

Section 15010 – MECHANICAL EQUIPMENT

Part 1 - GENERAL

1.01 Description of Work

- A. General: applicable provisions of the contract drawings and general conditions govern work.
- B. Scope of work: the work includes furnishing all labor, material and plant and installing all mechanical equipment necessary to the intended operation of the pumping station. While every effort has been made to show all necessary details of the equipment required, it is the intent of the plans and specifications to provide a completed, operable facility whether all minor components of construction are noted or not. All materials and work shall be in conformance with the city of Newport News, department of engineering, “standard specifications”, dated august 1983, as amended, except as noted herein.
- C. Work specified elsewhere but is not limited to:
 - Section 01330 - submittal procedures
 - Section 01781 - operation and maintenance data/manual
 - Section 03300 - cast-in-place concrete
 - Section 04200 - brick masonry
 - Section 04300 - concrete masonry
 - Section 16010 - electrical general provisions
 - Section 16550 - emergency power system
 - Section 16675 - pump control panel

1.02 Manufacturers

- A. Manufacturers of equipment covered by these specifications shall be reputable firms with at least five years experience in the manufacturer, testing and supervision of installation and operation of the equipment. All materials and equipment furnished shall be guaranteed free from defects in workmanship or design, and the contractor shall replace, without cost to the owner, any part or equipment which is defective or shows undue wear within one year after the equipment has been in permanent operation.

1.03 Submittals

- A. Shop drawings of all equipment shall be submitted to the owner for approval. Information shall include dimensions, capacity, material, finish, guarantee, etc.

- B. Six (6) copies of a complete operations manual for all equipment, including detail drawings, maintenance instructions and other pertinent data shall be compiled and submitted to the owner for review and approval before acceptance of the facility.

1.04 Sewage Pumping Units

1.04.01 GENERAL

- A. Contractor shall furnish all labor, materials, equipment and incidentals required to provide 2 5 HP explosion-proof submersible centrifugal sewage grinder pumps for NEC class 1, division 1, group C, D hazardous locations. Hydromatic HPGFX or approved equal.
- B. A control panel shall provide a circuit that monitors the seal sensors, heat sensors in the pump. This is supplied by others
- C. Pump shall be equipped with stainless steel nameplate. An optional name plate stating the unit is accepted for use in NEC Class 1, division 1, group C, D, hazardous locations with third party, (Factory Mutual,) approval.

1.04.02 OPERATING CONDITIONS

- A. Each pump shall be rated 5 H.P., 230 volts, 3 phase, 60 hertz, 1750 R.P.M. The unit shall produce 45 G. P M. at 50 ft TDH.

1.04.03 CONSTRUCTION

- A. The pump shall be a cast iron, explosion proof, centrifugal, submersible, grinder, wastewater type, model HPGFX as manufactured by Hydromatic Pumps or approved equal. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. The pump discharge shall be fitted with a 2" NPT flange. All external-mating parts shall be machined and Buna N Rubber O-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquids shall be 300 series stainless steel.

1.04.04 ELECTRICAL POWER CORD

- A. Electrical power cord shall be STW-A, water resistant 600 V, 60°C., UL and CSA listed and applied dependent on amp draw for size.
- B. The power cable entry into the cord cap assembly shall first be made with a compression fitting. Each individual lead shall be stripped down to bare wire at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary attraction.
- C. The power cord leads shall then be connected to the motor leads with extra heavy connectors having brass inserts with a screwed wire to wire connection, rather than a terminal board that allows for possible leaks.
- D. There shall be an addition epoxy compound potting area separating the motor housing from the cord cap assembly.
- E. The cord cap assembly where bolted to the connection box assembly and the connection box assembly where bolted to the motor housing shall each be sealed with a Buna N Rubber O-ring on a beveled edge to assure proper sealing.

