INDEX TO

SECTION 11100
SUBMERSIBLE WASTEWATER PUMPING STATIONS
PUMP TO CONTROL PANEL

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PART 1 – PRODUCTS

1.01 PUMP DESIGN

A. General: Each pump shall be suitable for service in raw, unscreened sewage with 3 inch solids and shall be conform to the requirements shown on the Drawings for flow rate, total dynamic head, horse power, voltage and phase. Pumps shall be as manufactured by Flygt or approved equal.

B. Qualifications of Manufactures: The pump manufacturer shall have a minimum of 10,000 heavy-duty submersible wastewater pumps installed and operating for no less than 5 years in the United States.

C. Design Requirements: Furnish and install submersible non-clog wastewater pump(s). Each pump shall be equipped with a close coupled, submersible electric motor connected for operation on 460 volts, 3 phase, 60 hertz, and 4 wire service with submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge connection and be capable of delivering the design flow and total discharge head. Each pump shall be fitted with stainless steel (304 S.S.) lifting chain or stainless steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight. The design operating point shall be as near as possible to the best efficiency point of the selected motor.

D. Pump Design: The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two parallel guide bars extending from the top of the station to the wet well mounted 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. The entire weight of the pump/motor unit shall be borne by the pump discharge elbow. No portion of the pump/motor unit shall bear on the sump floor directly or on a sump floor mounted stand.

Power and pilot cable supports shall be provided and consist of a wire braid sleeve with attachment loops or tails to connection to the underside of the access frame.

E. Pump Construction: Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel. All metal surfaces coming

into contact with the pumped media, other than stainless steel, 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.

Sealing design shall incorporate metal-to-metal contact between machined surfaces. Pump/Motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Joint sealing 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 bolt torque limit. Rectangular cross sectioned rubber, paper or synthetic gaskets that require 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.

F. Cooling System: Each pump/motor unit shall be provided with an integral, self-supplying cooling system. The motor water jacket shall encircle the stator housing and shall be of cast iron, ASTM A-48, Class 35B. The water jacket shall thus provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air. After passing through a classifying labyrinth, the impeller back vanes shall provide the necessary circulation of the cooling liquid, a portion of the pump-age, through the cooling system. Two cooling liquid supply pipes, one discharging low and one discharging high within the jacket, shall supply the cooling liquid to the jacket. An air evacuation tube shall be provided to facilitate air removal from within the jacket. Any piping internal to the cooling system shall be shielded from the cooling media flow allowing for unobstructed circular flow within the jacket about the stator housing. Two cooling liquid return ports shall be provided. The internals to the cooling system shall be non-clogging by virtue of their dimensions. Drilled and threaded provisions for external cooling and, seal flushing or air relief are to be provided. The cooling jacket shall be equipped with two flanged, gasket and bolted inspection ports of not less than 4"Ø located 180° apart. The cooling system shall provide for continuous submerged or completely non-submerged pump operation in liquid or in air having a temperature of up to 40°C (104° F), in accordance with NEMA standards. Restrictions limiting the ambient or liquid temperatures at levels less than 40° C are not acceptable.

G. 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 dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. 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 sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

1.02 PUMP MOTOR

The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180° C (356° F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40° C (104° F) with an 80° C temperature rise and capable of at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches shall be embedded in the stator end 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 shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

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 upon request 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 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 at least 65 feet.

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

A. Pilot Cable: The pilot cable shall be designed specifically for use with submersible pumps and shall be type SUBCAB (Submersible Cable). The cable shall be shielded, multi-conductor type with a chloroprene outer jacket and the tinned copper conductors insulated with ethylene-propylene rubber. The conductors shall be arranged in twisted pairs. The cable shall be rated for 600 Volts and 90° C (194° F) with a 40° C (104° F) ambient temperature and shall be approved by Factory Mutual (FM). The cable length shall be adequate to reach the junction box without the need for

splices.

B. Bearings: The pump shaft shall rotate on at least three grease lubricated bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust.

The minimum L10 bearing life shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed.

The lower bearing housing shall include an independent thermal sensor to monitor the bearing temperature. If a high temperature occurs, the sensor shall activate an alarm and shut the pump down.

C. Mechanical Seal: Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The lower seal shall be independent of the impeller hub. 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 corrosion resistant tungsten-carbide seal ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating corrosion resistant 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 and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal. For special applications, other seal face materials shall be available.

Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm. Any intrusion of fluid shall not come into contact with the lower bearings.

The following seal types shall not be considered acceptable or 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. No system requiring a pressure differential to offset pressure and to affect 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 continuously while non-submerged without damage while pumping under load.

Seal lubricant shall be FDA Approved, nontoxic.

D. Pump Shaft: Pump and motor shaft shall be a solid continuous shaft. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be of carbon steel ASTM A 572 Grade 50 and shall be completely isolated from the pumped liquid.

E. Impeller: The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, multiple vane, double shrouded non-clogging design, having long through-lets without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. 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 expansion ring and shall be capable of passing a minimum 3-inch diameter solid. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

F. 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 Nitrile rubber coated steel or brass ring insert that is drive fitted to the volute inlet. This pump shall also have a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller.

G. 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 and discharge size shall be as specified.

H. Protection: All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. Should high temperature occur, the thermal switches shall open, stop the motor, and activate an alarm.

I. Pump Motor Electrical Material:
   1. All materials shall be new and shall conform to the applicable standard or standards where such have been established for the particular material in question. Publication and Standards of the organizations listed below are applicable to materials specified herein:
      a. American Society for Testing and Materials (ASTM)
      b. Underwriters' Lab (UL)
      c. National Electrical Manufacturer Association (NEMA)
      d. Insulated Power Cable Engineers Association (IPCEA)
      e. Institute of Electrical and Electronic Engineers (IEEE)
      f. Edison Electrical Institute (EEI)
      g. National Fire Protection Association (NFPA)
      h. American National Standards Institute (ANSI)
      i. American Iron and Steel Institute (AISI)
   2. Materials of the same type shall be the product of one manufacturer.

3. No IEC Rated Type “P” Device. Underwriters’ Laboratory listed material shall bear U.L. Label. Also, no adjustable circuit breakers are to be used.

1.03 SUBMITTALS

The submittals for submersible pump, motor, guide rail system shall include, but not be limited to the following information relative to submersible pump, motor and guide rail system features:

A. Pump:
   1. Head capacity efficiency curves
   2. Duty point
   3. Input power (KW), voltage, phase, frequency, power factor
   4. Efficiency and brake horsepower
   5. Construction details: body, vane, impeller, minimum clearance between impeller and volute; vanes, pump dimensions, pump base, discharge nozzle, adapter, seals, bearings, bearing life, bolts, hooks, etc.
   6. Weight
   7. Centerline distance between two pumps
   8. Clearance from walls, floor
   9. External coating details of materials, applications, etc.
   10. Operating and maintenance information

B. Guide bar rail system: dimensions, material of guide bars, guide bar supports, hooks, clearance from wall, centerline distances, etc.

