufacturer.

- (8) **Pump performance:** The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut0off through run-out.
- (9) **Power Cable:** The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.
- (10) **Bearings:** The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single roller bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.
- (11) **Mechanical Seal:** each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary tungsten-carbide seal ring and one positively driven rotating tungsten-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available. **The following seal types shall not be considered acceptable nor equal to the dual independent seal specified:** shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Cartridge type systems will not be acceptable. No system requiring a pressure differential to offset pressure and to effect sealing shall be used. Each pump shall be provided with a lubricant chamber for the shaft sealing system The lubricant chamber

shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load. The seal lubricant shall be FDA approved and nontoxic.

- (12) Pump Shaft:** Pump motor and shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Coupling shall not be acceptable. The shaft shall be AISI type 431 stainless steel. The use of stainless steel sleeves will not be considered equal to stainless steel shafts.
- (13) Impeller:** The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller(s) shall be keyed to the shaft, retained with an allen head bolt and shall be capable of passing any solids that may enter it. All impellers shall be coated with an acrylic-dispersion zinc phosphate primer.
- (14) Wear rings:** A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet. Each pump must also have a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller.
- (15) Volute:** Pump volute(s) shall be single-piece gray cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet discharge size shall be as specified.
- (16) Protection:** All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125°C (260°F) the thermal switches shall open, stop the motor and activate an alarm. A leakage sensor shall be installed to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and remote. USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED. The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS shall be designed to be mounted in any control panel.
- (17) Explosion proof pumps:** All pumps must be explosion proof.

- (18) **Service Capability:** the pump manufacturer shall have an authorized factory service center / stocking facility capability of completely servicing the required pumps within 50 miles of the project site. This facility shall also have the capability of performing field service, including routine inspections and maintenance contracts. No exceptions to this will be accepted.
- (19) **Pump control device:** The City shall determine the equipment to be used to activate and terminate pump operation and to determine high and low level conditions. Pump controls shall be equipped with an alternating lead-lag pump option.
- (20) **Chains required:** all submersible pumps must be provided with stainless steel chains connected to each pump, to aid in the removal of each pump from the wet well for maintenance purposes. Each pump shall be supplied with a mating cast iron discharge connection and be fitted with a **Grip-Eye lifting system**. The working load of the lifting system shall be 50% greater than the pump unit weight.
- (21) **Mix Flush Valve required:** One pump shall be fitted with a Mix-Flush valve to automatically agitate the liquid in the wet well using a 90 degree discharge elbow and adjustable flushing period of 20 to 50 seconds.
- (22) **Storage and protection:** Pumps and accessories shall be stored and protected in accordance with the manufacturer's recommendations. Pumps shall be completely drained prior to shipment. Suction and discharge ports shall be provided with plastic plugs. Each pump shall be secured to a wooden skid to facilitate handling and storage.

**(B) PIPING CONSIDERATIONS:**

- (1) **Minimum velocity:** All sewage piping shall be sized to maintain a minimum velocity of two feet per second; however, piping shall be at least 4 inches in diameter.
- (2) **Ductile Iron:** All pipe, fittings, and valves shall be ductile iron and shall be properly rated for the expected operating and surge pressures.
- (3) **Avoid release valves:** When possible, the force main should be routed at a positive grade to the existing sewer to avoid the need for air and vacuum release valves.
- (4) **Force main termination:** All force mains should terminate in manholes and be provided with energy dissipating inlets.
- (5) **Check valves:** Check valves should be iron body, bronze-mounted, outside lever with flanged ends and conform to AWWA C508.

- (6) **Shut-off valves:** Shutoff valves shall be either plug valves or resilient-seated gate valves. Plug valves should be eccentric, non-lubricated two-way plug valves with lever operators and flanged ends.
- (7) **Flexible couplings:** Only when deemed necessary by an engineer, flexible couplings should be used around the valves and at the pump outlet. These couplings allow slight misalignment during construction, are easily disassembled and reassembled, and impede the transmission of damaging forces. The City does not recommend “dresser couplings”.
- (8) **Quick-connect bypass:** A connection for a quick-connect bypass pump should be provided in case of complete station failure. See Drawing at end of this Section.
- (9) **Hydraulic transients:** An analysis to detect possible hydraulic transients should be done if the total dynamic head is greater than 30 feet and the length of the force main is greater than 1,000 feet.

**(C) FORCE MAINS:**

- (1) **General:**

All materials used in the construction shall be new and unused when delivered to the site and shall be subject to inspection by the Engineer before installation.
- (2) **Pipe and Fittings:**
  - (a) **Polyvinyl Chloride (PVC)** – Prohibited for use as a force main.
  - (b) **Ductile iron pipe** shall meet the requirements AWWA C151 with push-on and mechanical joints meeting AWWA C111 and a standard cement lining. Pipe shall be pressure Class 350 unless shown otherwise on the BID SCHEDULE.
  - (c) **Fittings shall be measured for payment by unit weight** (bare barrel weight) of each fitting, excluding weight of cement mortar lining, gland, bolts and gasket. Weights of fittings shall be as listed in AWWA C153. Payment shall be at the Unit Price per ton as listed in the Bid Schedule.
- (3) **DIP Force Main Laying:**
  - (a) DIP shall be used for all force mains. PVC pipe is prohibited for use as a sewer force main or in any part of a pump station configuration.
  - (b) The following laying rules shall be followed for ductile iron pipe:
    - 1. Standard ductile iron pipe laying conditions shall be defined as follows:

**Type 3 Laying Condition:** Pipe bedded in 4" minimum loose soil. Loose soil or select material is defined as native soil excavated from the trench, free of rocks, foreign material and frozen earth. Backfill lightly consolidated to top of pipe.

**Type 4 Laying Condition:** Pipe bedded in sand, gravel or crushed stone to depth of 1/8 pipe diameter, 4" minimum. Backfill compacted to top of pipe. (Approximately 80% Standard Proctor, AASHTO T-99)

**Type 5 Laying Condition:** Pipe bedded to its centerline in compacted granular material, 4" minimum under pipe. Compacted granular or select material to top of pipe defined as native soil excavated from the trench, free of rocks, foreign material and frozen earth. (Approximately 90% Standard Proctor, AASHTO T-99)

- 2.** Laying condition Type 1 and Type 2 shall not be used.
- 3.** Ductile iron pipe laid in rock trenches shall have 6 inches of crushed stone under the pipe. See Standard Construction Drawing S-13.

- 4.** Minimum allowable depth of cover is 3-feet

**(c)** Pipe, appurtenances, and fittings shall be laid to the line and grade established on the Drawings, or as directed by the Engineer. A minimum cover of 48" shall be maintained over all pipe, unless otherwise indicated. The bed for the pipe shall be shaped either by trimming the bottom of the trench or by placing excavated earth thereon and tamping so that each piece of pipe has uniform bearing. The trench shall be further excavated around each bell or hub, so that it will be entirely clear of the ground and leave ample room for making joints.