1.04.05 MOTOR

- A. The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation, (155°C or 311°F), and a dielectric oil filled motor, NEMA B design (3 Ø). Further protection shall be provided by on winding thermal sensors. Because air-filled motors do not dissipate heat as efficiently as oil-filled motors, they shall not be acceptable.
- B. The pump and motor shall be specifically designed so that they may be operated completely submerged in the liquid being pumped. The pump shall not require cooling water jackets. Dependence upon, or use of, water jackets for supplemental cooling shall not be acceptable.
- C. Stators shall be securely held in place with a removable end ring and threaded fasteners so they may be easily removed in the field without the use of heat or a press. Stators held by a heat shrink fit shall not be acceptable. Stators must be capable of being repaired or rewound by local motor service station. Units that require service only by the factory

shall not be acceptable. No special tools shall be required for pump and motor disassembly.

D. Pump shall be equipped with heat sensors. The heat sensors shall be a low resistance; bi-metal disc that is temperature sensitive. It shall be mounted directly on the stator windings and sized to open at 120°C and automatically reset at 30-35°C differential. The sensors shall be connected in series with motor starter coil so that the pump will cease operation when an over-temperature condition is sensed. The starter shall be equipped with 3-leg overload relay with heaters sized for the pump's full load amps. The pump shall cease operation when the overload is tripped. The overload shall be manually reset.

1.04.06 BEARINGS AND SHAFT

A. An upper radial bearing and a lower thrust bearing shall be required. These shall be permanently lubricated by the dielectric oil that fills the motor housing. The shaft shall be machined from a solid 416 stainless steel bar and is a design that is of large diameter with minimum overhang to reduce shaft deflection and prolong bearing life.

1.04.07 SEALS

A. The pump shall have two mechanical seals, mounted in tandem, with an oil chamber between the seals. The upper seal shall be a John Crane Type 21, BF1C1; seals shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. The lower seal shall be a John Crane Type 6A BP892. The seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminants out of the seal area. Units that require the use of foreign manufactured seals shall not be acceptable.

Seals shall be locally available.

B. The pump shall be equipped with a seal leak detection probe and warning system. This shall be designed to alert maintenance personnel of lower seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level and consistency.

C. There shall be an electric probe or seal failure sensor installed in the seal chamber between the two tandem mechanical seals. If the lower seal fails, contaminants which enter the seal chamber shall be detected by the sensor and send a signal to operate the specified warning

device.

- D. Units equipped with opposed mechanical seals shall not be acceptable.

1.04.08 IMPELLER

- A. Impeller shall be bronze multi-vane, semi-open non-overloading design and have pump-out vanes on the backside of the impeller to prevent grit and other materials from collecting in the seal area. The impeller shall be designed so that it can factory or field trimmed to meet specific performance conditions. Wear or field trimming shall not deter the factory balance.
- B. Impellers shall be dynamically balanced. The tolerance values shall be listed below according to the International Standard Organization grade 6.3 for rotors in rigid frames.

RPM Tolerance 1750 .01 in. - oz./lb. of impeller weight

1.04.09 CASING

- A. The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the vertical discharge type. A rail system to allow easy installation and removal of the pump shall be available. The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers.

1.04.10 GRINDER CUTTERS

- A. The combination centrifugal impeller and grinder unit shall be attached to the common motor and pump shaft made of 416 stainless steel. The grinder unit shall be on the suction side of the pump impeller and discharge directly into the impeller inlet leaving no exposed shaft to permit packing of ground solids. The grinder shall consist of two stages. The cutting action of the second stage shall be perpendicular to the plane of the first cut for better control of the particle size. The grinder shall be capable of grinding all materials found in normal domestic sewage, including plastics, rubber, sanitary napkins, disposable diapers, and wooden articles into a finely ground slurry with a particle dimension no

greater than ¼ inch. Both stationary and rotation cutters shall be made of 440C stainless steel hardened to Rockwell 60 C and ground to close tolerance.

B. The upper (axial) cutter and stationary cutter ring shall be reversible to provide new cutting edges to double life. The stationary cutter ring shall be a slip fit into the suction opening of the volute and held in place by three (3) 300 series stainless steel screws and retaining ring. The lower (radial) cutter shall macerate the solids against the I. D. of the cutter ring and extrude them through the slots of the cutter ring. The upper (axial) cutter shall cut off the extrusions, as they emerge from the slots of the cutter ring to eliminate any roping effect, which may occur in single stage cutting action. The upper (axial) cutter shall fit over the hub of the impeller and the lower (radial) cutter shall slip fit and be secured by means of a peg and hole and rotate simultaneously with the rotation of the shaft and impeller. A 300 series stainless steel countersunk washer in conjunction shall lock the grinding mechanism to the shaft with a 300 series stainless steel flat head cap screw threaded into the end of the shaft.