C. Motor:
   1. Outline dimensions, weight, construction details, terminal board, seals, shaft dimensions, torque data and structural design data for motor shaft, so cable, bearings, bearing life, etc.
   2. Where a winding over temperature device is required, provide a response curve or the temperature device.
   3. Operating and maintenance information and overhaul instructions for each motor 5 H.P. and over.

1.04 WARRANTY

A. Warrant at 100% all parts and labor for one (1) year that covers normal wear and tear for typical sewage pump applications.

B. The manufacturer shall provide a 100% full coverage warranty for one year (12 months) from the date of acceptance of the pump station by the City for operation and maintenance. For years 2 - 5 of the service contract, the manufacturer shall provide warranty work on a pro-rated basis. A manufacturer's service representative and the Conveyance and Distribution Director or designee shall work together to make joint

resolutions of all warranty work, as well as, all other maintenance needs. The manufacturer shall also provide a service representative authorized by the pump manufacturer. Any work carried out by the authorized representative shall not violate manufacturer's warranty.

C. A four-hour response to service call by the City shall be provided by the service representative. The service representative shall restore pump to service within five (5) working days.

D. Service Manual - The pump manufacturer shall furnish the Owner with a minimum of six (6) service manuals for the pumps installed.

E. The pump manufacturer shall provide the identification of manufacturer's contact person and beeper number and an alternate name and number for 24-hour availability.

PART 2 – TESTING

2.01 CONSTRUCTION OBSERVATION

A. The submersible pumps shall be installed and tested by the Contractor under the direction of the Engineer or his Inspector. The Engineer or his Inspector will have the right to require that any portion of the work be done in his presence, and if the work is completed after such instruction, it shall be exposed by the Contractor for observation. However, if the Contractor notifies the Engineer or his Inspector that such work is scheduled and the Engineer or his Inspector fails to appear within 48 hours, the Contractor may proceed without him. All work done and materials furnished shall be subject to review by the Engineer, his Inspector, or project representative. Improper work shall be reconstructed. All materials which do not conform to the requirements of the specifications shall be removed from the work upon notice being received from the Engineer or his Inspector for the rejection of such materials. The Engineer or his Inspector shall have the right to mark rejected materials so as to distinguish them as such.

B. The Contractor shall give the Project Engineer, his Inspector, or Project Representative a minimum of 48 hours notice for all required observations or tests.

C. Equipment furnished under other sections of these specifications, to be connected under this section of the specifications, shall include, but not be limited to, pump station equipment.

D. The Contractor's attention is directed to other sections of these specifications where equipment requiring electrical service is specified. It is also necessary to be aware of the scope of work under this section of these specifications requiring electrical service and connections to equipment specified elsewhere.

2.02 ACCEPTANCE OF PORTIONS OF THE WORK

The Owner reserves the right to accept and use any portion of the work whenever it is considered to his interest to do so. The Engineer or his Inspector shall have power to direct in what area the Contractor shall work and the order thereof. The Contractor shall complete the Lift Station Data sheets (5) at the end of this section fully prior to the Owner's acceptance.

2.03 PUMP TEST

A. Testing performed upon each pump shall include the following inspections:
   1. Impeller, motor rating and electrical connections shall be checked for compliance with this specification.
   2. Prior to submergence, each pump shall be run dry to establish correct rotation.
   3. Each pump shall be run submerged in water.
   4. Motor and cable insulation shall be tested for moisture content or insulation defects.

B. Upon request, a written quality assurance record confirming the above testing/inspections shall be supplied with each pump at the time of shipment.

C. Each pump shall be tested in the field to provide a field certified pump curve with the initial draw down documentation submitted in accordance to lift station data sheets shown in Subpart 2.04 of this specification.

D. The pump(s) shall be rejected if the above requirements are not satisfied.

E. Start-up Service: The equipment manufacturer shall furnish the services of a qualified factory trained field service engineer for an 8-hour working day(s) at the site to inspect the installation and instruct the owner’s personnel on the operation and maintenance of the pumping units. After the pumps have been completely installed and wired, the contractor shall have the manufacturer do the following:
   1. Megger stator and power cables.
   2. Check seal lubrication.
   3. Check for proper rotation.
   4. Check power supply voltage.
   5. Measure motor operating load and no load current.
   6. Check level control operation and sequence.
   7. Submit a completed Subpart 2.04 for approval by the Engineer.
   8. Pumps shall clear the hatch of the wet well top without impedance.

   During this initial inspection, the manufacturer’s service representative shall review recommended operation and maintenance procedures with the owner’s personnel.

F. Factory Service: Factory-Approved service facilities with qualified factory trained mechanics shall be available for prompt emergency and routine service. The pump manufacturer shall warrant the pumps in writing against defects in workmanship and material for a period of five (5) years or 10,000 hours of normal use, operation and service. The warranty shall be in printed form and apply to all similar units. Warranty shall cover both parts and labor on a pro-rated basis after the first year. The first year warranty shall cover 100 percent labor and materials cost.

G. Operation and Maintenance Manuals: The manufacturer shall furnish to the owner six (6) sets of its Operation and Maintenance Instruction Manuals and parts List.

2.04 LIFT STATION DATA SHEETS

LIFT STATION NAME:_____ Number:_____

Address:_____ Cross Street:_____

Station Power:

Voltage:_____ Phase:_____ Amperage:_____ Gen Set:_____ Plug:_____

Sub Station:_____ Feeder Number:_____

Transformer Number:_____ Account Number:_____

Conveyance Information:

Pumps to:_____ Serves:_____

Equipment:

RTU:

Model Number:_____ Serial Number:_____DS

Controls:

Manufacturer:_____ Model Number:_____

Serial No.:_____ Vendor:_____

Contract Services:_____ Phone #: (____) _____ - _____

Contact:_____ Emergency #: (____) _____ - _____

Pumps:

Manufacturer:_____ Model Number:_____

Serial #:_____ Number:_____ Impeller Code:_____ HP:____

Serial #:_____ Number:_____ Impeller Code:_____ HP:____

Serial #:_____ Number:_____ Impeller Code:_____ HP:____

Serial #:_____ Number:_____ Impeller Code:_____ HP:____

Serial #:_____ Number:_____ Impeller Code:_____ HP:____

Serial #:_____ Number:_____ Impeller Code:_____ HP:____

GPM:_____ TDH:_____

Vendor:_____ Phone Number: (____) _____ - _____

Contract Services:_____ Phone Number: (____) _____ - _____

Contact:_____ Emergency Number: (____) _____ - _____

Gen Set:

Manufacturer:_____ Model Number:_____
Serial Number:_____ KVA:_____ M.C/B:_____
Vendor:_____ Phone Number: (____) ____-____
Contract Services:_____ Phone Number: (____) ____-____
Contact:_____ Emergency Number: (____) ____-____

Transfer Switch:

Manufacturer:_____ Model Number:_____
Serial Number:_____ KVA:_____
Vendor:_____ Phone Number: (____) ____-____
Contract Services:_____ Phone Number: (____) ____-____
Contact:_____ Emergency Number: (____) ____-____

Odor Systems:

Manufacturer:_____ Model Number:_____
Vendor:_____ Phone Number: (____) ____-____
Contract Services:_____ Phone Number: (____) ____-____
Contact:_____ Emergency Number: (____) ____-____

Equipment:_____
_____
_____

By-Pass: Type:_____
Manufacturer:_____ Model Number:_____
Vendor:_____ Serial Number:_____
Description:_____
_____

Contract Services:_____ Phone Number: (____) ____-____
Contact:_____ Emergency Number: (____) ____-____

Building Type:_____ Bldg Size (L x W):_____
Finished Floor Elevation (NAVD '88):_____ # of Floors:_____ # of Rooms:_____
Fence Type & Height:_____ Lot Size (L x W):_____

Gates: Number Gates:_____ #1:___x_____ #2:___x_____ #3:___x_____
Sump Pump:_____ HP:___ GPM:_____ TDH:_____ Voltage:_____ Phase:____

Fan:_____ HP:_____ RPM:_____ FPM:_____ Voltage:_____ Phase:____
Heater:_____ BTU:_____ Voltage:_____ Phase:_____ Wattage:_____
A/C:_____ BTU:_____ Voltage:_____ Phase:_____
Hoist:_____ Tons:_____ ft/sec:_____ Clearance:_____ ft Length:____ ft
Electric? Y/N Volts:_____ Phase:_____

Miscellaneous Equipment:
Description:_____ Voltage:_____ Phase:____
Description:_____ Voltage:_____ Phase:____
Description:_____ Voltage:_____ Phase:____
Description:_____ Voltage:_____ Phase:____

Comments:_____
_____
_____

Data: Last Update:_____
Date: _____/_____/_____
Station Construction: $_____
Start Up Date: _____/_____/_____
Warranty Description:_____
Warrantor: _____
Expires: _____/_____/_____

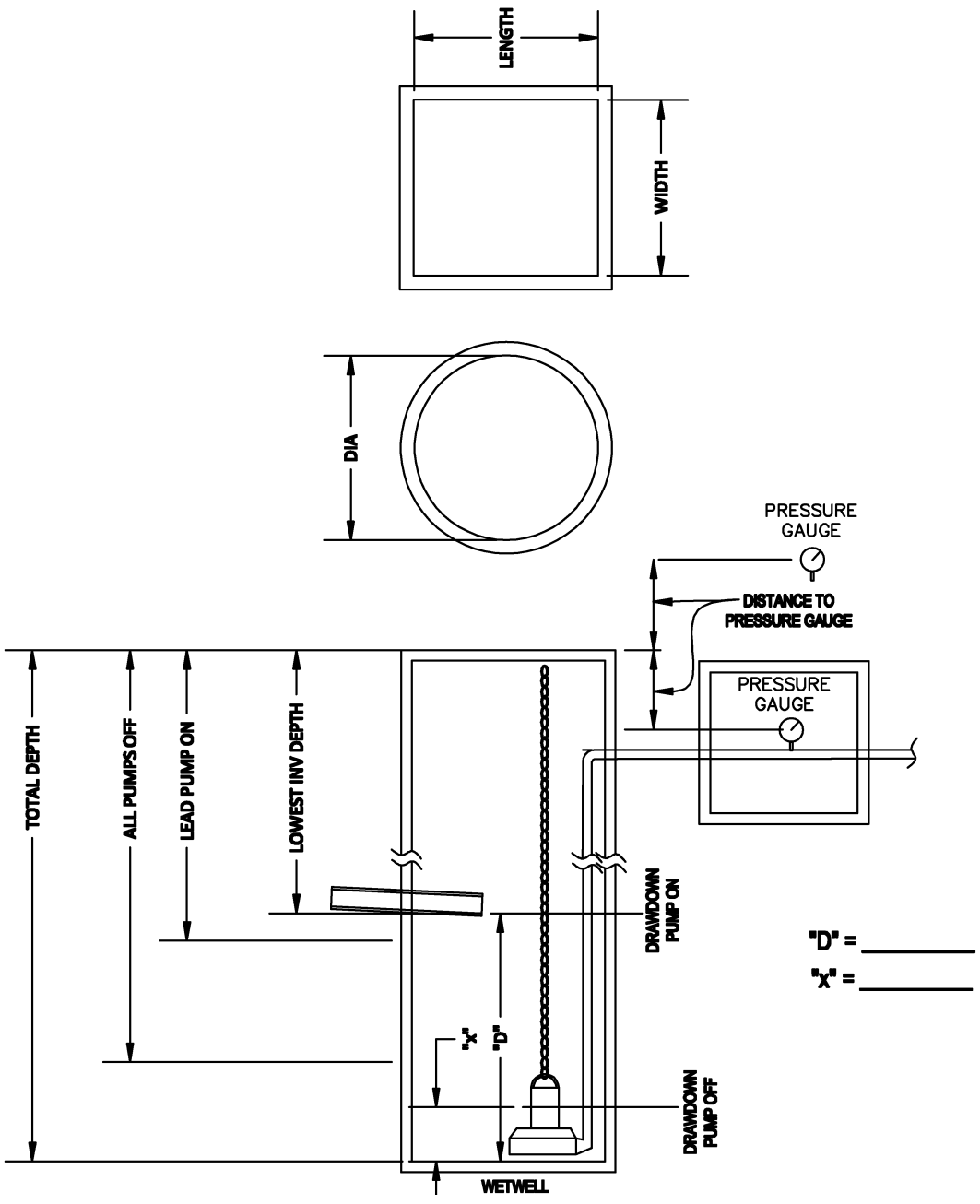
Wet Well Data:
Square_____ Rectangular _____ Circular _____ (Check Applicable Shape)
Length: _____ feet _____ inches Diameter: _____ feet _____ inches
Width: _____ feet _____ inches Depth: _____ feet _____ inches