**(d)** The inside of the bells and the outside of the spigots shall be thoroughly cleaned before they are placed. The inside of all pipes shall be thoroughly swabbed to insure that the pipe is clean and free of obstructions and foreign matter until the work is completed.

**(e)** Where pipe laying ceases at the end of the day, or for any cause, the end of the pipe shall be securely closed in order to prevent the entrance of water, mud, critters, or any other objectionable matter.

**(f)** The Contractor shall furnish and install copper wire (No. 14) or metallic detection tape in trenches alongside all PVC mains. All wire shall be joined by a common bond. Payment for furnishing and installing shall be included in the Unit Price bid for the pipe.

**(g)** The Contractor shall furnish and install pipe identification tape with the words "Buried Sewer Line." The tape shall be secured to the pipe and shall be

continuous along the entire length of sewage force main. Payment for furnishing and installing tape shall be included in the Unit Price bid for the pipe.

**(h)** In the event the sewage force main crosses a water main, a minimum vertical distance of 18" between the outside of the water main and the outside of the force main shall be maintained. This shall be the case where the water main is either above or below the force main. The crossing shall be arranged so that the force main joints will be equidistant and as far as possible from water main joints. Where a water main crosses under the force main, adequate structural support shall be provided for the force main to prevent damage to the water main.

A separation of 10 feet should be maintained between the force main and water main where they are laid parallel. When conditions prevent a 10-foot horizontal separation, the water main may be laid closer to a sewer (on a case by case basis) provided the water main is laid in a separate trench or on undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18-inches above the top of the sewer.

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, either the water main or the sewer line may be encased in a watertight carrier pipe which extends 10-feet on both sides of the crossing, measured perpendicular to the water main. The carrier pipe shall be steel with thicknesses and diameters as specified in the City of Cumming Manual of Technical Specifications and Construction Standard Details, Section IV General Material Specifications, Part 4 – Casings.

**(i)** Low Pressure Air Testing: All lines shall be air tested in the following manner after backfilling and tamping has been completed:

**1.** Test Preparation: All wyes, tees or end-of-side sewer stubs shall be plugged with flexible-joint caps, or acceptable alternate, securely fastened to withstand the internal test pressure. Prior to testing for acceptance, the pipe should be cleaned.

**2.** Test Procedure: The sewer segment being tested shall be pressurized to 3.5 psi. A short period of time (2-4 minutes) may be required to allow the pressure to stabilize. The pressure shall not decrease more than 0.5 psi (from 3.5 to 3.0 psi) during the time periods shown below:

<b>Pipe Size (inches)</b>	<b>Time Period</b>
4	1:53 min
6	2:50 min
8	3:47 min
10	4:43 min
12	5:40 min
15	7:06 min
18	8:30 min
21	9:55 min
24	11:20 min
27	12:45 min
30	14:10 min

**3. Test Failure:** If the pipe installation fails to meet the infiltration or air test requirements shown above, the Contractor shall determine, at his own expense, the source or sources of leakage, and he shall repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of these tests and the results of the air test shall be neatly tabulated by the Contractor and submitted to the City of Cumming Inspector.

**(j)** A leakage test shall be conducted after the pressure test has been satisfactorily completed. The duration of each leakage test shall be 2 hours. During the test, the system shall be subjected to a pressure of 150 psi gauge.

**(k)** Testing procedure shall be as specified in AWWA C600 and/or C900 (latest revisions) – Standard Hydrostatic Test Method Of (DIP and PVC) Sewer Force Mains and ASTM 1003.

**(l)** Allowable leakage shall not exceed 0.18, 0.28, 0.37, 0.55, 0.75, 0.90 and 1.1 gallons per hour per 1,000 feet of 2", 3", 4", 6", 8", 10" and 12" diameter DIP and PVC pipe, respectively.

**(m)** No separate payment will be made for leakage and pressure tests. The cost of these operations shall be included in the Unit Price bid for pipe.

**(4) Surge Blocks:**

**(a)** Concrete surge blocks shall be installed at all bends of 11-1/4 degrees or greater in the pipe line, and at all valves, plugs, tees, and caps. Concrete shall have a compressive strength of not less than 2000 psi after 28 days.

**(b)** Surge blocks shall be of mass concrete with minimum dimensions not less than the block dimensions shown on the Drawings. In no case shall surge blocks be poured so that piping connections are covered so as to prevent removal of fittings or valves.

**(c)** Surge blocks shall be backed against firm, undisturbed earth. Any extra

concrete volume required due to over-excavation shall be installed at no additional cost to the Owner.

**(d)** Surge blocks in place shall be paid for at the Unit Price bid for concrete blocking in the Bid Schedule.

**(5) Sewage Air Release Valve:**

**(a)** The sewage air release valves shall be Vent-O-Mat Model No. 050RGX1021 with 2-inch inlet size.

**(b)** The sewage air release & vacuum break valve shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in HDPE stainless steel nozzle and woven dirt inhibitor screen, nitrile rubber seals and natural rubber seat.

**(c)** The valve shall have an integral "anti-surge" orifice mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure to less than 2 x valve rated working pressure. The intake orifice shall be equal to the nominal size of the valve i.e., a 6" valve shall have a 6" intake orifice.

**(d)** Large orifice sealing shall be effected by the flat face of the control float searing against a nitrile rubber O-ring housed in a dovetail groove circumferentially surrounding the orifice. Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seal is prevented.

**(e)** The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to twice the designed working pressure.

**(f)** Connection to the valve inlet shall be facilitated by flanged ends conforming to ANSI B16.1 Class 125 or Class 250 Standards.

**(g)** Prior to the ingress of liquid into the valve chamber, as when the pipe line is being filled, valves shall vent through the large orifice when sewage/effluent approach velocities are relative to a transient pressure rise, on valve closure, of  $< 2$  x valve rated pressure.

**(h)** At higher sewage/effluent approach velocities, which have a potential to induce transient pressure rises  $> 2$  x valve rated pressure on valve closure, the valve shall automatically discharge air/gas through the anti-surge orifice and reduce sewage/effluent approach velocity, so that on closure a maximum transient pressure rise of  $< 2$  x valve rated pressure is realized.

(i) Valves shall not exhibit leaks or weeping of liquid past the large orifice seal at operating pressures of 7 psi to twice rated working pressure.

(j) Valves shall respond to the presence of air/gas by discharging it through the small orifice at any pressures within a specified design range, i.e. 7 psi to 150 psi and shall remain leak tight in the absence of air.

(k) Valves shall react immediately to pipe line drainage or liquid column separation by the full opening of the large orifice so as to allow unobstructed air intake at the lowest possible negative internal pipe line pressure.