1.04.11 PAINTING

- A. The pump shall be painted after assembly, and testing, with a dark green water reducible air dry enamel. The paint shall be applied in one coat covering all exterior surfaces. The pump shall be air dried after testing and before painting.

1.04.12 SERVICEABILITY

- A. The complete rotating assembly shall be capable of being removed from the volute without disturbing discharge piping or volute. The motor housing, seal housing with seal plate and impeller still attached to the shaft shall be capable of being lifted out of the volute case from the top as one assembly.

1.04.13 TESTING

- A. Commercial testing shall be required and include the following:
1. The pump shall be visually inspected to confirm that it is built in accordance with the specification as to HP, voltage, phase and hertz.
 2. The stator motor leads shall be tested for integrity using a megohmmeter at the highest setting.
 3. Pump shall be allowed to run dry to check for proper rotation.

4. Discharge piping shall be attached; the pump submerged in water and amp readings shall be taken in each leg to check for an imbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked with a bridge to determine if an unbalanced resistance exists. If so, the stator shall be replaced.

5. The pump shall be removed from the water, megohmmeter tested again, dried and the motor housing filled with dielectric oil.

B. In addition to the above commercial testing, a special megohmmeter test shall be performed and include the following:

1. The pump shall be submerged in water and allowed to run at maximum load for 30 minutes.
2. A written report on the above shall be prepared by the test engineer, certified and submitted to the engineer.

C. A non-witnessed Hydraulic Institute performance test shall be performed. This shall include the following.

1. The pump shall be tested at the design point as well as at least 4 other points to develop a curve. Data shall be collected to plot the head capacity curve as well as a KW input and amperage curve.
2. In making these tests, no minus tolerance or margin shall be allowed with respect to capacity, total head or efficiency at the specified design condition. Pump shall be held within a tolerance of 10% of rated capacity or at rated capacity with a tolerance of 5% of rated head. The pump shall be tested at shutoff, but not be plotted, and only used as a reference point when plotting the performance curve.
3. Complete records shall be kept of all information relevant to the test, as well as the manufacturer's serial number, type and size of pump, as well as any impeller modifications made to meet the design conditions.
4. A written test report shall be prepared, signed and dated by the test engineer incorporating 3 curves (head-capacity, KW input, and amperage) along with the pump serial number, test number, date, speed, volts, phase, impeller diameter, and certification number. This report shall then be submitted to the engineer.

1.04.14 WARRANTY

- A. The pump unit or any part thereof shall be warranted against defects in material or workmanship within one year from date of installation, and shall be replaced at no charge with a new or manufactured part, F.O.B. factory or authorized warranty service station.

1.05 E- Z Rail System Specifications

1.05.01 GENERAL

- A. Contractor shall furnish all labor, materials, equipment and incidentals required to provide a complete pumping system as specified herein.
- B. The E-Z Rail System shall include 2 submersible grinder sewage pumps base elbow sealing flange with stainless steel rail guides, stainless steel upper guide bracket, stainless steel lifting chain, access frame, stainless steel float mounting bracket, guide rails(stainless steel pipe).

1.05.02 DISCHARGE ELBOW

- A. A discharge base elbow, designed to mount directly to the sump floor shall be supplied for each pump. It shall have a standard 2" NPT Threaded connection on the outlet side with a 2" inlet connection. The design shall be such that the pump to discharge connection is made without the need for any nuts, bolts, or gaskets. The base elbow shall also anchor and align the 3/4" stainless steel guide rails. A spare sealing flange will be provided.

1.05.03 SEALING FLANGE WITH RAIL GUIDE

- A. A sealing flange/rail guide bracket shall be mounted on each pump discharge. It shall have a machined mating flange which matches the base elbow discharge connection. Sealing of this discharge connection shall be accomplished by a simple linear downward motion of the pump culminating with the entire weight of the pumping unit supported entirely by the base elbow. The sealing flange shall be of bronze to make it non-sparking

1.05.04 UPPER GUIDE BRACKET

- A. The stainless steel upper guide bracket shall align and support the two guide rails at the top of the sump. It shall bolt directly to the hatch frame and incorporate an metal inserts for secure rail installation.