Elevation at center of Pump Motor: _____feet Elevation at top of Wetwell: _____ feet
Elevation at bottom of Inflow Pipe: _____ feet Inflow Pipe Diameter: _____ inches
Elevation at top of lowest Manhole: _____ feet Elev. of lowest House Lateral:_____ feet

Pump Guide Bars:
Total Length:_____ feet_____ inches Dia.: ___ inches Middle Bracket: Y / N
Pump Base (Ø): _____ inches
Station Force Main Size (Ø):_____ inches By-pass Cam-lock Size:_____ inches
Remarks:_____
_____

LIFT STATION DRAWDOWN SKETCH

LIFT STATION NO. _____



PUMP MODEL:_____ **VOLUME (GAL/FT):**_____

PUMP HP:_____ **AVG PUMP RATE (GPM):**_____

IMPELLER (mm or Code):_____ **INFLUENT FLOW AVG (GPM):**_____

VOLUTE (In):_____

Lift Station Drawdown Data Sheet

Date:_____________ Lift Station #:__________ Weather: Dry or Wet By:___________________

Time	Pump #	Pump Status	Depth (ft)	Gauge Pressure (psi)

PART 3 – FINAL INSPECTION

3.01 FINAL INSPECTION / ACCEPTANCE

A. Field Pumping Test:
   1. The Water and Sewer Conveyance and Distribution Director or his representative shall be present at time of this test. Perform a minimum of two pump tests with each pump for a minimum of three flow discharges with each pump pumping with the discharge valve set as follows:
      a. Closed
      b. Full Open
      c. Throttled
   2. During final inspection, the contractor, in the presence of the Owner's representative, shall remove each pump using the hoist beam, set the pump on the top slab, reinstall the pump and start up the pump with no interference or excess force.

B. Dry Pumping Test: The pump will be tested in one of two ways; Facility Test or Site Test:
   1. Facility Test: A facility designed for testing of pumps and motor, with control over liquid level, head conditions, current, voltage and temperature, also monitoring and recording of data. Snore conditions may occur for an estimated period of 4 hours or 45 seconds.
   2. Site Test shall be performed as follows:
      a. Current and pump/motor temperature shall be recorded.
      b. Pump to be set as designed in station on base.
      c. Force main shall be plugged.
      d. By-pass valve open, with a cam-lock pipe connected shall be in place so water can flow back into wetwell.
      e. Wet well shall be filled to centerline of volute (more water may be added to maintain centerline).
      f. Pump shall be placed on line.
      g. By-pass valve shall be adjusted to meet designed duty point.

      Snore may occur due to turbulence and liquid level pump down. The Water and Sewer Conveyance and Distribution Director reserves the right to have this test performed for each pump by the manufacturer and/or supplier of the pumps.

3.02 PERSONNEL REQUIRED FOR INSPECTION

A. General Contractor

B. City Engineering Departments

C. Conveyance and Distribution applicable personnel

D. Civil and Electrical Engineering Consultants

E. Pump and Control Manufacturer

F. Emerson / Bristol Babcock for SCADA

PART 4 – ELECTRICAL / ELECTRONIC SUB-SYSTEM(S)

4.01 GENERAL

The electrical/electronic system of the pumping station shall consist of the below listed integrated capabilities which shall be required to successfully accomplish the objective of ensuring automatic operation of the pumping system. The minimum services/installations shall be:

A. Installation/activation/integration of the primary utility power source with all of the station electrical sub-systems in compliance with the supplying utility's installation guidelines and with NFPA 70 (National Electrical Code) standards.

B. A means to easily switch the station electrical load from the commercial electric power grid to an Emergency Power System (Generator) in the event of failure of the commercial power. This sub-system shall be in compliance with NFPA 70, NFPA 110, US EPA Standard 40 CFR 89, and all other standards cited in Standard Specification 16620 found on the City of Savannah website as applicable.

C. A stationary Emergency Power System (Diesel Generator Set and Automatic Transfer Switch) which shall be capable of providing electrical power to the station as outlined in City of Savannah Standard Specification 16620.

D. An integrated interconnection wiring system which shall interface with the SCADA system to:
   1. Annunciate alarms and status of HOA switch position, Pump running, Pump and/or Pump Control has failed, Main Circuit Breaker status, Power Source (Utility or EPS) is providing power to the station, Wet Well High Level Alarm condition, a 4-20ma signal proportional to the wet well level, a 4-20ma signal proportional to pump running amperes, and a 4-20ma signal proportional to station flow meter reading (as applicable). These signals/alarms shall apply for each and every pump at the station as applicable in the individual station contract documents.
   2. Allow the SCADA system to assume control of the station through its on-board "Watchdog and CMD" system as back-up to the primary process control system at the pumping station.

E. An integrated interconnection wiring system which shall interface with the Cellular Alarm Panel to annunciate:
   1. Station wet well is in a "High Level" condition.

2. The station primary 3-phase power is not correct.
3. A pump/pump control is in failure mode.
4. The back-up Emergency Power System is supplying primary power to the station.
5. Provide Mission Communications M800 RTU

F. The cellular alarm panel shall be mounted in the control room or on the back board, as applicable.

G. A Emerson (Bristol) Process Management "Control Wave" SCADA system to include antenna. The SCADA panel shall be located in the station control room or be mounted on the station main backboard.

H. A power distribution system which allows for the TOTAL isolation and removal of power from individual pump motor control enclosures at stations which have separate pump motor control enclosures without having to remove power from any other device within the overall system. This will generally apply to stations which have an on-site building structure which contains the control panels and power distribution sub-system, (an "I-Line" style distribution panel configuration is recommended).

I. At pump stations with separate and individual pump controls in a building structure, a master level control panel shall serve as the primary control interface for automatic operational control of the station primary functions. Refer to Section 5 of this Specification for details.

J. The station shall have indoor and outdoor lighting located such that any and all repair/maintenance activities may readily take place during the night without the deployment of temporary lighting systems. Light fixtures shall utilize LED technology.

K. The station shall have 120VAC convenience receptacles located indoors and outdoors such that power tools and etc. may be operated without the use of extention cords greater than 50 feet in length at any location within the station. These receptacles shall be configured as duplex NEMA 5-20R devices.

L. Stationary Generator Sets shall have a minimum two circuits for generator auxiliary loads: generator coolant heater, generator battery charger, service light, etc. Provide 240V single phase or 120V single phase as required.