(l) Materials of construction shall be certified the following ASTM specifications:

Body & Cover Internal Linkage, Stem,	Cast Iron	ASTM A48, Class 30
Concave Float	Stainless Steel	ASTM A240
Needle	Buna-N	Nitrile Rubber
Exterior Paint	Phenolic Primer Red Oxide	FDA Approved for Potable Water
Exterior Finish Coat	Compatible with Primer	FDA Approved for Potable Water

(6) **Plug Valves:** Plug valves shall be of the eccentric non-lubricated, manually operated type, and be designed for the use and working pressure intended. Valves shall have flanged ends or mechanical joint end, as shown on the Drawings. Valve body shall be of semi-steel. Seats shall have a welded-in overlay of not less than 90% pure nickel on all surfaces which will contact the plug face. The plug shall be totally encapsulated with Buna-N rubber. Plug stem bushing shall be of stainless steel, and permanently lubricated type. Valves shall have a 2" square operating nut, with worm gear actuator and open LEFT. Valves placed in a valve box shall have a hand-wheel operator. Plug valves shall be as manufactured by DeZurik, Homestead, or approved equal.

**(D) WETWELL AND PUMP STATION SITE:**

**(1) Precast Concrete Sections:**

(a) **Precast concrete sections** shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.

(b) **Wall thickness** shall be as shown on the Drawings.

- (c) **Joint seals:** Joints between precast sections shall be sealed by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.
- (d) **Non-shrink grout:** All pumps, compressors, motors and other heavy equipment items shall be grouted in place with a nonmetallic, noncorrosive, nongaseous, non-shrink grout requiring no cutback or protective coating. Non-shrink grout shall show zero shrinkage from the placement volume or initial expansion volume as determined by ASTM C 827, and shall have an initial set time at 70 degrees F of not less than 45 minutes as determined by ASTM C 191. When tested in accordance with ASTM C 109, non-shrink grout shall have a one-day compressive strength of not less than 2,000 psi and a 28-day compressive strength of not less than 9,000 psi at a flow of not less than 100 percent, determined in accordance with the Corps of Engineers Specification CRD-C-621. The grout shall contain no corrosive irons, calcium, chloride, oxidizing catalysts, gas-forming agents, harmful aluminums or corrosive chemicals and shall be resistant to oil, water and sewage. The grout shall be premixed and shall require only the addition of water prior to placement. The grout shall be delivered to the job site in unopened, plastic-lined bags and shall have the manufacturer's mixing instructions printed on the back of each bag. Nonshrink grout shall be EUCO N-S Grout as manufactured by the Euclid Chemical Company, Masterflow 713 Grout as manufactured by the Master Builders Company, or Upcon High Flow Grout as manufactured by UPCO Division of Emhart Chemical Company.

**(2) Poured Sections**

- (a) **Poured Wetwell Top** - The top of the wetwell **SHALL NOT BE PRECAST** concrete but shall be poured on site. In addition, all other poured areas, such as the area around the on-site crane, valve box top and etc. shall be poured in one pour and be contiguous. All concrete shall be smoothed and finished in a professional manner and shall be painted dark brown.
- (b) **Poured Crane Counterweight and Finished Concrete Area Around Crane** - The finished concrete area around the on-site crane shall be poured in one single contiguous pour with the wetwell top, valve box top, crane counterweight and all sidewalks. All concrete shall be smoothed and finished in a professional manner and shall be painted dark brown.

- (c) **Poured Valve Box Top** - The top of the valve box **SHALL NOT BE PRECAST** concrete but shall be poured on site. The top of the valve box shall be poured in one single contiguous pour with the wetwell top, crane counterweight, finished area around crane and all sidewalks. All concrete shall be smoothed and finished in a professional manner and shall be painted dark brown.
- (d) **Sidewalks** - All sidewalks shall be poured in one single contiguous pour with the wetwell top, valve box top, crane counterweight, and finished area around crane. All concrete shall be smoothed and finished in a professional manner.

**(3) Wetwell Top Door:**

- (a) The wet well door shall be a double leaf type, built to withstand 150 pounds per square foot.
- (b) The frame shall be ¼-inch extruded aluminum with built-in neoprene cushion and with strap anchors bolted to the exterior. The door leaves shall be ¼-inch aluminum diamond plate reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be equipped with a snap lock and removable handle. Doors shall also be equipped with a hasp and padlock in addition to built-in locking mechanisms. Padlocks for all doors shall be keyed alike and match the standard lock of all other City pumpstations. Bituminous coating shall be applied to the exterior of the frame by the manufacturer. All parts shall be aluminum or stainless steel.
- (c) Doors shall be Typed KD for double leaf doors by the Bilco Company or equivalent as specified by the City.
- (d) All access doors and hatches must have the capability of being locked with a pad lock as required by the City. Locks and spare keys must be supplied to the City. Locks should be keyed to match the City's standard pump station lock.

**(4) Ladder required:**

- (a) Steps provided by the wet well manufacturer that are preset into the walls of the wet well are not acceptable.

- (b) The ladder must be constructed of corrosion resistant material preferably stainless steel.
  - (c) The ladder must be permanently mounted in the wet well to provide access for maintenance personnel.
  - (d) The ladder must be equipped with a safety harness system. A separate safety harness must be provided for each wetwell.
  - (e) The ladder must be 18 inches wide.
  - (f) Each step must be roughened to prevent foot slippage.
- (5) **Trash basket required:** A trash basket and rail system must be provided for each influent pipe to the wet well. Each trash basket must be easily removed from the wet well for cleaning purposes.
- (6) **Reflective signage:** Reflective signage denoting pump station address, emergency telephone numbers, and other required information must be provided and attached to the fencing as specified by the Superintendent.
- (7) **Conduit:** All conduit that enters a wet well must be sealed at the wet well and at the motor control panel.
- (8) **Lighting:** An outdoor security light, that is capable of automatically switches on at night and off in the day, shall be provided at each pump station site. Each light pole must be equipped with a hinge, pin, and wench system that allow the pole and light to be lowered to the ground for maintenance and bulb changing, and then to be raised back into an upright position. The type of light and location of the pole must be approved by the Superintendent and the pole shall be painted dark brown.
- (9) **Maintenance and Equipment Building:** An equipment and maintenance building shall be provided and shall be built within 10 ft – 15 ft of the wet well. Guidelines for the design of the building include the following:
- (a) The building should be architecturally compatible with nearby structures. In most cases, concrete block buildings are acceptable and must be painted dark brown or a City approved color.
  - (b) An oversized double-door should be provided at a convenient location for the removal and replacement of equipment. The doors must be heavy duty steel with appropriate hardware and lock.

- (c) The building shall house the auxiliary power transfer switch, surge suppressor, SCADA RTU unit, and main power disconnect. The pump control panel shall be hung on the exterior of the building, on the closest side facing the wetwell. There shall be sufficient space for maintenance operations inside. A 8-foot by 10-foot building is typically adequate for small pumping stations.
  - (d) Adequate lighting shall be provided in work areas for night operations, both inside the building and on the exterior.
  - (e) The building shall have adequate ventilation to prevent buildup of corrosive and potentially dangerous gases. This includes a ventilation fan system.
  - (f) A thermostatically-controlled heater shall be provided in the building.
  - (g) The building must be at a minimum constructed of concrete block and painted inside and out with two coats of dark brown paint. The ceiling must be insulated and covered with plywood and painted. The building must be supplied with adequately sized gutters and downspouts.
  - (h) The roof structure must be galvalume and shall be dark brown in color.
- (11) **Power disconnect:** A breaker or other device as described by the Superintendent, that will **completely disconnect the pump station from the power source** must be provided on the main power supply line.
- (12) **Potable water supply required:**
- (a) All pump stations must be supplied with a self-draining, non-freezing  $\frac{3}{4}$  inch or larger yard hydrant. The water service shall be located as close to the wet well as is practicable.
  - (b) Back flow prevention:
    - (1) Potable water supply lines must be equipped with a reduced pressure principle back flow prevention device (RPZ).
    - (2) The RPZ must be installed according to the Georgia plumbing code.
    - (3) The RPZ must be above grade and covered with a frost proof, insulated, heated cover that is made of a corrosion proof metal

such as aluminum. For recommended manufacturers, contact the Water Pollution Control Division.