1.05.05 LIFTING CHAIN

- A. Each pumping unit shall be provided with a stainless steel lifting chain or cable, and be of sufficient length to extend from the pump to the top of the wet-well. The access frame shall provide a hook to attach the chain or cable when not in use. The lifting chain shall be sized according to the pump weight. (stainless steel lifting chain is 3/16")

- D. **Quality Assurance**

Pumps and motors are to be engineered, manufactured and assembled in the United States under a written Quality Assurance program. This written Quality Assurance program shall have been in effect for at least five (5) years, and include a written record of periodic internal and external audits to confirm compliance with UL Quality Assurance specifications.

A manufacturers representative shall be present at pump startup to ensure that the pumps are operating correctly and all warranties remain in tact.

- E. **ISO-9001 Certification**

Pumps and motors shall be manufactured by ISO-9001 certified companies only.

1.06 Ventilation Materials and Equipment

- A. Ventilation work shall include the furnishing of all ductwork, exhaust fans and fan work. The purpose of the plans is to show the general arrangement and location of the various components of the ventilation system. Some flexibility in arrangement and locations may be permissible; however, no alterations shall be made except with the specific approval of the owner.
- B. All equipment shall be new and shall conform to underwriter's laboratories, incorporated, standards. The installation of the work shall be performed by skilled mechanics and shall comply with all requirements of the national fire protection association.
- C. Detail drawings: shop drawings of all equipment shall be submitted to the owner for approval. Drawings shall show dimensions, capacity, material, finish, guarantee, etc.

- D. Sheet metal work: metal ductwork shall be 1/16-inch thick aluminum alloy 6061-16. Ductwork shall be secured to the walls with 1-inch wide, 1/8-inch thick aluminum straps on 36-inch centers. Where cutting of walls is necessary for installation of ductwork, cuts shall be made as neatly as possible and after completion of the work shall be patched and the rough openings shall be covered with flashing. All aluminum which comes in contact with concrete surfaces shall be coated with a bituminous paint.
- E. PVC ductwork shall be as shown on the plans. It shall be secured to the walls as specified for metal ductwork.
- F. Exhaust fans:
 - 1. The control room ventilation fan shall be Jenco Fan direct drive exhaust fan Model GDWE 104A, all aluminum construction, 1/20 HP, single phase, 1550 RPM, 559 CFM @ 1/8" S.P. with aluminum shutter and insect screen. The fan shall be non sparking.
 - 2. The wet well vent fan shall be JennFan Upblast Roof Exhauster Model TXD-8SC delivering 644 cfm at .25 - inch static pressure, .25 hp, single phase, 115 volt, 1130 rpm motor with unibeam curb to provide 30 air changes per hour.

1.07 **Miscellaneous**

- A. Painting: the entire pump assemblies shall receive two shop coats of machinery green enamel. Paint for touch-up painting shall be supplied by the pump manufacturer.
- B. Supervision of installation. The pump manufacturer shall furnish a service representative to supervise and inspect the installation and initial operation of the pump.

1.08 **Alarm system**

- A. The contractor shall furnish and install complete; all internal alarm systems, circuits, sensing devices and appurtenant equipment to provide the specified alarm and operational information to the Newport news operations center. The alarm transmitter shall be Motorola (model MRU plus) advanced alarm status or equal. Location and height of antennae must be sufficient to ensure that the alarm signal will be received at the Newport News operations center.
- B. System equipment: the contractor shall furnish and install all sensing and transmitting equipment as required for all alarms in specification section 16675.2.F.6 and also but not limited to the following :

1. Door monitor and alarm
2. Limit switches on each discharge check valve
3. High water
4. Low water
5. Pump #1 failure to start
6. Pump #2 failure to start
7. Power failure
8. Station on emergency generator
9. Generator failure to start

Part 2 - TESTS

2.01 General

- A. Motor manufacturer to furnish guaranteed minimum efficiency based on test using method "b" (dynamometer) IEEE-112 test procedures for polyphase induction motors and generator.
- B. Manufacturer to furnish percentage of efficiency, percentage of pf, amp at full load, 3/4 load, 1/2 load with quotation and be prepared to furnish actual test results on individual ratings if requested.
- C. All equipment shall be tested under operating conditions. The necessary gauges, meters and devices required to display compliance of the equipment with the specifications shall be furnished by the contractor.