M. The cellular alarm panel shall have its own dedicated receptacle configured as a duplex NEMA 5-20R device located within one foot to the alarm panel inside a building structure or inside its respective enclosure as applicable. This receptacle shall be powered from its own dedicated 20 AMP circuit breaker. This receptacle shall be a Hubbell HBL53605A surge protection receptacle.

4.02 BASIC ARRANGEMENT OF THE LIFT STATION ELECTRICAL SUB-SYSTEMS

A. Lift Stations shall not have any electrical device/panel other than convenience receptacles or lighting fixtures mounted to the exterior surfaces of any building structure on the property. All exterior electrical devices/panels shall be mounted to free-standing backboard structures. The backboard structures shall be constructed as follows:

1. Pressure treated wood used for construction of the equipment backboards shall conform to the following:
    a. Pressure treated wood shall be preserved using chromated copper arsenate (CCA), use category UC4B, and labeled by the manufacturer with AWPA listing for ground contact.
    b. All end-grain of timber vertical supports and horizontal boards, all field cuts, and all bored/drilled holes shall be field treated with two coats of copper naphthenate (Tenino).
    c. The vertical timber supports and the horizontal boards shall be painted with two coats of waterborne solid color deck stain (Sherwin Williams Super Deck Series), stain color shall be Sherwin Williams SW3009 (Pineneedle). One coat shall be applied prior to installation/assembly, the final coat shall be applied before mounting of electrical equipment. The finish shall be retouched before final acceptance.
    d. Horizontal boards shall be attached to the vertical timbers using two 1/2" stainless steel bolts on each end. Provide oversize "fender" type stainless steel washers under the bolt head and the nut.
    e. Equipment shall be attached to the horizontal boards using four 3/8" stainless steel bolts one at each corner. Provide oversize "fender" type stainless steel washers under the bolt head and the nut.
2. The main equipment backboard shall be located a minimum of 10 feet away from the wet well and shall not be placed in a location which may interfere with the entry/exit and safe operation of a mobile crane or boom truck during the installation or retrieval of pumps/other equipment located inside the wet well.
3. The backboard for wet well junction boxes and/or disconnect switch devices shall be located adjacent to the wet well.
4. Any additional backboards shall be located such that they meet the requirements of “1” and “2” above and be located near/along the security fence line as applicable.
5. Specific location(s) of backboard assemblies shall be as shown on the contract drawings.
6. Backboard Construction Details – Main Backboard:
    a. The backboard support posts shall be anchored in round concrete foundation forms (Sonotube). Foundation dimension shall be 18” diameter x 48” deep. Posts shall be set in the center of the forms to a depth of 36”.

b. The support posts shall be 6” x 6” pressure treated timber as specified above. The maximum span between posts shall not exceed 72”, center to center. For backboards exceeding 72”, a third post shall be provided in the middle. The assembly shall be capable of supporting the weight of all mounted equipment without sagging or leaning. Angle support bracing is not permitted; furnish additional support posts and concrete foundations as required. All equipment shall be mounted on the front of the backboard; rear mounted equipment will not be accepted.

c. Concrete pads or other such structure(s) under the backboard assembly are prohibited except for foundation bases for free standing control panels. This area shall be clear to facilitate the installation of electrical conduit to/from the devices and equipment.

d. The support post elevation above finished grade shall provide for attachment of the required number of cross pieces such that that the bottom of all devices mounted to the final assembly is a minimum of 24 inches above finished grade and that the top of the tallest enclosure/device is not less than four (4) inches below the top edge of the cross pieces.

e. The backboard cross pieces shall consists of 2” x 8” pressure treated lumber of sufficient length and numbers to accommodate the mounting of all of the devices which are to be mounted to it leaving sufficient space between the devices (6” between enclosures minimum) for air flow and the installation of interconnecting electrical conduit. All equipment and conduit shall be mounted to the front of the backboard assembly.

7. Backboard Construction Details – Other Backboards:

a. All other backboard assemblies required shall conform to the provisions of “6.” above, except that the support posts may consist of 4” x 6” pressure treated lumber posts due to the potentially reduced amount of weight which they will be supporting.

b. The final location of these backboard assembly(s) shall be as designated on the individual station contract drawings.

c. Backboards shall be provided for utility meters and service disconnects.

8. Backboard Assembly Details:

a. Where field conditions require that the assemblies/other devices mounted to the backboard(s) are mounted higher than specified above finished grade, a free-standing maintenance platform shall be constructed in front of the backboard assembly which may be easily moved by one person so that conduits and/or other items underneath it may be readily accessed. The platform shall be fabricated from 2” x 6” pressure treated lumber and decked with fiberglass grating. The working platform shall extend the length of the backboard and be 48” wide.

b. The backboard component pieces (boards) shall be assembled utilizing thru-bolt techniques with hex-head stainless steel bolts, nuts, fender washers, and lock-washers. Fender washers shall be used under the bolt

head and nut. The use of lag bolts, wood screws, decking screws and etc. will not be accepted.

c. The assembly bolt heads on the "front" side of the assembly shall be countersunk such that a flat surface is presented to the equipment be mounted on it.

d. All hardware and countersunk depressions shall be protected and painted prior to the mounting of any equipment on the backboard.

e. All equipment/devices mounted to/on the backboard assembly shall be securely fastened to the backboard assembly utilizing thru-bolt mounting techniques with hex-head stainless steel bolts, nuts, washers and lock washers. The use of lag bolts, wood screws, decking screws, and etc. shall not be acceptable.

9. Miscellaneous Backboard Details:

a. When fully assembled with all the equipment mounted; the backboard(s) shall stand plumb with no sag or droop of the cross pieces.

b. The backboard(s) shall stand firmly and not tilt, lean, or wobble when pushed from either the side or from the ends.

c. Following complete assembly of all devices to the backboard, the paint shall be touched up to eliminate scars, gashes, or other marring defects such that it presents a finished and professional appearance.

B. Pump Stations with pumps of 60 HP or greater will usually have a Control Room building which houses most of the electrical control system except for that which is required to be located outdoors. For those portions of the electrical system located outdoors, the above described criteria for backboard construction shall apply. For the portion(s) of the system located indoors; the following requirements shall be applicable:

1. The control room shall be arranged such that all equipment systems are located around the inside perimeter of the control room and interconnected with appropriate conduit raceways required for interconnecting wiring.
2. Receptacles, light switches, and other such devices shall be surface mounted. Do not install flush mounted.
3. Indoor lighting shall be provided for all interior spaces. Temporary lighting systems, under normal conditions, shall not be required.
4. Lighting fixtures shall be INDUSTRIAL grade devices compliant with OSHA and National Electrical Code standards. These fixtures shall be installed unobstructed.
5. Equipment enclosures inside the control room building shall be rated NEMA 1 or NEMA 12.
6. Equipment/enclosures located outside of the control room building shall be rated NEMA 3R or NEMA 4X.