**(13) Fencing:**

**(a) Overall height** for fencing shall be seven feet including three strands of barbed wire on malleable iron post tops. Posts shall be set at no more than 10 foot centers, a full three feet deep in concrete footings, poured the full size of the holes as excavated. Corner posts shall have the necessary strut and tie bracing.

**(b) Materials and construction:**

- (1) Fence mesh:** 9 gauge wire, woven to 2-inch squares, galvanized after weaving, six foot wide roll. Continuous tension wire shall be provided at the lower edge of the mesh.
- (2) Line post:** 2-1/2-inch O.D. Galvanized Pipe (3.65 #/ft.).
- (3) Corner post:** 3-inch O.D. Galvanized Pipe (5.79 #/ft.).
- (4) Gate post:** 4-inch O.D. Galvanized Pipe (9.11 #/ft.).
- (5) Top Rail:** 1-5/8-inch O.D. Galvanized Pipe (2.27 #/ft.). with extra long pressed steel sleeves.
- (6) Gates:** shall be supplied with heavy-duty latches, keepers and padlocks with duplicate keys.
- (7) Gate frames:** 2-inch O.D. Galvanized Pipe Frame (2.72 #/ft.).
- (8) Barbed wire:** Barbed wire shall consist of three strands of 12 gauge wire, with 4-point pattern barbs, galvanized after weaving.
- (9) Concrete:** Concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Superintendent. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94.
- (10) Installation:** Fence installation shall not be started before the final grading is completed, with finished grade elevations established, unless permitted by the Superintendent.

- (11) **Damage:** Repair damaged coatings in the shop or during field erection by recoating with manufacturer's recommended repair compound, applied per manufacturer's directions.
  - (12) **Barbed wire:** install three parallel wires on each extension arm; on security side of fence, unless otherwise indicated. Pull wire taut and fastened securely to each extension arm.
  - (13) **Top rails:** Top rails shall be run continuously through post caps or extension arms and shall be bent to radius for curved runs. Expansion couplings shall be provided as recommended by the fencing manufacturer.
  - (14) **Cleaning:** Perform cleaning during installation of the work and upon completion of the work. Remove from the site all debris and equipment. Repair all damage resulting from chain link fence system installation.
  - (15) **Color:** All fencing material and posts shall be coated with black vinyl.
- (c) **Access gates** must be at least 15 feet wide. The location of all gates must be approved by the Superintendent.
  - (d) **Fence crossings:** Where fencing crosses ditches, steep grades, and other unusual conditions, special provisions shall be made to insure that the security, appearance, maintainability and permanence of the standard fencing are equaled or exceeded.
  - (e) **Standards** of manufacturer shall comply with the standards of the Chain Link Manufacturers Institute and all City specifications.
  - (f) All fencing must be provided as a complete unit produced by a single manufacturer including the required erection accessories, fittings and fasteners.
  - (g) For **residential areas or other areas as specified by the City**, a wooden privacy fence shall be used.
- (14) **Access roads and pavement:**
- (a) All access roads to pump stations must be 20 feet wide with a 32 foot turning radius.

- (b) All access roads must be paved. Roads must have a 6 inch minimum base of crusher run, a 2 inch minimum of asphalt plant mix, and a 1 inch minimum top layer of asphalt type "E".
  - (c) Access roads may be paved with reinforced concrete according to city specifications.
  - (d) A paved area inside the pump station fenced area must be constructed to provide access for service vehicles to the wet well and all other facilities.
  - (e) A paved turn around must be provided for service vehicles.
  - (f) All paved areas must be contiguous with the paved access road.
  - (g) A pole-gate shall be installed at the access road entrance and shall span the entire width of the drive. The pole-gate shall be positioned 1 vehicle's length from the main road and shall be constructed of approved materials and shall be painted dark brown.
- (15) **Unpaved areas:** All unpaved areas inside the fenced area must be covered with a minimum of 6 inches of crusher run. The finished grade shall be sloped so that all water drains away from the pump station site.
- (16) **Hoist or crane:** A hoist or crane must be included with each station. Each hoist or crane must be properly sized and placed to facilitate the removal of each pump from the wet well. The hoist system shall be designed so that the pumps can be lifted from the wet well and placed on a platform or maintenance vehicle easily. The hoist shall also be capable of lowering and raising maintenance personnel into and out of the wet well. Special care should be taken to ensure that the proper length and strength of hoist cable is provided. Electric hoists must be provided for each crane and hoist system. Manual hoists are prohibited. All cranes and components shall be painted dark brown.
- (17) **Signage:** Reflective signage shall be provided as specified by the Superintendent.
- (18) **Valve vaults:** Pump station check valves and isolation valves must be housed in a below grade, concrete valve vault, separate from but immediately adjacent to the wet well.
- (a) The discharge piping from each pump shall be routed through the valve vault with check valves and shutoff valves on horizontal stretches of pipe. Check valves shall be placed upstream of shutoff

valves. Connection of the discharge pipes should be accomplished outside and downstream of the valve vault.

- (b) A pressure gage with diaphragm mounted seals should be located on the sides of each pipe in the valve vault, upstream of the check valve.
  - (c) The valve vault should have a reinforced concrete floor and top slab with a hinged aluminum floor door (see wet well floor door requirements above - Section (D)(3)). The vault walls may be precast or cast-in-place reinforced concrete or reinforced masonry. The valve vault should have a maximum depth of 4 feet unless specifically approved by the Superintendent.
  - (d) The floor of the valve vault should be sloped to a sump to collect water. A drain should be provided in the sump. The drain should be routed to the wet well with a P-trap installed to prevent the release of hazardous gases into the valve vault. A TideFlex Valve shall be installed in the drain line to prevent flooding of the valve vault by backflow from the wet well.
- (19) **Corrosion prevention:** The first manhole up stream from the pump station and the first manhole downstream from the pump station, the wet well itself, and all valve boxes must be coated with a two part epoxy (such as Protecto 401 Ceramic Epoxy or Mainstay DS-4 coal tar epoxy mortar) to prevent corrosion from hydrogen sulfide gas.