Part 3 - EXECUTION

3.01 Installation

- A. Installation of all equipment shall be accomplished in accordance with contract drawings and the equipment manufacturers recommendations. Equipment must be properly aligned and anchored to prevent movement or undue stress or associated components or adjacent equipment.
- B. The contractor shall verify that the openings called for on the contract drawings are of the correct dimensions to facilitate the installation of the equipment to be provided.

Part 4 – SPARE PARTS

4.01 General

- A. Contractor to provide the following spare parts:

1. Impeller (2)
2. One complete pump seal kit

END OF SECTION

SECTION 16675 - PUMP CONTROL PANEL

1. SCOPE

A. The CONTRACTOR shall furnish and install one complete station control panel as manufactured by Automation Controls, Inc. of Newport News, Process Control Services of Seaford, Universal Controls of Chesapeake, Systems East Inc. of Newport News, Electric Motor and Contracting Company, Inc. of Courtland, or Thermo-Trol Corporation of Tidewater, Inc.. No substitutes. The control panel shall control two (2) 7.5 hp Submersible Grinder Sewage Pumps at 230V, 3 Phase. The control panel shall contain the following:

1. A 70A/3P main breaker and a 30 amp/3P circuit breaker and NEMA size 1 starter for each pump motor properly sized for motor running current and short circuit protection.
2. One control circuit to provide a field adjustable lead, lag, alternate operation for all pumps with provisions for hand-off-auto operation. Elapsed time meters to be provided for each pump.
3. Adjustable three phase voltage sensor to protect motors from single phasing and under voltage conditions.
4. The control Panel shall include an Allen Bradley SLC505 programable logic controller integrated with the digital set point controllers.
5. Provisions to shut down pumps in even of a failure-to-pump condition to prevent pump damage.
6. Limit switches on station check valves to sense a failure to pump condition.
7. Each Control Panel will be equipped with correctly sized line reactors and isolation contacts. The purpose of the line reactor and isolation contacts is to provide protection to the electrical components from electrical transients and/or electrical noise. MTE is a manufacturer of such products and Electrical Equipment Co. of Norfolk is a local point of contact for additional

information.

8. The Control Panel shall be UL listed as a complete assembly in accordance with UL-508.
9. All control panels will be equipped with an adequately sized heat removal unit (e.g., vent fan, heat exchanger or air conditioner). The control panel manufacturer shall certify the adequacy of the proposed heat exchange unit.
10. Phase monitor to monitor utility power.
11. Phase monitor to monitor generator power.

B. Responsibility

1. The prime CONTRACTOR shall be responsible for the performance of the panel manufacture.
2. The panel manufacturer shall be responsible for the proper coordination of starting current available, voltage, control circuits and the alarm system for the pump motors and control panel.

C. Submittals

1. The control panel manufacturer shall submit drawings, bearing the seal of a Certified Professional Engineer in the State of Virginia experienced in Electrical Engineering, adequate for panel fabrication, installation and maintenance. Drawings shall be submitted and approved prior to the control panel manufacturer starting any fabrication. Approval of the drawings does not relieve the manufacturer from his responsibility for satisfactory performance of the equipment provided nor from compliance with the specifications.
2. No substitute on panel manufacturer other than those specified. Others wishing to be approved as an equal to those specified in future projects must be approved by the City of Newport News, Department of Public Works Product Review Committee.

2. MATERIALS

D. Panel Enclosures

All motor branch components and all electrical control components shall be mounted in one floor standing or wall mounted enclosure to UL Standards. The enclosure shall be NEMA 12 in design. The interior shall be finished white and the exterior shall be finished with acrylic, "Vista Green" in color, for protection from the pump station atmosphere. All components shall be wired to terminal strips and bulkhead fittings. All items coming from the wet well shall be sealed off prior to reaching the panel. All control panels shall not be of the MCC type.