4.03 DETAILED TECHNICAL DESCRIPTIONS OF CONTROL SYSTEM SUB-ASSEMBLIES

A. Refer to Section 16000 for Wires and Conduit descriptions.

B. Refer to Section 16482 for Pump Motor Starter/Drive descriptions.

C. Refer to Section 16400 for Flow Measurement Equipment.

D. Refer to Section 16620 for Emergency Power Back-Up Systems.

4.04 PRIMARY UTILITY POWER GRID INTERFACE TO PUMPING STATION

A. The pumping station shall be connected to the utility power grid IAW NFPA 70 (National Electrical Code) standards and the installation standards of the supplying electric utility company. Field coordinate with the electrical utility.

B. The entry point for electrical utility power to the station shall be located as close to the perimeter fence of the station as is allowable by the utility company. The type of interface connection (pole, pedestal, or stand-alone transformer) shall be coordinated with the utility company.

C. The utility connection point shall not be located such that overhead wiring extends beyond five (5) feet within the perimeter fence of the station. In no case shall overhead wires (power or telecommunications) be located closer than 30 feet of the boom truck/ crane operation area required to service the station wet well.

D. All station utility metering, required CT auxiliary enclosures and station service disconnects shall be mounted on a separate backboard located as close to the utility power pole as is permitted by the utility company regulation guidelines and shall comply with NFPA 70. Do not mount meter cans or other devices on the utility power pole unless required by the electrical utility.

E. The utility interface back board shall have the following items mounted on it in the order listed:
   1. The utility meter can and meter w/necessary CT enclosure shall be located as the first device downstream of the utility connection.
   2. A three-pole service disconnect/ overcurrent protection device with insulated neutral bus shall be installed after the metering and utility company monitoring device(s) (i.e. enclosed circuit breaker). This breaker shall be coordinated with the utility voltage and current service supplied to the pumping station. The enclosure for this breaker shall be rated as NEMA 3R or NEMA 4X and shall be a UL approved service disconnecting device which may be pad-locked in the “OFF” position.
   3. This enclosure shall be equipped with an appropriate earth ground bonding-to-utility-neutral bonding capability which meets or exceeds the requirements of NFPA 70. U.L. listed for service entrance application.

4.05 WARRANTY

Conflict of the warranty requirements of this specification may exist for some sub-systems as described in specification sections 16000, 16400, 16482 and 16620. Where such conflicts exist, the provisions of the cited sections shall govern.

A. Warrant at 100% all parts and labor for one (1) year that covers normal wear and tear for typical sewage pump applications.

B. The pump manufacturer shall provide a comprehensive warranty for one year (12 months) from the date of acceptance of the pump station by the City for operation and maintenance. For years 2 – 5 of the service contract, the manufacturer shall provide warranty work on a pro-rated basis. A manufacturer's service representative and the Conveyance and Distribution Director or designee shall work together to make joint resolutions of all warranty work, as well as, all other maintenance needs. The manufacturer shall also provide a service representative authorized by the pump manufacturer. Any work carried out by the authorized representative shall not violate manufacturer's warranty.

C. A four-hour response to service call by the City shall be provided by the service representative. The service representative shall restore pump to service within five (5) working days.

D. Service Manual – The pump manufacturer shall furnish the Owner with a minimum of six (6) service manuals for the pumps installed.

E. The pump manufacturer shall provide the identification of manufacturer's contact person and cell phone / pager number and an alternate name and phone number for 24-hour availability.

4.06 ACCEPTANCE OF PORTIONS OF THE WORK

A. The employment of contractor installed, owned, operated, and monitored station bypass pumping system(s) for actual sewer water shall not permitted to be deactivated or taken "off-line" prior to full acceptance of the station pumping systems' demonstrated ability to operate completely in the automatic mode and to provide required alarms to the normal City of Savannah remote monitoring facilities. This demonstration shall be accomplished to the complete satisfaction of the Engineer or his/her Inspector as well as the City of Savannah maintenance department that shall assume maintenance/operations responsibility for the accepted portions of the station. Partial and/or final acceptance of the work completed shall be predicated upon meeting the applicable specification and demonstratinmg the operational capabilities of that portion of the pumping station as defined by this section of the specifications and specification sections 16000, 16400, 16482 and 16620 as applicable. In the event that this section differs from sections 16000, 16400, 16482 and 16620, the

provisions of the cited sections shall govern.

B. The Owner reserves the right to accept and use any portion of the work whenever it is considered to be in his/her best interest to do so. The City's Engineer or his Inspector shall have the authority to accept or reject any portion of the work prior to final acception.

C. The Contractor shall complete the Lift Station Data sheets (5) included in this section fully prior to the Owner's acceptance.

D. During this initial inspection, the manufacturer's service representative shall review recommended operation and maintenance procedures with the owner's personnel.

4.07 ELECTRICAL INSPECTIONS AND ACCEPTANCE

A. The Contractor shall coordinate with all entities (City of Savannah witnesses, manufacturer representatives, and, etc.) in order to schedule their presence at the project site as required in the project specifications. This coordination responsibility assignment shall apply to partial, in-process, and final-acceptance inspections and manufacturer support activities throughout the entire project.

B. Acceptance inspections (partial or full) shall not be acceptable unless requisite technical drawings and maintenance/troubleshooting guides are provided to the actual maintenance activity which will become responsible for operating and maintaining the accepted portion of the work prior to relieving the Contractor of such responsibility. "Mark-UP" copies of drawings and instruction books shall be acceptable for partial / "in-Process" acceptance. Final "As-Built" drawings shall be required for all final acceptance inspections.

C. Electrical / Electronic Systems Inspections: All electrical/electronic equipment/system(s) acceptance inspections shall be as specified in this document AND in the four (4) specification sections 16000, 16400, 16482 and 16620 of the City of Savannah Standard Specifications found on the City of Savannah website relating to sewer and wastewater collection and conveyance.

PART 5 - SUBMERSIBLE PUMP STATION CONTROLS

5.01 ACCEPTABLE MANUFACTURERS

The pump station control panel shall be provided as part of the pump package. Equipment shall be furnished by ITT/Xylem/Flygt. No subsitutions permitted.