**(E) CONTROL PANELS:**

- (1) **General:** The control system shall be designed to operate the required number of pumps specified on the drawing at the power characteristics shown on the plans. The control function shall provide for the operation of the pumps under normal conditions, and shall alternate the pumps on each pump down cycle to equalize the run time. In the event the incoming flow exceeds the capacity of the lead pump, subsequent pumps shall automatically startup to handle the increased flow. As the flow decreases, the pump shall cut off at the elevations as shown on the plans. The control shall function as described below. The equipment listed below is a guide and does not relieve the supplier from supplying a system that will function as required.
- (2) **Electrical enclosures:** All pump station electrical components and controls must be housed in a weatherproof, water tight, 14 gauge, Nema 4X rated enclosure manufactured from 304 stainless steel. The enclosure shall be a wall mounted type with a minimum depth of 12 inches, sized to adequately house all the components. The door gasket shall be rubber

composition with a retainer to assure a positive weatherproof seal. The door shall open a minimum of 180 degrees.

- (3) **Inner dead front door:** A polished, aluminum dead front shall be mounted on a continuous aircraft type hinge. It shall contain cutouts for mounted equipment, and provide protection of personnel from live, internal wiring. Cutouts for breaker handles shall be provided to allow operation of breakers without entering the compartment. All control switches, indicator pilot lights, elapsed time meters, duplex receptacle, and other operational devices shall be mounted on the external surface of the dead front. The dead front shall open a minimum of 150 degrees to allow access to equipment for maintenance. A  $\frac{3}{4}$  " break shall be formed around the perimeter of the dead front to provide rigidity.
- (4) **Back plate:** the back plate shall be manufactured of 12 gauge steel and be finished with a primer coat and two (2) coats of baked on, white enamel. All hardware mounted to the subpanel shall be attached with machine thread, tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified.
- (5) **Power distribution:** The panel power distribution shall include necessary components and be completely wired stranded copper conductors rated at 90 degrees C. All conductor terminations shall be as recommended by the device manufacturer. Control power to the panel, including all alarm and telemetry circuits shall be provided by an uninterruptable power supply (UPS).
- (6) **Circuit breakers:** All circuit breakers shall be heavy duty thermal magnetic motor circuit protectors similar and equal to Square D Type FAL. Each motor breaker shall be adequately sized to meet the pump motor operating characteristics and shall have a minimum of 14,000 amps interrupting capacity at 480 VAC. The control circuit shall be controlled by heavy duty breakers. Circuit breakers shall be indicating type, providing "on-off-trip" positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position indicating "trip". Thermal magnetic breakers shall be quick-make and quick-break on manual and automatic operation and have inverse time characteristics secured through the use of bimetallic tripping elements supplemented by a magnetic trip. Breakers shall be designed so that an overload on one pole automatically trips and opens all legs. Field installed handle ties shall not be acceptable.
- (7) **Motor starters (across-the-line):** motor starters shall be open frame, across-the-line, NEMA rated with individual overload protection in each leg. Motor starter contacts and coil shall be replaceable from the front of the starter without removal from its mounted position. Overload heaters shall be

block type, utilizing melting alloy spindles and shall have visual trip indication. Overloads shall be sized for the full load amperage draw of the pumps. Adjustable type overloads, definite purpose contactors, fractional size starters and horsepower rated contactors or relays shall not be acceptable.

- (8) Motor starters (reduced voltage autotransformer):** motor starters shall be open frame, reduced voltage, autotransformer, NEMA rated with individual overload protection in each phase. Motor starter contacts and coil shall be replaceable from the front of the starter without removal of the starter from its mounted position. Overload heaters shall be blocked type, utilizing melting alloy spindles sized for the full load amperage of the load. Adjustable overload, definite purpose contacts, fractional size starters and horsepower rated contact or relays shall be acceptable. Motor starter resets shall be provided on the front of the dead front.
- (9) Motor starters (solid state reduced voltage):** Motor starters shall be solid state reduced voltage starters to provide smooth, stepless acceleration through the use of silicon controlled rectifiers. By gradually applying voltage to the motor, a soft start condition will accelerate the motor to full speed. The adjustable current-limit feature: the starters shall limit currents to 25%-70% and starting torque to 6%-49% respectively of full voltage values. Adjustable ramp shall be for 1 – 30 seconds. A ramp down signal may be required and must be available on the starters. Motor protection shall be provided by calculation of temperature rise of the motor and starter and shut the motor down in case of an out of tolerance condition.
- (10) VFD Drives:** the City may require that pumps be equipped with VFDs. The City will specify the type and brand of VFD drive and the configuration of the control panel.
- (11) Pressure Transducer controller system:** The station pumping system shall be controlled by a pressure transducer. See City for brand of transducer and specifications.
- (12) Spare pressure transducer required:** An extra pressure transducer must be supplied with each pump station.
- (13) Level control systems:**

  - (a) Duplex Pump Stations:** the control system shall provide for the automatic and manual control and alternation of the pumps to maintain a pumped down condition of the wet well. Levels shall be sensed through a measurement device adjusted to the specified levels. The device shall sense the “off”, “lead”, “lag”, and “alarm” levels. As the level in the wet well rises, the lead pump as determined by the

alternator, shall start and pump the station to the “off” level. In the event the incoming flow exceeds the capacity of the lead pump, the lag pump shall start and both pumps shall run to the “off” level. If the level continues to rise, alarm functions shall be activated. The control system shall include, but not be limited to, the ancillary equipment listed below.

- (b) **Triplex Pump Stations:** the control system shall provide for the automatic and manual control and alternation of the pumps to maintain a pumped down condition of the wet well. Levels shall be sensed through a measurement device adjusted to the specified levels. The device shall sense the “off”, “lead”, “lag”, and “alarm” levels. As the level in the wet well rises, the lead pump as determined by the alternator, shall start and pump the station to the “off” level. In the event the incoming flow exceeds the capacity of the lead pump, the lag pump shall start and both pumps shall run to the “off” level. If the level continues to rise, the second “lag” pump shall start and all three pumps shall run to the “off” level. If the level continues to rise, alarm functions shall be activated. The control system shall include, but not be limited to, the ancillary equipment listed below.

**(14) Ancillary equipment:**

- (a) **HOA (Hand/Off/Auto) switches:** A three-position HOA switch shall be provided for each motor. The switch shall be NEMA 4X rated with 10 amp contacts. A position indicating legend plate shall be provided. The HOA in the hand position shall allow the pump to run and bypass all safety shutdowns except for overloads. In the Auto position the pump controller will control the pumps while monitoring all shutdowns and stop the pump.
- (b) **Run indicators:** A green run pilot indicator shall be mounted on the dead front door.
- (c) **Elapsed time meter:** An elapsed time meter shall be mounted on the dead front door. The meter shall operate on 120 VAC, shall indicate in hours (6 digits) and tenths and shall not be resettable.
- (d) **Moisture and thermal measurement:** A plug-in, solid state control and status relay with indicating LEDs shall be provided to measure motor thermal overload and moisture in the pump housing. Any moisture or thermal condition shall signal failure and stop the pump. The failure mode shall also be indicated by an illuminated light on the MT3PC controller.

