

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**

A. **General**

Furnish a quantity of **2 – 7.5 Hp Gorman-Rupp suction lift pumps (no substitutes) 4”x 4” model T4A3-B**

The pumps shall be of the horizontal self priming centrifugal type, equal in construction and performance to the “T” Series self priming sewage pumps as manufactured by the Gorman-Rupp Company of Mansfield, Ohio, specifically designed for the handling of raw, unscreened sanitary domestic sewage.

Each pump must have the necessary characteristics and be properly selected to perform under these operating conditions:

	Primary	Secondary
Capacity, in GPM	180	178
Total dynamic head, in FT.	33	36
Total dynamic suction lift, in FT.	9.8	9.8
Maximum priming lift, in FT.	22	22
Design RPM	1060	1060
Impeller in In	9.76	9.76

Each pump at its rated speed shall be designed to retain adequate liquid in the pump casing to insure unattended automatic repriming in a complete open system without suction or discharge check valves and with a dry suction leg. Upon completion of repriming cycle, pumps shall deliver full rated capacity at rated TDH at the designed total dynamic suction lift.

The pumps shall be 4 inch, Model T4A3-B.

The openings and passages of the pump shall be large enough to permit the passage of a sphere 3 inches in diameter and any trash or stringy material which can pass through the average house collection system. The pump must be equipped with a removable cover plate, weighing not more than 65 Lbs., allowing complete access to pump interior to permit the clearance of stoppages and to provide simple access for service and repairs without disturbing suction or discharge piping.

The pump shall also be fitted with a replaceable wear plate. Replacement of the wear plate, impeller and seal shall be accomplished through the removable cover

plate. The entire rotating assembly, which includes bearings, shaft, seal, and impeller, shall be removable as a unit without disturbing pump volute or piping.

The impeller shall be 2 – vane, semi-open, non-clog, cast in ductile iron, with integral pump-out vanes on the back shroud, and shall thread onto a pump shaft of high carbon steel.

Means shall be provided for external adjustment of the impeller to the wear plate.

The shaft shall be covered and protected with a removable sleeve. The shaft shall be contained within a bearing pedestal of ample size to contain heavy duty ball thrust bearing and radial bearing of adequate size to withstand all imposed loads. Bearings shall be oil lubricated, with the bearing pedestal cooled by pumped liquid.

The pump shaft shall be sealed against leakage by a balanced mechanical seal. Both the stationary sealing member and mated rotating member shall be of tungsten-titanium carbide alloy.

Each of the mated carbide surfaces must be ground and polished to produce a flatness tolerance not to exceed one half a light band, or 5.8 millionths of an inch, as measured by an optical flat and monochromatic light. To insure the seal faces are in full contact at all times, the stationary seal seat must be double floating and self aligning during periods of shock loads that will cause deflection, vibration and axial or radial movement of the pump shaft.

The mechanical seal shall be installed within a separate oil filled reservoir of the pump pedestal, the oil being both lubricating and cooling media.

The seal must be removable and replaceable through the cover plate opening.

The mechanical seal must be warranted for a minimum period of four (4) years from date of shipment. Should the seal fail within the first year, the manufacturer is obligated, upon notification, to furnish a new seal, no charge, to owner, f.o.b. factory. The cost of replacement seals thereafter will be on a pro rata basis.

The pumps shall incorporate molded one-piece tapered suction check valves that can be removed or installed through the cover plate opening without disturbing the suction piping.

The pump volute casing shall contain no openings of a lesser diameter than the sphere size specified. Screens or any internal devices that create a maintenance nuisance or interfere with priming and performance of the pump will not be permitted.

Provide air release valve on each pump discharge and drain hose with stainless

steel clamps.

Provide each pump assembly on separate skid suitable for anchoring onto a concrete pad.

Experience and workmanship – Pumps shall be the product of a manufacturer with a minimum of 15 years experience in design and manufacture of self-priming centrifugal pumps handling sewage.

Upon request, manufacturer must submit to engineers, for their evaluation and approval, a list of self priming pump installations reflecting 15 years of satisfactory, automatic operations while permanently installed in an unattended sewage lift station.

Workmanship and materials throughout shall be of highest quality.

1.05 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 JencoFan model GDWE 104A, 115 volt, single phase, 60 hz, 559 cfm, 1,550 rpm, 1/20 hp, 1/8- inch static pressure. The fan shall be non sparking.
2. The wet well vent fan shall be JencoFan Explosion Proof Upblast Roof Exhauster Model TXD-811 delivering 536 cfm at .25 - inch static pressure, 1/4 hp, single phase, 115 volt, 1040 rpm motor to provide 30 air changes per hour minimum suitable for NFPA installations. The fan shall be non sparking, explosion proof.

1.06 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.

1.07 Alarm system

- C. 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.
- D. System equipment: the contractor shall furnish and install all sensing and transmitting equipment as follows:
 1. Door monitor and alarm
 2. Limit switches on each discharge check valve
 3. High water
 4. Pump #1 failure to start
 5. Pump #2 failure to start
 6. Power failure
 7. Station on emergency generator
 8. 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 rebuild 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 Suction Lift 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.