5.02 PURPOSE

Pump station control systems shall serve the function of controlling the level of the raw sewage in the station wet well by way of starting, running, and stopping the

station pumps in order to move the influent sewage from the wet well to the designated Water Quality Control Sewer Treatment Plant via the force main piping. The controls shall be capable of fully unattended automatic operation as well as manual (attended) operation of the pumping and monitoring systems at the station. The pump controls shall also serve as the primary origination of and routing interface of all remote and local alarm and status monitoring functions related to the SCADA as well as the auto-dialer sub-systems at the station. The controls shall also provide a means of monitoring the primary power and acting to prevent damage to pump motors and/or incorrect operation of the station due to single phasing, reverse phase rotation, loss-of-phase, and "brown-out" conditions of the primary power source as well as to provide an alarm signal to the SCADA and Auto-Dialer sub-systems.

5.03 RELATED DOCUMENTS

The below listed documents shall be used in conjunction with this specification. In the event of conflict between the requirements of this document and the related documents and/or additional requirements outlined in this document, the cited sections shall govern.

A. Specification Section 16000

B. Specification Section 16400

C. Specification Section 16482

D. Specification Section 16620

The most current revision at the time of project approval shall apply. Specification revisions become official once posted on the City of Savannah web site.

5.04 SUBMITTALS

Submittals shall be provided as specified in the Contract Documents.

PART 6 – CONTROL DESCRIPTION

6.01 AUTOMATIC LEVEL CONTROL SUB-SYSTEM

A. The automatic level control system shall be one of the types listed below and shall be considered the "heart" of the Automatic Control System.
   1. Siemens/Milltronics Hydroranger 200 with ultrasonic transducer level sensing.
   2. Multi-smart control with (as applicable) ultrasonic transducer or multitrode probe level sensing, (consult with local Xylem/Flygt representative for detailed information).
   3. Alternating relay with wet well float switch sensing.

B. All level control system(s) sensor devices shall be suspended/hanging in the wet well by their own cables inside the wet well such that the opening/closing of the wet well hatch does not vary their physical location in any way.

C. All automatic level control systems shall have an additional float switch suspended in the wet well designated as the high level sensor which shall be incorporated into the station level control sub-system such that it will activate the "Fail Safe" function described elsewhere in this specification. This float switch shall hang in the wet well by its own cable inside the wet well such that opening the wet well hatch does not vary its physical location in any way.

D. An additional float switch shall be located inside the wet well designated as "low level all pumps off" if shown in the electrical drawing. If present, this float switch shall comply with all the requirements for suspending, securing, and locating as described above.

E. Only 24VAC current limited control voltage power shall be permitted for use in the wet well.

F. No other automatic level control system shall be acceptable unless specified in writing by the Electrical Engineer with the concurrence of the wastewater conveyance maintenance superintendent and noted on the electrical drawings as a variance to the Standard Specifications.

6.02 PUMPING STATION CONTROL CHARACTERISTICS

A. Pumping Stations with 49 HP and smaller pumps shall have one Master Control Panel including but not limited to the following functions/components/attributes:

1. Three-pole thermal-magnetic circuit breakers for primary power removal from pump motor starters and drives, (one for each pump).
2. Motor starter/drives with associated control circuitry for the station pumps.
3. Single-pole 120VAC circuit breakers as listed below:

a.	Control Circuit	20 AMP	1 each
b.	Alarm Dialer Power	20 AMP	1 each
c.	SCADA Panel Power	20 AMP	1 each
d.	Generator Battery Charger	20 AMP	1 each
e.	Yard/area Lighting	20 AMP	1 each
f.	Convenience Receptacles	20 AMP	1 each
g.	Generator jacket heater	20 AMP	1 each (2-pole)
h.	Spare breakers	20 AMP	2 each
i.	Spare breaker	30 AMP	1 each (2-pole)

4. One each two-pole circuit breaker for input to an externally mounted single-phase transformer for 480 VAC to 120/240 VAC conversion, (applies to stations with primary feed voltage of 480 VAC only). Current rating is to be as shown on the electrical drawing.

5. One each two-pole circuit breaker for output of the transformer cited in “4” above. Add for generator jacket heater larger than 1500W.
6. Power Distribution Block(s) for main system power in (3-Phase plus Neutral as required) and follow-on distribution within and external to the panel.
7. UL approved ground lugs for equipment grounding conductors.
8. Automatic Level Control System less the portion which resides in the wet well.
9. Local alarm (visual and audio) system control/activation/silence system less the portion which is located outside the panel.
10. Pump Motor starter/drive systems.
11. Terminal strip(s) for wiring which is external to the panel for 120 VAC distribution and for control, status, and alarm functions external to the panel as required, (these terminal strips shall not be located within the panel in such a way as to require stooping low or kneeling on the ground in order to view or access them).
12. All circuitry devices required to generate or route command and control as well as monitoring signals into/out of the panel. The electrical drawing shall show all of the required devices and wiring necessary for the Master Control to perform as required in the above paragraphs.

B. Pumping Stations with pumps 50 HP and larger will usually have the control system housed in a building structure on the lift station property. This Control Room shall contain all the controls, pump motor starters/drives, primary power distribution, SCADA system, Auto-Dialer system, and interconnecting wire ways and wiring for station operation except for those portion(s) required to provide interface panels, junction boxes, and etc. to include main utility power metering and isolation devices located outdoors. The Control Room shall house a Station Control System with appropriate control and monitoring capabilities and in appropriate enclosures, as listed below and at a minimum:

(Equipment located outdoors shall be mounted as described in Standard Specification Section 11100, paragraph 4.02).

1. A station master level control system which shall provide automatic command and control of the station pump starter/drive control sub-system(s).
2. As part of the master level control sub-system, a capability of wiring interface (terminal boards) between the master control and the SCADA, Auto-Dialer, wet well sensing devices, Automatic Transfer Switch position sensing, condition sensing of the pump controls, and “Fail-Safe” control and local alarm activation with audio silencing function.
3. As part of the master level control sub-system, Flygt/Xylem MAS and CAS monitoring devices and interface terminals for routing “GO – NO GO” control commands to the pump control/protection sub-system(s) as required.
4. As part of the master level control sub-system, a phase monitoring capability which shall provide a “GO – NO GO” command to each pump control sub-system

in order to preclude motor damage due to “single-phasing” conditions and incorrect rotation direction of the pump motors/impellers.