- (e) **Heater:** An internal 100 watt heater shall be provided to maintain temperature above the dew point. The unit shall be thermostatically controlled.
- (f) **Trouble light:** An internal trouble light shall be installed to illuminate the internal portion of the enclosure.
- (g) **Alarm system:** A visible alarm light shall be installed on the exterior of the control panel and shall be a weatherproof, shatterproof, red light fixture with a 40 watt bulb to indicate alarm conditions. The alarm light shall be turned on by the alarm relay. An audible alarm such as a bell, horn, or buzzer must be installed. The audible alarm shall be turned on by the alarm relay.
- (h) **Automatic Dialer:** An automatic dialer shall be installed and connected to a phone line. The city requires that this device be a Verbatim brand automatic dialer with a minimum of 8 channels. The phone service shall be part of the City's ESSEX phone system.
- (i) **Gas detector:** Gas detection equipment for each pump station is required as specified by the Superintendent. This detector must be connected to the autodialer, audible horn and visible alarm light.
- (j) **Lightning-transient protection:** Each complete suppression unit shall be UL listed as a secondary surge arrestor and bear CSA certification and meet ANSI/IEEE C62-11-1987; suitable for indoor and outdoor applications; suitable for use in service entrance location; meet requirements of NEC Article 280; rated at 650V phase-to-ground maximum.
- (k) **Transformers:** Control transformers shall be provided to produce the 120 VAC and/or 24 VAC for control circuits. Transformers shall be fused on the primary and secondary circuits. The secondary circuits shall be grounded.
- (l) **Phase monitor:** A line voltage rated, adjustable phase monitor shall be installed to sense low voltage, loss of power, reverse phase, and loss of phase. Control circuit shall de-energize upon sensing any of the faults and shall automatically restore service upon return to normal power.
- (m) **Drawings** A final, "as built" drawing encapsulated in mylar shall be attached to the inside of the front door. A list of all legends shall be included.

- (n) **Panel markings:** All component parts in the control panel shall be permanently marked and identified as they are indicated on the drawing. Marking shall be on the back plate adjacent to the component. All control conductors shall be identified with wire markers at each end, as close as practical to the end of the conductor.
- (o) **Testing:** All panels shall be tested to the power requirements as shown on the plans to assure proper operation of all components. Each control function shall be activated to check for proper indication.
- (p) **Guarantee:** All equipment shall be guaranteed for a period of three (3) years from the date of shipment. The guarantee is effective against all defects in workmanship and/or defective components. The warranty is limited to replacement or repair of the defective equipment.
- (q) **Manufacturer:** The manufacturer shall be a UL listed shop for industrial control systems and shall indicate evidence of such on the control panel enclosure.
- (r) **Phase convertors:** Phase convertors will not be accepted unless specifically approved by the superintendent.

**(F) EMERGENCY POWER BACKUP REQUIRED:**

- (1) **Location:** The location of the generator shall be next to the Maintenance and Equipment Building, on the opposite side from the wetwell. The Maintenance and Equipment building shall be in the middle of the wet well and generator set.
- (2) **Generator brand:** The brand of generator accepted by the city is limited to Caterpillar, Cummins-Onan, Caterpillar, Katolite, or Kohler.
- (3) **Sizing:** The engine / generator set shall be sized to accommodate all loads at the pump station.
- (4) **Hot water jacket:** A hot water jacket shall be supplied to keep the engine warm and ready to operate.
- (5) **Storage battery:** A storage battery should be provided with each engine / generator along with a trickle charger fed off commercial power.
- (6) **Fuel type:** All 100 kW (or smaller) generators must be fueled by natural gas. All 101 kW or larger must be fueled by diesel.

- (7) **Automatic transfer switches:** An automatic transfer switch must be installed separately from (not inside) the control panel. Automatic transfer switches should be supplied by the manufacturer of the generator.

  - (a) Simultaneous starting of two pumps should be prevented. A reasonable generator run time should be provided before pump start and after primary power returns.
  - (b) A connection should be provided so that the generator can power an external, portable load bank for maintenance purposes.
- (8) **Generator receptacle:** The Superintendent may require the control panel to have a generator receptacle mounted to the side. The receptacle brand must be Crouse Hinds, AR2042 for 230V and DF4404 for 480 V.
- (9) **Housing:** Weatherproof, sound attenuated steel housing with lockable, hinged doors and Critical Grade Exhaust Silencer with mounting hardware. Silencer mounting kit, tail pipe and rain cap. Genset shall be painted dark brown.
- (10) **Engine Cooling System:** Unit Mounted Radiator w / pusher fan  
50 Ambient Low Coolant Level Shutdown
- (11) **Engine Heating System:** Engine Block and Coolant Heater, 120 V, 2500 Watts 40 F Minimum Ambient Temperature.
- (12) **Automatic exercise cycling:** Generators must be set up for automatic exercise cycling.
- (13) **Engine Fuel System:** Flexible Fuel Lines Sub-base Fuel Tank sized for 24 Hours of Continuous Operation at Full Load. Double Wall Construction, Skid Mounted, With Leak Detection Monitoring, U.L. Listed, Fuel Level Gauge, Low Fuel Level Alarm.
- (15) **Engine Electrical Equipment:** Battery Rack and Cables, Starting Batteries – 2 @ 12 volts, lead acid type, Battery Charging Alternator - 60 Hz DC, 10 Amp Battery Charger, 120 Volts AC, 24 Volt DC Starter
- (16) **Governor:** Electronic Isochronous Governor
- (17) **Electrical Accessories:** Main Line Circuit Breaker, Mounted on Generator, 3 Pole, 600 Amps Per Pole, Voltage Regulator +/- 2% Safeguard Breaker.
- (18) **Controller and Alarms:** Engine Pre-Alarm Senders to include:

Pre-high Engine Temperature Alarm, Pre-low Oil Pressure Alarm  
Low Engine Temperature Alarm.

- (19) **Other Genset Requirements:** Skid End Caps, Spring Type Vibration Isolators – External to Skid Base.
- (20) **Automatic Transfer Switch Requirements:** Application: Utility to Genset, 800 Amp, 3 phase, 3 pole, 277/480 volts, seven day exerciser clock, pilot lights on door to show switch position, pilot light on door to show normal is available, adjustable time delay on engine start, adjustable time delay for cool-down after re-transfer to normal before stopping, test switch on door, plant exerciser with load, in-phase monitor both directions.
- (21) **Additional Requirements:** 5 – Year Comprehensive Warranty, 2 sets of owner’s/operator’s manuals to be provided prior to delivery of equipment. Initial start-up to be performed by manufacturer’s representative – includes warranty validation, engine oil and antifreeze must be provided and installed at start up by manufacturer.
- (22) **Communications:** the generator controller must be capable of Modbus Protocol and be compatible with the City’s SCADA and RTU systems as described below.
- (G) **MONITORING DEVICES – REMOTE TERMINAL UNITS (RTUs) SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)**
- (1) SCADA system brand: **J.K. Duren Company**. Each Pump Station must be equipped with an RTU that will communicate with the Advanced Water Reclamation Facility’s (AWRF’s) SCADA system. All system upgrades to the City’s SCADA system required for the efficient operation of each individual RTU shall be included. This may include but not be limited to “store and forward” upgrades to subsequent RTUs required to convey the signal to the AWRF main computer or upgrades to the AWRF main computer, antenna, radio, or any other related equipment or programming. Each RTU shall have the following common characteristics:
- (a) Shall be microprocessor based
  - (b) Capable of routing or “store and forward” repeating
  - (c) Capable of serving as an area or process controller
  - (d) Capable of executing system control computer (SCC) commands
  - (e) Capable of monitoring and controlling site functions and status
  - (f) Shall process digital and analog inputs and outputs
  - (g) Capable of on-board counters for totalization
  - (h) Shall operate on a 12 VDC battery backup for minimum of (1) one hour
  - (i) Shall operate on normal input power 15 Amp /120 volts AC