E. Items to be Mounted on the Door of the Panel Enclosure

1. On-off circuit breaker operators, one for main breaker and one for each pump motor, to be General Electric T-HM2 series or equal sized to fit properly with the pump motor circuit breakers and main breaker. Panel circuit breakers shall be interlocked with panel door.
2. 1 - Control Power circuit breaker, General Electric TE III series or equal "Control On" pilot light.
3. Provide a digital wet well level graph indicator in the control panel to monitor the wet well level and to provide start/stop contacts for control of the pumps. The level indicator/controller shall be a Texmate Leopard Vertical Bargraph.
4. Provide a digital pressure graph indicator in the control panel to monitor the discharge pressure. The indicator shall be a Texmate Leopard Vertical Bargraph.
5. Provide a digital flow indicator to display Flow in gpm from the Khrono Magnetic Flow meter.
6. 1 - Running ammeter with 3 phase selector switch for each pump.
7. Running time meters reading in hours and tenths, total of 6 digits, one for each motor, to be ATC series 5700 or equal.

8. Hand-off Auto switches, one for each pump motor, to be Allen-Bradley 800 T series or equal.
9. Overload reset buttons - one for each pump motor to be Allen-Bradley 1493 series or equal. Provide Allen-Bradley 800 T series lights to indicate motor overload. One light for each motor. Overload alarm contacts are required for connection to the SCADA system.
- 10.1 - Selector switch for pump alternator - "On" - "Pump #1 Lead" - "Pump #2 Lead" - for a duplex configuration; alternator - "On", - "Pump #1 lead" - Pump #2 lead", alternate selection between - "Pump #1 and #2".
11. Failure to pump lights, over temperature and seal failure lights, one of each pump to be Allen Bradley 800 T series or equal. Also include failure to pump reset buttons, one for each motor.
12. "Pump Running" lights, one for each pump to be Allen-Bradley 800 T series or equal.
13. Name tags for the above shall be located on the panel door.
14. One momentary push button switch that, when depressed, will simulate a failure status of all alarms. This switch shall be labeled "Alarm System Test Switch."
15. Branch circuit breakers, General Electric TE III series to supply power to lights, receptacles and vent fans with engraved name plates and ampere rating as indicated.
16. Seal fail and over temperature lights, if applicable, one for each pump.

F. Items to be Mounted on the Interior of the Panel Enclosure

1. Circuit breakers to serve as disconnects and short circuit protection for pump motors, to be molded case circuit breakers of adequate size voltage rating and short circuit capacity to meet NEC requirements.

2. One motor starter for each pump motor. Starters shall be of adequate size and voltage rating to properly start the pump motors complete with properly sized overhead heating elements. Starters to have overload relays installed in all three (3) phases. Starters to be Allen Bradley FVNR.
3. 1 - Adjustable voltage sensor, diversified model #SLA-230-ALA, time mark 258B or equal.

12. A lightning surge protection device shall be provided.

13. The following alarm contacts wired to a separate terminal strip:

1. Wet well high water
2. Wet well High High water
3. Wet well Overflow
4. Wet well low water
5. Dry well high water
6. Pump #01 Run
7. Pump #01 Flow Fail
8. Pump #01 Motor Overload
9. Pump #01 Seal Fail
10. Pump #01 Over Temperature
11. Pump #02 Run
12. Pump #02 Flow Fail
13. Pump #02 Motor Overload
14. Pump #02 Seal Fail
15. Pump #02 Over Temperature
16. Utility Power Fail
17. Station Power Fail
18. Generator Run (to be active whenever generator is running regardless of transfer switch position).
19. Generator Exercise
20. Generator Fail
21. Intrusion
22. PLC Fail
23. RTU Fail

6. Terminal strips to accept all field control wiring.

8. Each Control panel shall be equipped with a properly sized 5% line load reactor with isolation contacts (MTE or equal).
9. GFI Receptacle in side of panel.
10. Provide a Siemens pressure transmitter in the piping header 0-58psi, with chemical seal and Texmate Leopard vertical Bargraph meter in the control panel to monitor the discharge pressure.
11. Provide a Texmate Leopard vertical Bargraph meter and setpoint controller in the control panel to monitor the wet well level. A level transmitter shall output a 1-5V analog signal proportional to the wet well level to the programmable controller. The pressure transmitter shall be KPSI Series 705 0-5psi with lightning protection.
12. Digital graph meters shall be mounted flush in the control panel to display the wet well level, discharge pressure and flow. The meters shall receive a 1-5V process input signal and shall digitally display the wet well level in inches and pressure in feet. The digital meter shall operate on 120 VAC power and shall have an accuracy of $\pm 0.02\%$ of the reading. The digital meters shall be Texmate Leopard Vertical Bargraph model.