5. A station primary power distribution system which shall allow the 100% isolation of power from one individual pump control system at a time with NO EFFECT on any of the others so that the station may continue to perform its primary function albeit with one less pump on-line. An “I-Line” style power distribution system is preferred.
6. An Alarm Dialer to send alarm calls via cellular network to the City of Savannah remote monitoring facilities. These alarms shall be appropriately interfaced (wired) between the Dialer device and the appropriate “dry contact” terminals associated with the conditions listed below:
    a. High Wet Well Level
    b. Loss of correct three-phase power conditions
    c. At least one pump or pump control is in a “failure” condition
    d. The station Automatic Transfer Switch (Load side) is connected to the Emergency Power System generator power source
7. A Emerson (Bristol) Process Management “Controlwave” control and monitor panel correctly interfaced with all other sub-systems terminals/connection points for all required digital input signals, analog (4 – 20ma) signals and the 120 VAC power distribution sub-system, (NOTE: 4–20 mA signal wiring shall not be routed by way of intermediate terminal board connections, wiring shall be routed directly from device to device).
8. A separate pump starter/drive assembly with Hand-Off-Auto (HOA) control switch, Pump Run elapsed time meter display (as required), a pump starter/drive control “RESET” function, a “Select Starter/Drive” function if the pump control is designed with both VFD and back-up starter equipment for each station pump.
9. Each pump starter/drive assembly shall have the following capabilities/sub-systems as a minimum:
    a. A transformer which shall convert the primary power voltage to 120 VAC which shall function as an independent control power source for that control. This power source shall be interfaced (wired into) with the phase monitoring sub-system located in the master level control cabinet. The input and output of this transformer shall be fused as required by NFPA 70.
    b. A transformer which shall be fed from the 120 VAC source cited above and producing 24VAC power shall serve as the power source for individual pump accessory devices such as a Flygt MAS unit as applicable. This transformer shall be fused in accordance with NFPA 70.
    c. All necessary VFD drives and/or Reduced Voltage Soft Starters (RVSS) along with applicable contactor assemblies necessary to select/connect the applicable starter/drive to the pump assembly. Note: RVSS devices shall be designed and wired in the “Non-Reversing Shorting Contactor” configuration in order to prolong the service life of the soft starter device.

d. All necessary relays and other devices to include terminal board(s) necessary to distribute power, control, and monitoring signals within the control as well as for interfacing with external sub-systems.

e. The use of "wire nuts" or other similar devices to make wire joints/connection shall not be acceptable.

10. A transformer and load center sub-system designed to produce and distribute 120/240 VAC power to lighting circuits, convenience receptacles, environmental control systems (heat pump/air conditioner), and sub-assemblies which do not generate their own internal 120/240VAC power from the station primary power system. This load center shall be UL approved and capable of providing all non-internally generated power required by various devices, and shall have appropriately sized circuit breakers in sufficient quantity to service all required loads plus two (2) spare single-pole 20 AMP 120VAC and one spare 30 AMP double pole 240VAC circuit breakers. The load center and transformer shall be incorporated into an "MCC" type enclosure/ system or shall be configured as a floor-mounted transformer and surface-mounted load center system. Load centers which are mounted into "hollow" walls similar to that normally used in residences shall not be acceptable.

11. All enclosures/devices shall be industrial grade devices with UL approval and shall conform to the requirements of NFPA 70.

C. A "Fail-Safe" control circuit which shall assume control of "pump-on" and "pump-off" functions bypassing the normal automatic level control sub-system in the event of the failure of that sub-system to exercise control. This function shall be designed such that it operates between the "high level" and "high-high" level in the wet well and activates the "high level" alarm to SCADA, Alarm-Dialer, and local (horn and strobe) devices for as long as the condition exists.

D. Pumping stations which must be "custom" designed due to unusual characteristics such as the available utility power being other than 480VAC or 240VAC or single-phase as opposed to three-phase shall follow the general guidelines as discussed above with appropriate additional features as necessary to control 480/240VAC pumps. Since such stations are few in number, each design shall be created with the Project Electrical Engineer consultant and the Wastewater Conveyance Department working in close cooperation for each design in order to produce an operationally and cost effective end result.

E. Equipment assemblies/panels located out of doors shall follow the guidelines listed below:

1. There shall not be any equipment other than lighting fixtures, convenience receptacles, conduit entry/exit devices, and necessary environmental (air conditioning/heat pump) equipment attached to or mounted on any building structure located on the station property. Appropriate backboard assemblies shall be utilized for mounting of these devices. These backboard(s) shall be

located as determined by the contract drawings. Mount all equipment on unistrut channels.

2. Equipment enclosures/equipment shall be rated a minimum of NEMA 3R or better.
3. Outdoor equipment shall include but not be limited to:
    a. Utility company connection point device(s)
    b. Utility power metering and monitoring equipment
    c. Utility power disconnect/isolation switch device(s)
    d. Utility utility power main breaker device(s)
    e. The complete Emergency Standby Power system to include generator set, skid-base fuel tank, and automatic transfer switch, (the generator and fuel tank shall be installed on an appropriately designed concrete mounting pad)
    f. Enclosures containing junction/connection points for all electrical equipment located in/at the station wet well
    g. Outdoor area lighting
    h. Outdoor convenience receptacle(s)

PART 7 – TESTING, INSPECTION, AND FINAL ACCEPTANCE

7.01 EQUIPMENT START-UP/PROGRAMMING

A. The Contractor shall coordinate as necessary to retain the technical services of factory certified personnel to verify that sub-assemblies such as RVSS, VFD, and other devices are correctly installed, programmed per end-user requirements, and acceptable for warranty purposes.

B. The equipment systems and sub-systems operational capabilities shall be demonstrated at the operational site to the satisfaction of the Inspector or his/her representative as well as the Wastewater Conveyance Maintenance Superintendent or his/her representative(s).

7.02 DOCUMENTATION AND END-USER O&M PERSONNEL TRAINING

A. A minimum of one copy of applicable operating and maintenance instructions shall be provided to the Wastewater Conveyance Maintenance Superintendent or his/her representative in printed form as part of the final acceptance procedures/inspection(s), and one PDF (electronic) copy on compact disk.

B. A minimum of copy of blueprints, installation notes/mark-ups, and interconnection drawings utilized to build the station electrical system(s) shall be provided to the Wastewater Conveyance Maintenance Superintendent or his/her representative at the time of the final acceptance inspection, and one PDF (electronic) copy on compact disk.

C. A minimum of copy of applicable “as built” drawings related to the interior wiring of items such as the Master Level Control Panel and Pump Control assemblies shall be provided to the Wastewater Conveyance Maintenance Superintendent or his/her representative prior to the acceptance of operational or maintenance responsibilities for the station by the applicable department of the City of Savannah, and one PDF (electronic) copy on compact disk.

D. The Contractor shall coordinate with all applicable venders and the City of Savannah Wastewater Conveyance Maintenance Superintendent to schedule and provide operation and maintenance training of city personnel on site.

PART 8 – WARRANTY

Warranty provisions shall be as described in Specification 11100 and 16620.

END OF SECTION 11100