- (j) Capable of being solar powered including radio
  - (k) Shall have a unique group and station digital address
  - (l) Capable of reporting alarms as they occur
  - (m) Shall have overvoltage protection on I/O, line and antenna interconnections
  - (n) Shall be programmable in IEC 61131 suite of logic languages
  - (o) Shall communicate using MODBUS RTU Protocol
  - (p) Shall communicate with existing Master at City of Cumming - Advanced Water Reclamation Facility
- (2) The RTU enclosure shall be sized for the equipment, environment, and meet NEMA-4X standards with a hinged pad-lockable door.
- (3) RTU general requirements are established in the interest of functionality, durability, flexibility, cost effectiveness, and standardization for operations and maintenance.
- (a) Electrical Specification
- (1) AC power 120 volts, 60 hertz
  - (2) DC power 13.8 volts, 22 amp, the DC power supply in the base station RTU shall be sized to power the indicated analog loops and shall have at least 40% spare capacity for future use.
  - (3) Battery shall be sealed lead-acid 12 VDC rated at 5 Amp-hours
- (b) Input Specification
- (1) Analog inputs, 4-20 ma/0-5vdc/1-5vdc
  - (2) Digital inputs, on/off, 12vdc, 24vdc, 120vac, dry contacts, isolated
  - (3) Counter 16 bit or 32 bit, on/off isolated
- (c) Output Specification
- (1) Analog output, 4-20ma, 0-5vdc
  - (2) Digital outputs, on/off, 120vac, dry contacts
- (4) The RTU I/O requirements are as follows:
- (a) **Analog Inputs (AI)**
- AI-1 Level
  - AI-2 Spare
- (b) **Digital Inputs (DI)**
- DI-1 Pump-1 Status
  - DI-2 Pump-2 Status
  - DI-3 Pump-3 Status
  - DI-4 Pump-1 Fail Alarm
  - DI-5 Pump-2 Fail Alarm

- DI-6 Pump-3 Fail Alarm
- DI-7 High Wetwell Level Alarm
- DI-8 High Wetwell Float Alarm
- DI-9 Motor Control Panel Power-fail Alarm
- DI-10 Generator Run Status
- DI-11 Generator Major Alarm (Shutdown such as over-temp)
- DI-12 Generator Minor Alarm (Warning such as low fuel)
- DI-13 Transfer Switch in Generator Position
- DI-14 TVSS Fail Alarm
- DI-15 Valve 1 Fail Alarm
- DI-16 Valve 2 Fail Alarm
- DI-17 Valve 3 Fail Alarm
- DI-18 Gas Detector Alarm
- DI-19 RTU Power-fail Alarm

**(c) Digital Outputs (DO)**

- DO-1 Spare
- DO-2 Spare

**(5) Radio**

**(a) General** - The telemetry signals shall be transmitted over a radio system operating in a half-duplex mode on a single FM radio frequency. The radio equipment shall be capable of operating on a narrow band splinter frequency in the Power Radio Service. The telemetry system manufacturer shall provide all radio path surveys design the system for a least 99.9% reliability. System manufacturer shall also provide all help necessary to the end user for radio frequency coordination and FCC licensing, all as previously specified.

**(b) Radio Transceiver** - The radio transceiver shall be a new current modem FM 2-way radio suitable for transmitting and receiving audio tones at up to 1200 bits per second.

**Transmitter**

- RF Power Output ..... 20 watts adjustable to 5 watts minimum
- Frequency Range ..... 150-174 MHz
- Frequency Stability ..... +/-0.0005% from -30 to 60 C
- Modulation..... 6F9, +/-2.5 KHz for 100% modulation
- FM Hum and Noise ..... Minus 50 dB
- Spurious and Harmonics ..... Minus 80 dB

**Receiver**

- Sensitivity (12 dB SINAD) .....0.35 uV
- Selectivity .....Minus 80 dB @ +/- 30 KHz
- Frequency Stability ..... +/-0.0005% form 30 to 60 C
- Intermodulation ..... Minus 70 dB

Spurious and Image Rejection .... Minus 85 dB

Radio transceivers shall be provided with integral audio feedback to allow audible diagnostics while troubleshooting.

**(6) Antennas, Cable, Masts, and Poles** - The radio telemetry system supplier shall provide the antennas for each site as required to achieve the overall communications and requirements of the system. Antennas shall be directional or omni-directional as required and suitable for outdoor environments. They shall be of all aluminum construction and rated to withstand at least 100 MPH winds with ½ inch radial ice. Adequate lengths of RG213A/U coaxial cable shall be provided for connection of the antenna to the radio transceiver at each site. The transmission line shall be terminated only in connectors rated for the required service. A lightning arrestor shall be placed between the transceiver and coaxial cable. Unless specifically stated, the antennas shall be attached to existing structures, such as tanks or buildings. Particular attention shall be given to the correct installation of the antennas to give adequate protection from nearby lightning strikes by providing a low resistance DC path to ground. Instructions for installing these antennas shall be given to the contractor so as to insure reliable operation. Contractor shall furnish all mounting masts or poles as required to support the antennas at the elevations and orientations required. Masts and poles shall be suitable for outdoor environmental conditions, provide adequate support and protection for transmission lines and be provided complete with all necessary mounting accessories. Minimum acceptable technical and physical specifications of the antenna shall be as follows:

Directional Antenna

Type.....5 element Yagi, with a forward gain of at least 7 dB  
Front to back ratio.....20 dB  
Lightning protection....Direct ground  
Feed-point method.....Weather-proof gamma match for coaxial feed line

**(7) Modifying Software:** The supplier shall be responsible for modifying the software at the Master telemetry unit to include this RTU. The HMI SCADA software shall be modified to add a new screen for this lift station, and include this lift station in all reports, communications, maps, and overview screens. The HMI computer and SCADA software versions shall be upgraded as required to maintain this unit at the most current reliable industrial standard.

**(H) LANDSCAPING:**

**(1)** Six (6) ft to eight (8) ft tall Leland Cypresses trees must be planted around the perimeter of each station.

- (2) All native brush and trees must be removed from the pump station site except where prohibited by the City.
- (3) All trees deemed dangerous by the City and within striking distance of the pump station site shall be removed before the station will be accepted by the City.
- (4) A “soil sterilizer” shall be properly applied to all graveled areas on the pump station site as directed by the City.