G. Additional items:

1. Furnish and install a limit switch on each pump check valve to indicate whether the check valve has lifted off its seat. The check valve limit switches shall be wired to the programmable controller and used for pump failure monitoring. The check valve limit switches shall consist of a corrosion-resistant pre-wired limit switch with a 12-inch long nylon rod lever. The limit switches shall be Allen-Bradley Bulletin 802MC-AY5, or equal.
2. Furnish and install two (2) mercury float switches in the wet well to detect a high water level and low water condition. The float switches shall have a normally closed contact that shall be wired directly to the alarm

transmitter. The float switches shall be Anchor Scientific Roto-Float Type S, or equal

3. Furnish and install a backup Float system in the event of level transducer failure. Provide Float switches for Lead, Lag and pump off conditions. The general sequence of operation shall be as described in section "C" of this specification. Float backup system operation shall be selectable operator on the front of the panel.
4. Provide a 316 stainless steel wall mounting bracket for mounting each float switch. The mounting brackets shall be Anchor Scientific #WMS, or equal.
5. Furnish and install a magnetic door switch at the station entry door and on valve vault hatch to detect that someone has entered. The magnetic door switch shall be hermetically sealed and shall be Sentrol, or equal.
6. A solid state submersible pressure transducer shall be provided for installation in the wet well. The transducer shall provide a 1-5V signal proportional to wet well level to the control panel mounted Level Indicating Controller (LIC). The controller converts the analog signal to a digital display to allow the operator to view and adjust level control set-points. The transducer shall be designed for continuous operation in the sewage wet well. The transducer housing shall be an all-welded design, constructed of corrosion resistant 316 stainless steel. The transducer shall be provided with a sufficient length of polyurethane jacketed cable. The transducer shall be a KPSI model 705. A 1 1/2 inch PVC pipe assembly and mounting hardware as shown on the contract drawings shall be provided for installation of transducer into the wet well.

C. Sequence of Operation

1. The Submersible transducer and Texmate 4 point controller with digital bar graph (LIC) shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator's selection of automatic operation, the (LIC) shall start the motor for one pump when the liquid in the wet well rises to the "lead pump on" level.

When the liquid is lowered to the "lead pump stop" level, the (LIC) shall stop this pump. These actions constitute one pump cycle.

If the wet well level continues to rise with the lead pump operating, the (LIC) shall start the second pump when the liquid reaches the "lag pump start" level. All pumps shall continue to operate until the liquid is lowered to the "lead pump stop" level.

Should any pump experience a failure, the circuit shall be designed so that the standby pump is immediately energized and will continue to operate until the liquid reaches the "lead pump stop" level.

Pumps shall alternate each cycle.

2. In addition to the panel enclosure completely wired containing the above mentioned items, the CONTRACTOR shall supply the following items for mounting in the sewage station:

- a. Install high and low water alarm float switch in wet well. Float switches shall be ABS mercury float switches Model No. 3288881 or equal. Provide aluminum brackets to locate switch from station walls.
- b. One limit switch for each door alarm.
- c. Two check valve limit switches for failure to pump alarm.

3. GENERAL

- a. Control panel shall be sized to permit at least 3 feet of working space including door opening.
- b. Control panel doors shall not conflict with other station equipment.
- c. All existing controls shall be removed and returned to the city.

4. INSTALLATION

PUMP STATION No. 5 Renovation Section 16675-8 PUMP CONTROL PANEL

Control panel and support systems shall be installed by factory-trained technicians.

5. TRAINING

After the pumps have been placed and all pumps are operational and fully controlled by the control panel, CONTRACTOR shall provide a factory-trained technician for one 8-hour day to train City personnel.

Control panel shall be designed for pumps operating at voltage and amperage specified for the approved pumps being installed. Contractor is responsible for verifying all pump station existing conditions.