**(I) SPARE PARTS:**

- (1) **Spare pump:** The Developer must supply the City with a spare pump for each pump station.
- (2) **Spare fuses:** One of each of the fuses that are used in the electrical control system must be provided to the City.
- (3) **Spare transducer:** an spare transducer must be supplied with each station.

**(J) START UP:**

- (1) The developer, the pump manufacturer’s representative, the generator manufacturer’s representative, the design engineer, the superintendent, and any other associated parties must be present at “start up”.
- (2) The pump manufacturer’s representative must inspect each pump for proper rotation, pumping capacity, vibration, and amperage draw.
- (3) The generator manufacturer’s representative must test the generator and transfer switch for proper operation at full load.
- (4) Each pump must be removed from and reinstalled into the wet well to demonstrate that the pumps can be easily maneuvered for maintenance purposes.
- (5) All keys and spare parts must be submitted to the City.

**(K) INFORMATION SUBMITTAL REQUIRED AT START UP:**

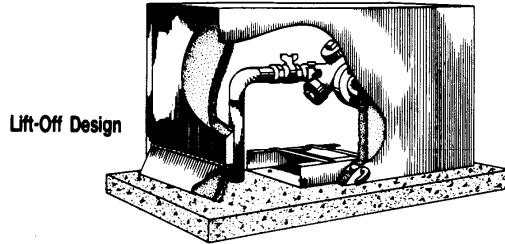
- (1) Three sets of ***as-built*** drawings.
- (2) Three sets of detailed drawing schematics.

- (3) Three sets of manufacturer's operation and maintenance (O&M) literature for each piece of equipment at the station.
  - (4) Three copies of each pump curve.
  - (5) The name, address, and telephone number for the developer, design engineer, contractors, subcontractors, and manufacturers' representatives.
- (L) **FLOOD PLAIN REQUIREMENTS:** The pump station, fenced area, access road, and all equipment shall be above the 100 year flood plain. The construction plans must show the flood plain limits.
- (M) **RESERVED RIGHT TO CHANGE THESE REQUIREMENTS WITHOUT NOTICE:** The City of Cumming reserves the right to make changes to these specifications without notice. In the event these specifications conflict with another set of specifications, an ordinance, or law, the more restrictive requirement shall prevail.

SAFE-T-COVER is sold by Kendall Supply  
**4096 Chamblee Road, Oakwood, Georgia 30566**  
**(678) 377-3215 FAX (770) 532-7410 Terry Martin**



Nashville, Tennessee  
 (800) 245-6333  
 (615) 259-4481 (FAX)



**DATA SHEET** Model 100S-AL & 200S-AL "R" Value Minimum 8.0

Model No.	B.F.P. Size	Inside Width	Inside Length	Inside Height	Weights	Recommended Concrete Pad Dimensions	
						Width	Length
100S-AL	¼"-1"	7"	32"	22"	26 lbs.	18"	43"
200S-AL	1¼"-2"	14"	42 7/8"	29"	44 lbs.	26"	55"

**FEATURES**

- 1) **Insulation** — Closed cell polyisocyanurate foam core."R" value 6.0 per inch.
- 2) **Drain** — Oversized to meet or exceed all Plumbing Codes. Drain door insulated. Opens to outside only. Closed during no-flow periods.
- 3) **Access** — Lift-off design for testing or maintenance.
- 4) **Installation** — Fast & simple, no special tools required.
- 5) **Durability** — Stainless steel mounting brackets.
- 6) **Security** — Guards against tampering or vandalism by completely enclosing device. Lockable.
- 7) **Movable** — Can be completely moved to another location.

## Bilco Metal Hatch



**Type K & KD**  
**Single or Double Leaf**  
**Aluminum Construction**

Single or double leaf covers are constructed of ¼" (6.35mm) diamond pattern plate and reinforced for a 150-lb/ft<sup>2</sup> (732 kg/m<sup>2</sup>) live load. Features zinc plated and chromate sealed hardware, concealed hinges and the T-CAM™ system for ease of operation.

# City of Cumming

## Acceptable Manufacturers

### Names, addresses, and phone numbers:

1. **Flygt Pumps** -  
Submersible Wastewater Pumps  
90 Horizon Drive  
Suwanee, Georgia 30024  
(770) 932-4320 Ext. 19 FAX (770) 932-4321  
<http://www.flygtus.com/115107.asp>
2. **J.K. Duren Company** – *Ken Duren*  
SCADA System and Verbatim Autodialer  
Box 1124  
Roswell, Georgia 30077  
(770) 992-5405 FAX (770) 993-0127  
[www.jkduren.com](http://www.jkduren.com)
3. **Sunbelt Power / Caterpillar**  
Generators (Diesel above 100 kW Natural Gas below)  
259 Lee Industrial Blvd  
Austell, Georgia 30168  
(678) 309-4421 FAX (770) 941-2411
4. **Cummins South / Onan** – *Beth Mincey*  
Generators (Diesel above 100 kW Natural Gas below)  
5125 highway 85  
Atlanta, Georgia 30349  
(404) 765-5138 FAX (404) 763-0711  
<http://www.south.cummins.com>
5. **Nixon Power Services / Kohler** –  
*Thomas Lammert*  
Generators (Diesel above 100 kW Natural Gas below)  
3121 Oakcliff Industrial Street

Atlanta, Georgia 30340  
(770) 452-7695 FAX (770) 452-7696  
[www.kohlergenerators.com](http://www.kohlergenerators.com)

6. **Reagan Equipment / Katolite** – *Alan Resmondo*  
Generators (Diesel above 100 kW Natural Gas below 100 kW)  
995 Marietta Industrial Drive  
Marietta, Georgia 30062  
(770) 419-8800 FAX (770) 419-8802  
[www.katolight.com](http://www.katolight.com)
  
7. **Safe-T-Cover – Kendall Supply** – *Terry Martin*  
RPZ Backflow Prevetion Device Heated Cover  
For above ground installation of RPZ  
4096 Chamblee Road  
Oakwood, Georgia 30566  
(678) 377-3215 FAX (770) 532-7410
  
8. **USA Crane and Hoist** – *Danny Marshall*  
Jib Cranes and Electric Hoists  
530 Winkler Drive  
Alpharetta, Georgia 30009  
(770) 844-7876 FAX (770) 844-7877  
[www.usacraneandhoist.com](http://www.usacraneandhoist.com)
  
9. **Eastec Sales Company**  
Wetwell and Valve Box Hatch Doors  
P.O. Box 2056  
Suwanee, ZIP 30024  
(770) 831-6111 FAX: (770) 831-1017  
[www.bilco.com/index-2.htm](http://www.bilco.com/index-2.htm)
  
10. **Hughes Supply** – *Frank Farrell*  
GE lightpole and fixture, GE bracket, winch, lamp, and photocell  
6779 Crescent Drive  
Norcross, Georgia 30071  
(770)734-8900 FAX: (770) 735-8905